Overview of regional centers plans

Guy Wormser
HEPCCC Chairman
(IN2P3, France)

- Role of regional centers
- Plans and status for each center
- Experience from the BABAR experiment
- The role of HEP-CCC
- Conclusion

LHC computing model in 1999

MONARC

Models **O**f **N**etworked **A**nalysis
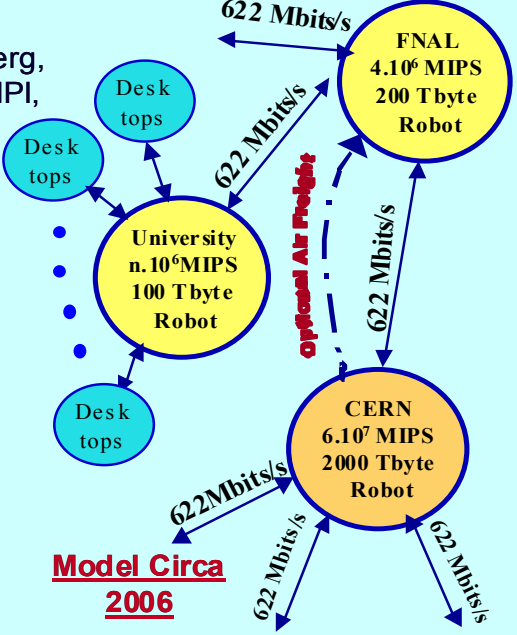**A**t **R**egional **C**enters

Caltech, CERN, Columbia, FNAL, Heidelberg, Helsinki, INFN, IN2P3, KEK, Marseilles, MPI, Munich, Orsay, Oxford, Tufts

GOALS

→ Specify the main parameters characterizing the Model's performance: throughputs, latencies
→ Develop "Baseline Models" in the "feasible" category
→ Verify resource requirement baselines: (computing, data handling, networks)

COROLLARIES:

→ Define and Design the Analysis Process
→ Define RC Architectures and Services
→ Provide Guidelines for the final Models
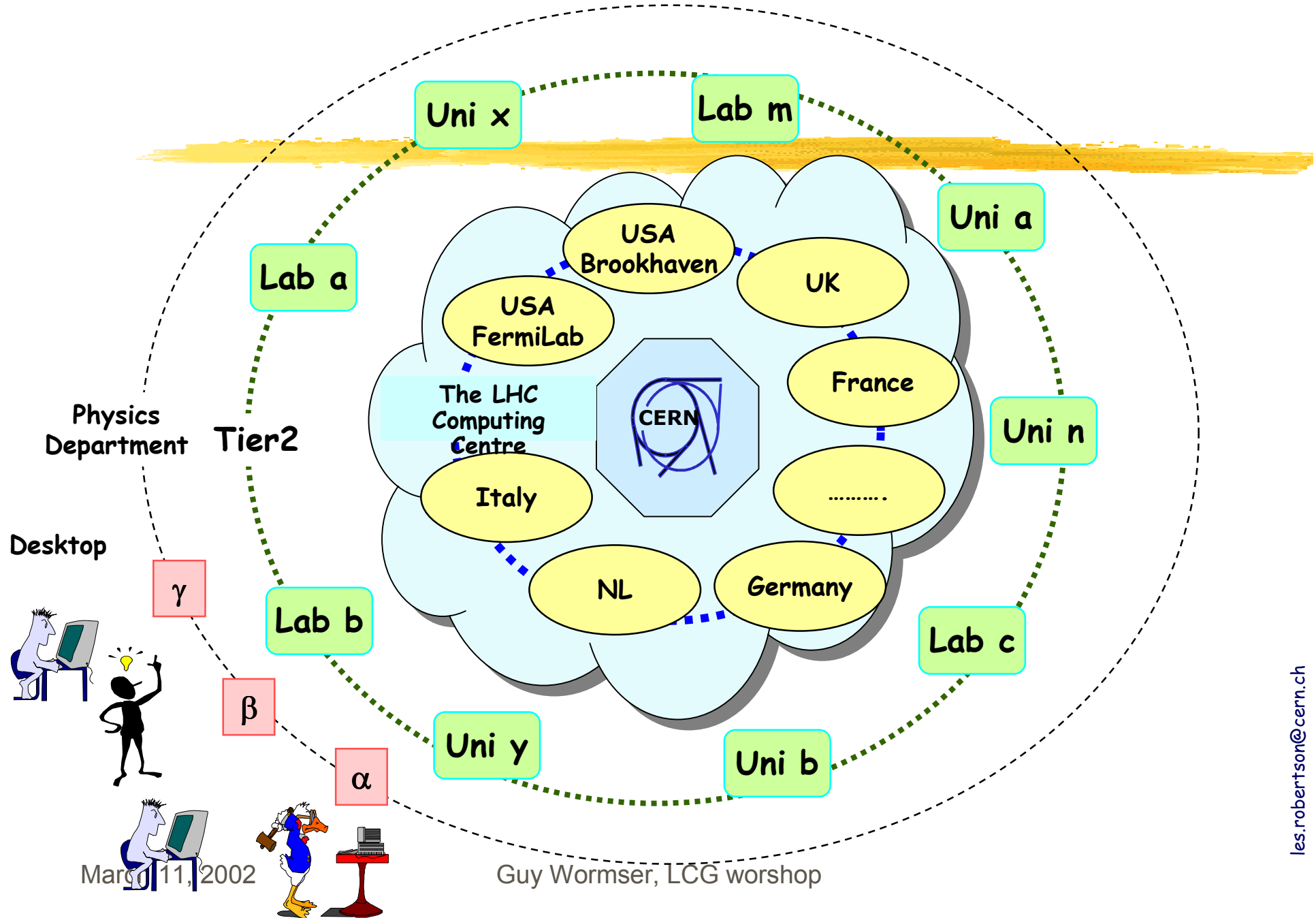→ Build and Provide a Simulation System and Toolset for Further Model studies

Desk tops

University
n.10^{6}MIPS
100 Tbyte
Robot

FNAL
4.10^6 MIPS
200 Tbyte
Robot

CERN
6.10^7 MIPS
2000 Tbyte
Robot

622 Mbits/s
622 Mbits/s
622 Mbits/s
622 Mbits/s
622Mbits/s
622 Mbits/s
622 Mbits/s

Optical Air Freight

Model Circa 2006

June 26, 1999   MONARC Status Report   Harvey Newman (CIT)

Present LHC Computing Model

Uni x   Lab m

Uni a

Lab a

USA Brookhaven

UK

USA FermiLab

France

The LHC Computing Centre

CERN

Physics Department

Tier2

Uni n

Italy

....

Desktop

γ

Germany

Lab c

Lab b

NL

β

Uni y

Uni b

α

March 11, 2002   Guy Wormser, LCG worshop

les.robertson@cern.ch

The main differences for a Tier1 site in the GRID era

- ⌘ A Tier1 site is linked to all other Tier1 sites
- ⌘ National Tier2 clusters not necessarily tied to the regional Tier1
- ⌘ Tier1 is very likely to welcome users from the whole collaboration using GRID mechanisms
- ⌘ Much faster networks required (and available!)

The official list of regional centers

Project Overview Board

Chair: CERN Director for Scientific Computing
Secretary: CERN IT Division Leader

Membership:
Spokespersons of LHC experiments
CERN Director for Colliders

Representatives of countries/regions with Tier-1 center :
France, Germany, Italy, Japan, United Kingdom, United States of America

4 Representatives of countries/regions with Tier-2 center
from CERN Member States

In attendance:
Project Leader
SC2 Chairperson

Present official list of Tier1s

⌘ **7 official Tier1s** as of March 2002

- ⊡ 4 European Multi experiment, with a non LHC component
  - ☒ France (Lyon) D. Linglin
  - ☒ Germany (Karlsruhe) M. Kunze
  - ☒ Italy (Bologna) F. Ruggieri
  - ☒ UK (Rutherford Lab) J. Gordon
- ⊡ 3 dedicated to a single experiment
  - ☒ Japan-ATLAS (Tokyo) H. Sakamoto
  - ☒ US-ATLAS (Brookhaven) J. Huth
  - ☒ US-CMS (Fermilab) L. Bauerdick

Tier1 Status Summary

	France	UK	It	Ge	US-Atlas	US-CMS	Japan
Nb of LHC	4	4	4	4	1	1	1
Non LHC expts	~30	1 (Babar)	1 (Virgo)	4	0	0	0
CPU/TB disk/ TB tape	700/40/ 200	250/10/ 35	120/10/ 10	100/25/ 60	120/3/ HPSS	60/16	80/3
Present personnel	45	8 (HEP)	31	5	A few	A few	A few
Attached Tier 2s	0	4	15	>1	5	5	0
Grid Test Bed	Yes	Yes	Yes	No	No	No	No
Open to non national	Yes	Yes	Upon MoU	Thru CA	To be discussed	To be discussed	To be discussed
Already Tier1	Yes	In 2002	No	In 2003	No	No	No

German Tier1

Tier-1 Center for LHC experiments
Funded by BMBF and FZK
Will satisfy 10% of LHC computing needs
Will take part in all test bed and data challenges
Will serve german Tier-2 Centers (e.G. GSI Darmstadt)
+
Compute and Data Center for
BaBar
CDF
D0
COMPASS

Operational since summer 2001

Will possibly serve as well:
Bio-Informatics Applications
E-Science Applications
Industrial Applications

Guy Wormser, LCG worshop
http://grid.fzk.de

The German Tier1

- **Overview Board (OB)**
  FZK Management, Director of Computing, Project Leader, Experiments, BMBF, KET, KHK

- **Technical Advisory Board (TAB)**
  Project Leader (and Deputy), IT-Experts from Experiments, Representatives from LCG, other Tier centers, DESY, KET, KHK

- New department for **Grid Computing Infrastructure & Services, GIS**, Hardware (Holger Marten)

- New department for **Grid Computing and e-Science, GES**, Software (Marcel Kunze)

Current Installation (March 2002):

Login Server for ALICE, ATLAS, BaBar, CDF, D0
Each dual PIII, 2 GB ECC RAM, 300 GB HDD IDE-RAID

Software Installation Server, MDS-Server, CA-Server

Fabric Infrastructure
16 dual PIII, 512 MB ECC RAM (BaBar)
20 dual PIII, 1 GB ECC RAM (LHC)
4 dual PIII, 1 GB ECC RAM (CrossGrid)
4 dual PIII, 1 GB ECC RAM (Test)

7 NAS IDE-RAID Server, 13.1 TB, 25 MB/s each
FC-AL SCSI-RAID, 2 TB, 40 MB/s
IBM Fast500 SAN, 10 TB, 400 MB/s

IBM 3584-L32 + 3584-D32 LTO Ultrium with FC-AL drives (60 TB
    native)
2 StorageTek Powderhorn 9310 with FC-AL drives

The German Tier1 Grid CA

- Hardware for CA available
- Delivery of certificates tested
- CP and CPS draft document available
  "FZK-Grid CA, Certificate Policy and Certification Practice Statement"

Open questions:
⇨ which other CAs accept our policy (trust us)?
⇨ do we trust all other CAs?

RDCCG Manpower and Office Space

2002:   5 FTE
2006: 40 FTE
2004: New building with office space (130 seats)

INFN – TIER1 Project

- Location: CNAF – Bologna
- Multi-Experiment TIER1: ALICE, ATLAS, CMS, LHCb.
- Support to Tier2 Centers
- Already Started and participating in Testbed (DataGRID) and Data Challenges (2002).
- Resources: Assigned to Experiments on a Year Plan. Usage by other countries will be regulated by a MoU.
- Authentication: Certificates (GRID) and/or Kerberos5.

TIER1 Resources

HARDWARE

Year	FARM (SI2000)	DISKS (TB)	TAPES (TB)
2001	60,000	10	10
2002	200,000	80	50
2003	900,000	120	300
2004	1,550,000	192	600
2005	3,100,000	380	2,000
2006	4,000,000	480	3,000

TIER1 Resources

PERSONNEL

Type	N.	New	Outsource
Manager	1		
Deputy	1		
LHC Experiments Software	2		
Programs, Tools, Procedures	2	2	
FARM Management & Planning	2	2	
ODB & Data Management	2	1	
Network (LAN+WAN)	2	2	
Other Services (Web, Security, etc.)	2	1	
Administration	2	1	
System Managers & Operators	6		6
Total	22	9	6

INFN – Tier2

- 10-15 INFN sites and 3 Experiments: ALICE, ATLAS, CMS (LHCb will have only Tier3).
- Many of them already active in Testbed (DataGRID) and Data Challenges.

RAL Plans

- RAL is the prototype Tier1 Regional Centre for the UK
  - providing resources and playing a part in the Data Challenges of all four LHC experiments
  - supporting Tier2 centres in the UK
    - UK plans approx 4 Tier2 centres, not yet clear which.
  - and is also a TierA Centre for BaBar
- Already doing simulation for LHCb and CMS now
  - and acting as a major repository of data for many experiments
    - old and new, EU and US
- UK PP grid support provided by core of four sites (RAL, Manchester, Bristol, Imperial, lead by RAL) not just the Tier1
 - all other UK sites want to be Tier2 - see political points

RAL Current Resources for HEP

- Now 250 cpus, 10TB disk, 35TB tape (robot capacity 330TB)
- In March 2002, adding 312 1.4GHz cpus, 45TB disk, 50TB extra tape
- Will spend similar amounts of cash in 2002/3 and 2003/4
  - on cpu, disk, and upgrading robot capacity and throughput
- Currently about 8 FTE running HEP part of centre
  - not including physicists and development staff (eg EDG)
- Currently have negotiated funding for 13 FTE
  - Estimate we need about 16 FTE
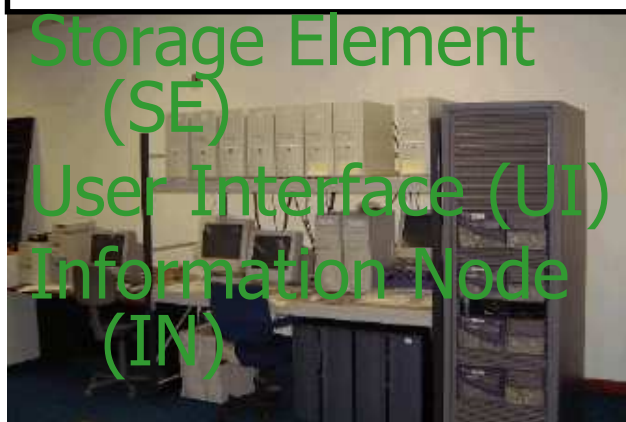 - Negotiating on exact tasks to be performed

UK Tier1/A Status
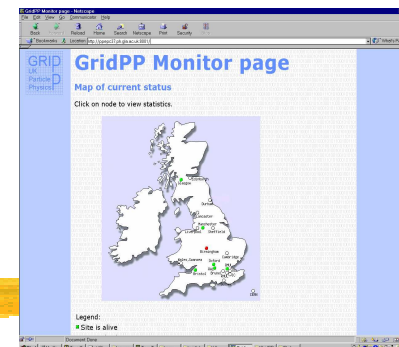
Current setup

14 Dual 1GHz PIII, 500MB RAM 40GB disks

Compute Element (CE)

Storage Element (SE)

User Interface (UI)

Information Node (IN)

+Central Facilities (Non Grid)

250 CPUs

10TB Disk

35TB Tape (Capacity 330 TB)

Hardware Purchase for delivery in March 2002

156 Dual 1.4GHz 1GB RAM, 30GB disks

GridPP Monitor page

Map of current status

Click on node to view statistics.

Legend:
Site is alive

RAL Planned Use

- ⌘ Testbeds
  - ⊡ EDG testbed1, 2, 3
  - ⊡ EDG development testbed,
  - ⊡ DataTAG/GRIT
  - ⊡ LCG testbeds
  - ⊡ other UK testbeds
- ⌘ Data Challenges
  - ⊡ Alice, Atlas, CMS, and LHCb confirmed they will use RAL
- ⌘ Production
  - ⊡ BaBar and others

RAL Political Issues(1)

- Computer security
- a political approach to persuading sites to trust each other would be useful
- Acceptable use policies - very important, coupled with above
- Is the funding coming with strings attached? (a la: accessible only for local country)
- No, as long as experiments are supported by UK then collaborators can use us.
- Software configuration - we have problems when different experiments demand different configurations, compilers, priorities, etc.

RAL Political Issues(2)

- Scheduling between experiments -
- UK experiments are prepared to negotiate on scheduling but they won't have control over global data challenges so there needs to be scheduling of DCs at the top level.
- What is a Tier1/2/3 Centre?
- In the UK all sites want to be Tier2 Centres. If they are, do we have any Tier3/4 Centres? What is the distinction between Tier1/2/3 etc

CMS Regional Centers in the U.S.

⌘ Fermilab is host-lab for U.S. CMS Software and Computing
  ⌂ DOE/NSF sponsored program to build "User Facilities" for CMS in the U.S.

⌘ User Facilities: Tier-1 center at Fermilab + 5 Tier-2 centers at U.S. Universities
  ⌂ Fermilab and U.S. Universities also involved in CMS Core Software
  ⌂ Fermilab support for Tier-2 centers, "user community", physics analysis center

⌘ Prototypes and test-beds are operational now
  ⌂ R&D prototype for Tier-1 at Fermilab operational
  ⌂ Two prototype Tier-2 centers at UCSD/Caltech and U.Florida operational

⌘ R&D and test-bed efforts are very important
  ⌂ Computing R&D, Grid integration, test-beds for CMS
  ⌂ Making Fermilab "fit" to become a major international partner
  ⌂ Serving a user community for CMS physics studies: Trigger, DAQ, Detector

⌘ These facilities play a major role for CMS production efforts for physics studies and upcoming data challenges

U.S. CMS Regional Centers: 3-Phases

⌘ Project Funding for R&D, Equipment, Staff

⌘ Prototyping: has started in 2000
  - �₀ Computing R&D
  - �₀ Computing hardware prototyping and test-beds
  - �₀ Computing for Physic Reconstruction and Selection

Prototype Facilities
– 5% Data Challenge 2003
– 20% Data Challenge 2004

⌘ Deployment: 2005-2007
  - �₀ Procurement Model: Start deployment in 2005, 30%, 30%, 40% costs
  - �₀ Ramp-up of User Facility Staff

Fully Functional T1/T2s
– 100% Capacity in 2007

⌘ Maintenance and Operations: 2007 on
  - �₀ Constant staff level
  - �₀ "Rolling Replacement" of hardware components, yearly budget 1/3 of initial investment
  - �₀ Moore's law takes care of Evolution and Upgrades

U.S. CMS RC Schedule and Milestones

- ⌘ "Physics" driven Milestones and Schedule:
  make systems available in time for data challenges and data taking
- ⌘ 3 waves of equipment procurements, installations, commissioning

  - ◰ R&D systems, funded in FY2002 and FY2003
    - ⊠ Used for "5% data challenge"
      - ⇨ release Software and Computing TDR

  - ◰ Prototype T1/T2 systems, funded in FY2004
    - ⊠ for "20% data challenge"
      - ⇨ end "Phase 1", Regional Center TDR, start deployment

  - ◰ Fully Functional Tier-1/2 funded in FY2005 through FY2007
    - ⊠ for LHC pilot and physics runs
      - ⇨ find Higgs and Supersymmetry….

U.S. CMS Tier-1 RC Installed Capacity

5% DC: Tier-1 +Tier-2 R&D Systems

20% DC: Prototype Systems

Fully Functional Full Capacity Tier-1/2 Facilities
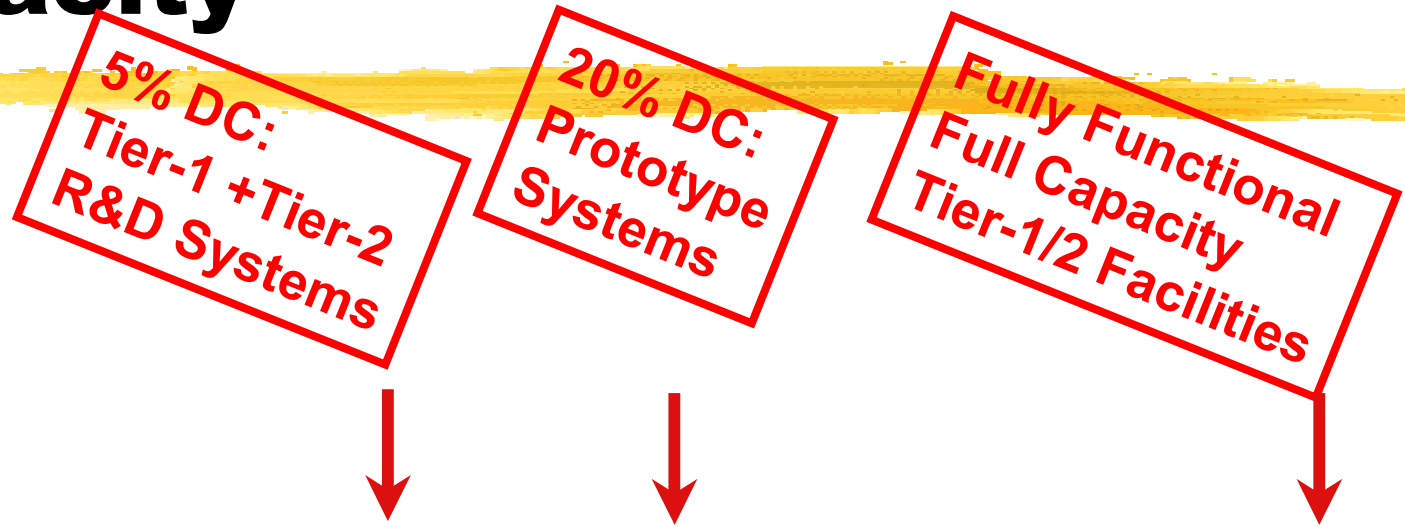
Fiscal Year	2002	2003	2004	2005	2006	2007
Simulation CPU (Si95)	2,000	3,000	4,000	7,200	28,800	72,000
Analysis CPU (Si95)	750	2,100	4,000	8,000	32,000	80,000
Disk (TB)	16	31	46	65	260	650
Server CPU (Si95)	50	140	270	1,500	6,000	15,000

Le Centre de Calcul

One computing centre for
IN2P3-CNRS & DSM-CEA

National : 18 laboratories,
40 experiments,
2500 people

International : Tier-1 / Tier-A
status

45 people

0,5 PBytes
Data Bases,
Hierarchical storage

~ 600 cpu's, 20kSI95
40 TB disk

Budget:

~ 6-7 M Euros/year

Plus ~ 2 M for personnel

Network & QoS.
Custom services "à la carte"
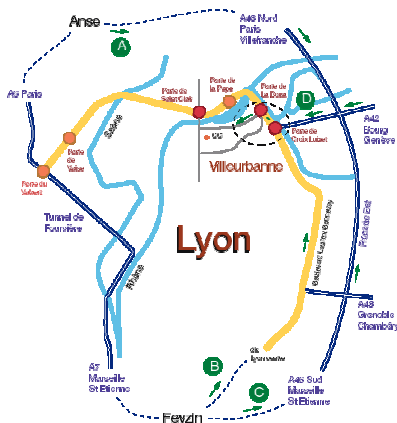
The French HEP computing center in Lyon
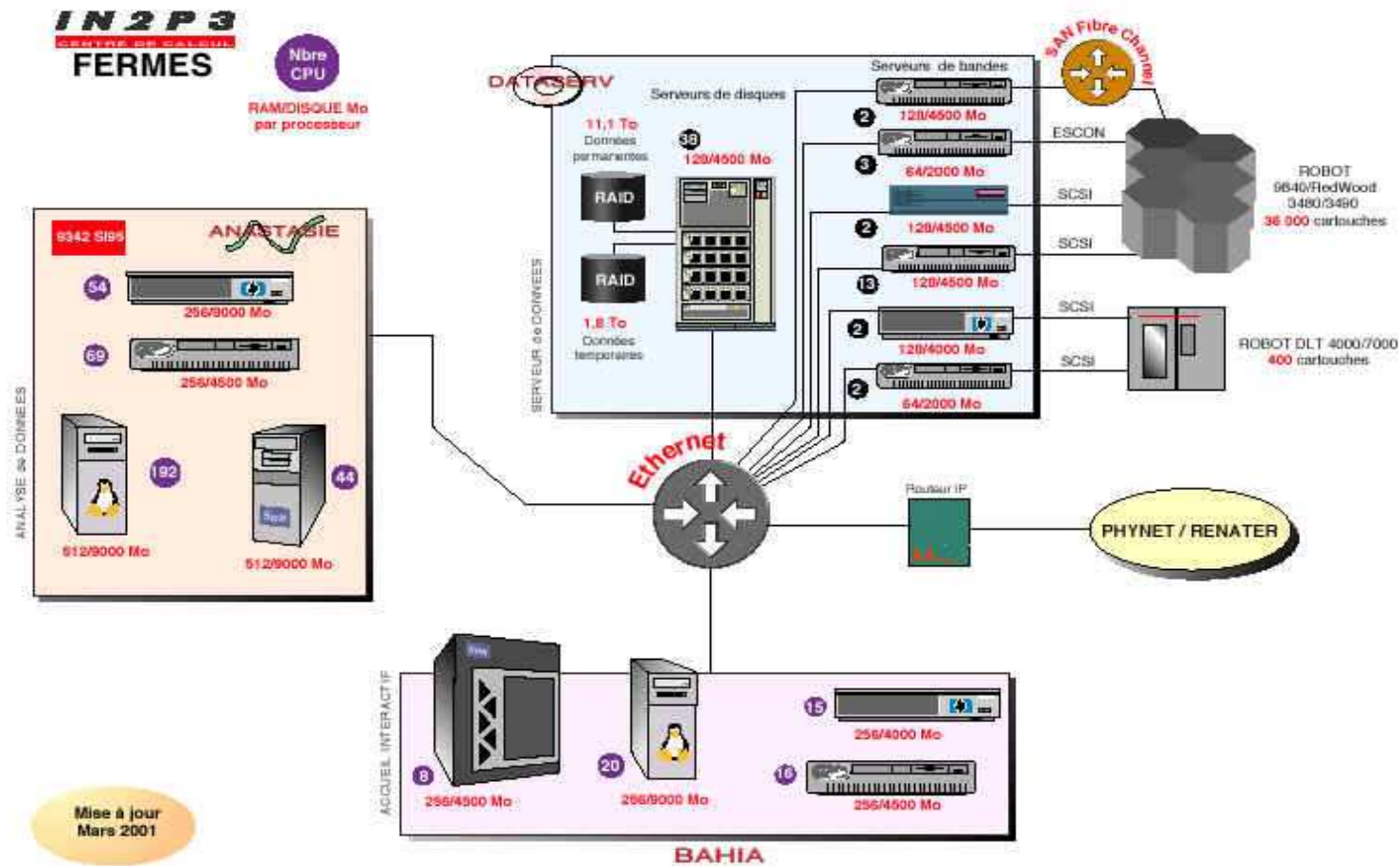
CC-IN2P3 Batch Farms 1996-2001

1 hour ~ 4-5 SI-95 hours
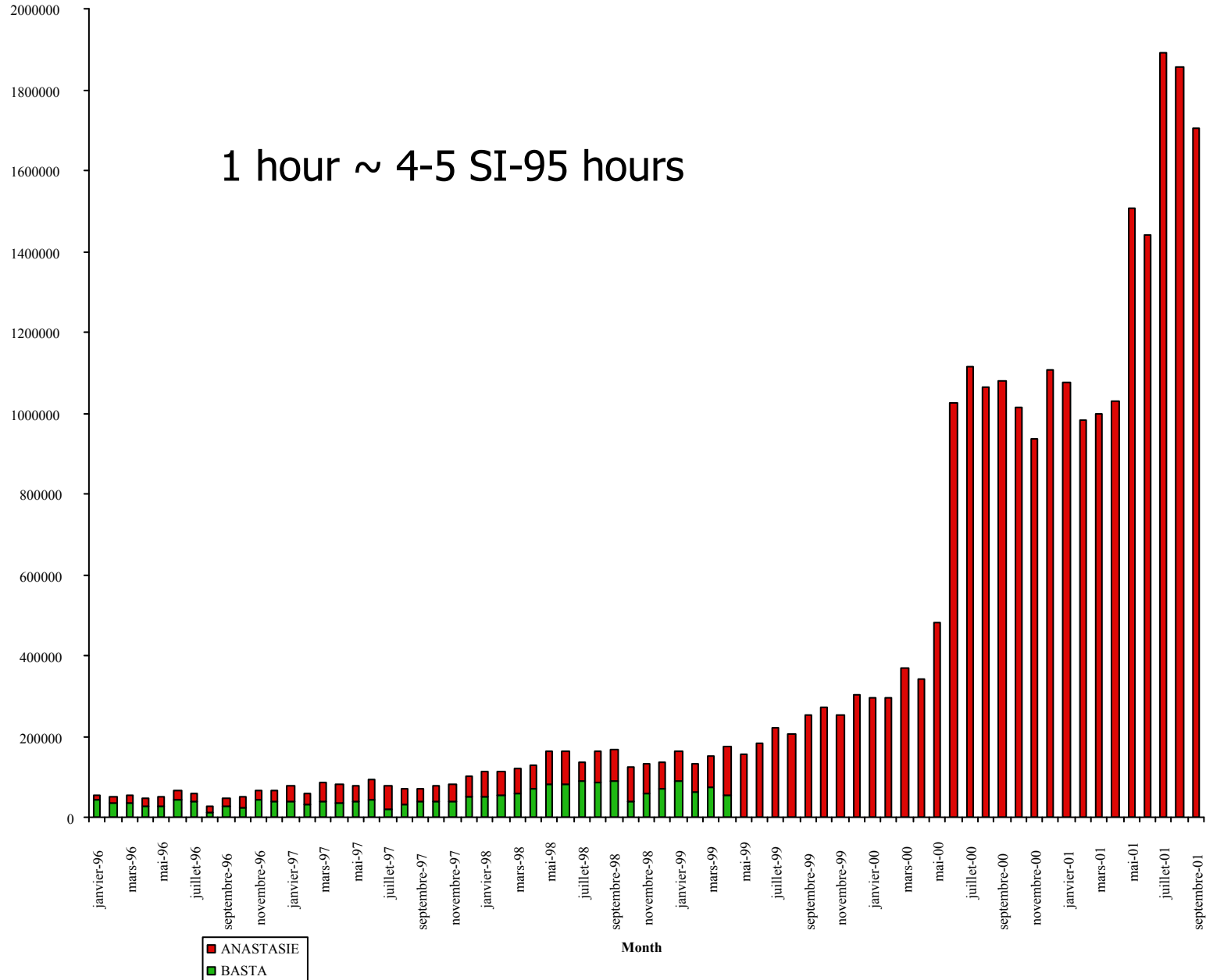
Data Bases

Disk space has many different usages and therefore different solutions.
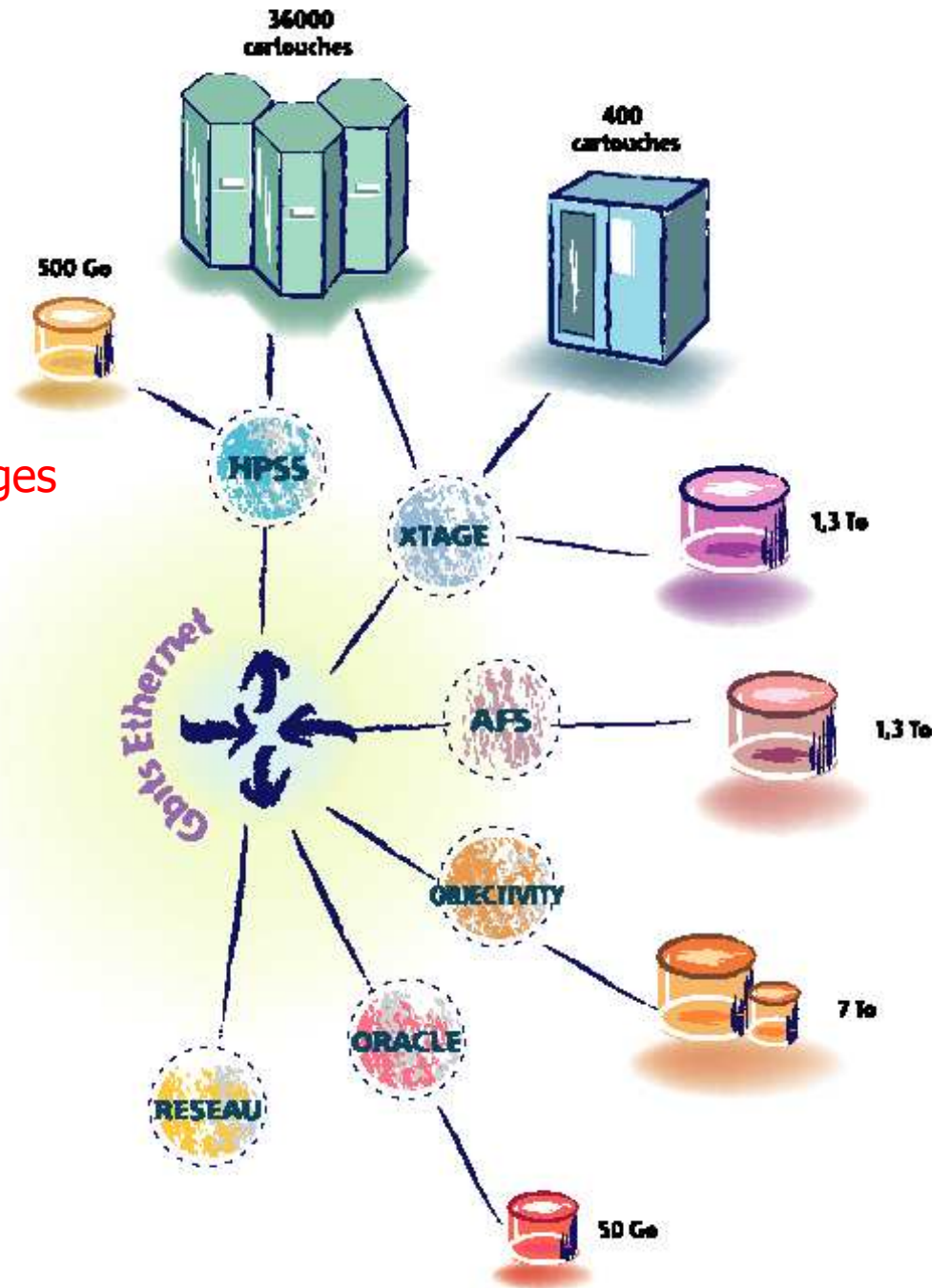
Expérience	AFS Group en Go	AFS Throug en Go	Bandes en Go	Disques data en Go	Type d'utilisatio	Autres en Go	Réseaux en Mb/s	via	Softs
Aleph			200		K7 9840			cern	Fortran
Alice		2	10 000		HPSS			cern	Root, AliRoot, PHP, MySQL, C++
Ams								US (cern)	C++
Antares			700		HPSS			in2p3	g++ (STL), F90, nag, Oracle
Atlas	5							cern	Together, C++
Auger	60		500		HPSS				Oracle
Babar				25 000	HPSS	100	100	US (esnet)	Objectivity, bbftp, C++
Chooz								in2p3	
Clas	20							US (cern)	
Cmb				300	HPSS				MPI, C++ avec OpenMP, Oracle
Cms						200		cern	Objectivity, Oracle, C++
D0	100	2	10 000		HPSS		5	US (cern)	bbftp, C++
Delphi			?					cern	Fortran
Edelweiss	20								Mathlab
Eros	100		4 000		HPSS				Oracle
Euso									
Glast	10		200		K7 9840			in2p3	
H1									
Hess	10		8 000		DLT 8000			in2p3	
Indra								in2p3	
L3	6	6						cern	
Lhcb	100		7 000		HPSS			cern	LHC++, CLHEP, OpenScientist
NA48			4 000		K7 9840			cern	
NA50								cern	
Nemo			100					in2p3	MySQL
Ngs-Opera	2	1							CVS
Nomad								cern	
Phenix			3 000		HPSS		?	US (cern)	Objectivity, bbftp, C++
Siren								/	PVM (parallélisme)
Star								US (cern)	
Snovae	40	3	1 000		HPSS		1	(esnet)	CVS, CMT, AgendaMaker, Oracle, postSQL, bbftp
Tesla									
Thémis			500		K7 9840			in2p3	
Virgo			2 000		K7 9840				
WA98								cern	
Total	473	14	51 200	25 300		300	106		

The BABAR experience

- In 2001(pregrid area) manual load repartition between SLAC and IN2P3
  - account opening in yon (<24hours) for BABAR members
  - data transfert (reco, microdst) in <48h
- 2002: Continue this mode and
  - Gradual deployment of GRID technology
    - Very interesting test bench
  - RAL and Padova ramping up (Padova for dedicated purpose)
- Importance of human interaction
  - Weekly meetings
  - Personel exchange (~1 month visit)
- MoU : win-win situation
  - Value : what is saved at SLAC
  - Investment return : 50% of the value

IN2P3 Lyon center as a BABAR Tier1

Tier A

SLAC

BaBar

PEP-II Rings
Positrons
Low Energy Ring
BABAR Detector
High Energy R...
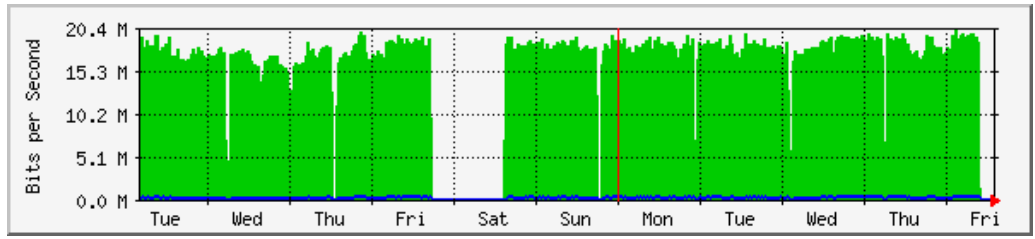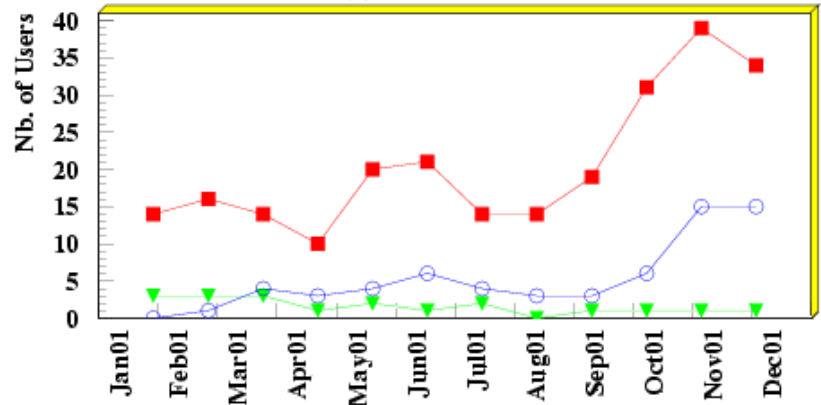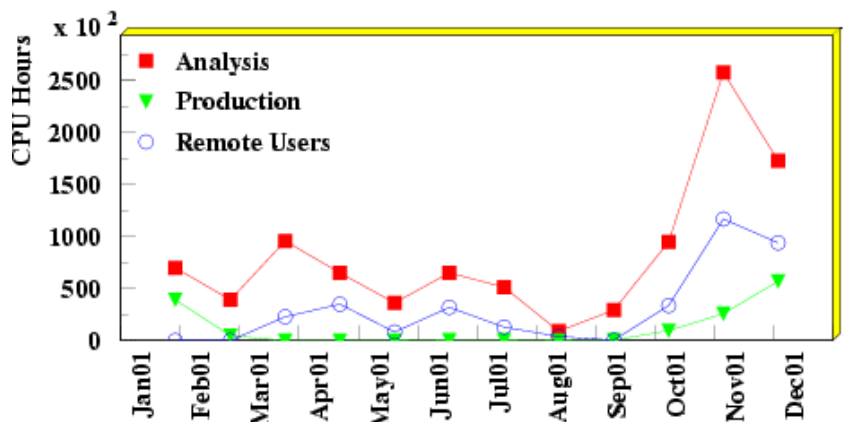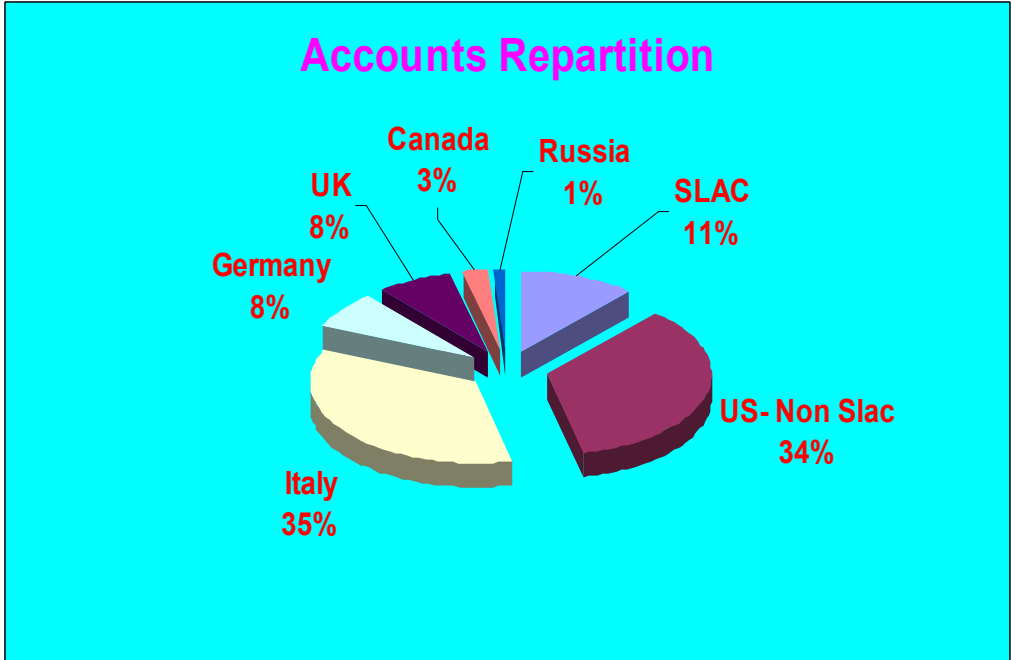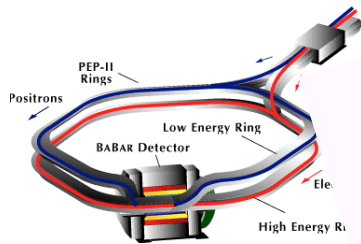
Two centres are trying to work as one:
- Data not duplicated,
- internationalization,
- transparent access, etc..

"Physicists have indeed foreseen to test the GRID principles starting first from the Computing Centres in Lyon and Stanford (California). A first step towards the ubiquity of the Grid."
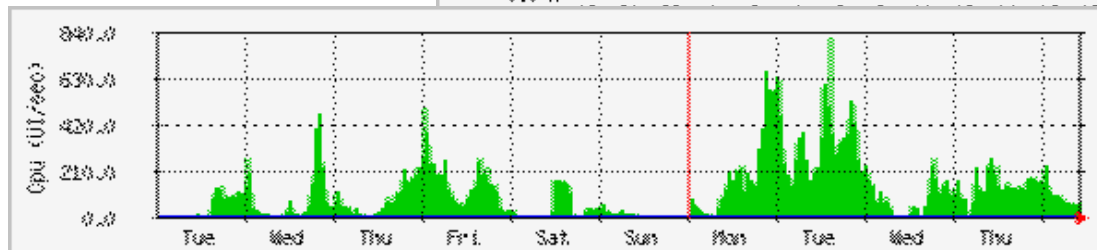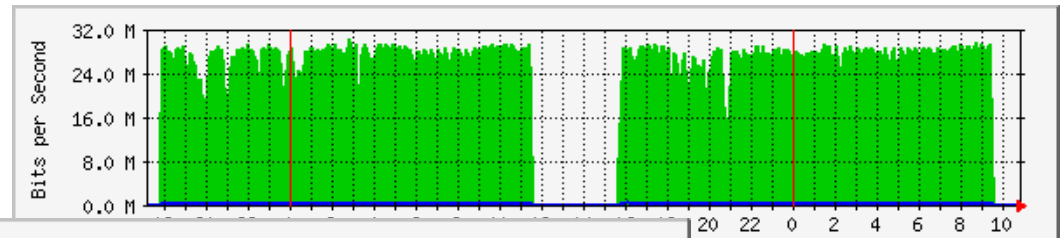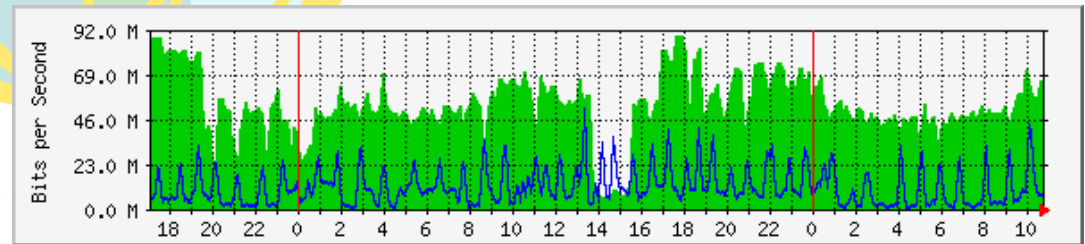
Pierre Le Hir
Le Monde
12 april 2001

March 11, 2002

Experiment Deployment

GridPP Monitor page
Map of current status
Click on node to view statistics.

Legend:
Site is alive
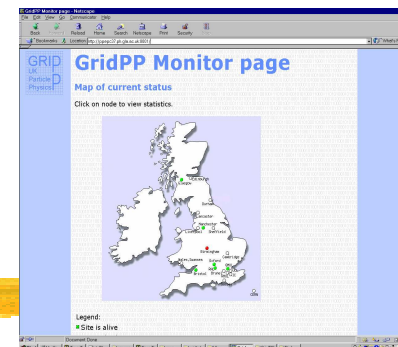
Current MDS Data from ldap://babargrid.phy.bris.ac.uk:2135

Total Statistics

	Simulation	Mixer	Reco	Total
Running	23	6	46	75
Pending	488	48	38	574
Total	511	54	84	649

BaBar GRID Monitoring

Total Number of VO's Online
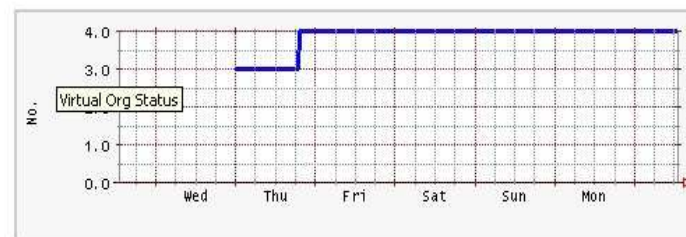
Total Number of Machines Online
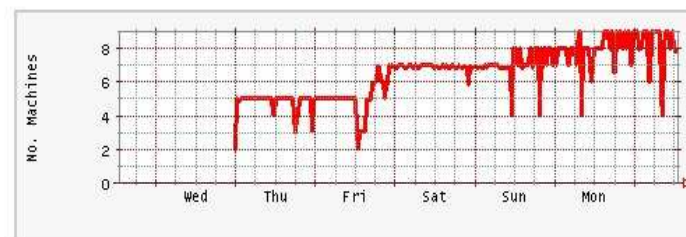
The role of HEP-CCC

- Several meetings per year of director of the lage regional centers
- Non LHC- dedicated
- Importance to get global representation: contact with ICFA

HEPCCC Terms of reference

- ⌘ CCC/**CERN/89/08** Rev.

- ⌘ The **High-Energy Physics Computing Co-ordination Committee - HEP-CCC** - provides a forum in which the Directors responsible for Computing at the major European Institutes which provide funds for HEP are able to discuss the organisation, co-ordination and optimisation of computing in terms both of money and personnel.

- ⌘ In HEP-CCC, members analyse potential problems and develop common or complementary strategies to solve them in the most cost-effective way for the European HEP community.

- ⌘ The aim is to achieve a European-wide co-ordination of computing resources. It is believed that this improves the opportunities of the national HEP communities to satisfy their computing needs.

HEP CCC terms of reference (2)

⌘ HEP-CCC may set up some technical committees whose role is to gather the information, to select the best courses to follow, and to present them with the pros and cons to the HEP-CCC for decision. In this context, HEP-CCC has established in 1995 the HEP-CCC Technical Advisory Sub-Committee (HTASC), the mandate of which may be found at HTASC Mandate.

⌘ The members of the HEP-CCC endeavour to disseminate the information gathered and to implement the recommendations in their respective areas of responsibility. HEP-CCC takes every precaution to consider also the problems and interests of the countries and institutes of the HEP community, which do not have members on the committee; these are explicitly represented by the Chairman of ECFA. HEP-CCC may maintain further communications through Correspondents, or by inviting Observers.

⌘ The conclusions of HEP-CCC are thus meant to serve also as carefully elaborated,

strong recommendations to the whole European HEP community

Attendance in Nov 2001

⌘ PRESENT: G. Barreira, M. Cattaneo (for P. Jeffreys) W. deBoer, M. Delfino, J. Le Foll, W. Hoogland, D. Jacobs (secretary), T. Haas, H.F. Hoffmann (near the end), D. Kelsey, D. Linglin, S. Lloyd, L. Price, F. Ruggieri (item 5 onwards), E. Valente, H. von der Schmitt, G. Wormser (chairman)

⌘ EXCUSED: A. Ferrer, L. Foà, I. Gaines, P. Jeffreys, J. May, K. Peach, P. Villemoes

⌘ INVITED: F. Gagliardi, J. Harvey (for D. Schlatter) L. Robertson

Proposal

- Explore the possibility for HEPCCC to become a IUPAP/ICFA committee
- Form a working group to that effect to report in a few months
- Membership : SCIC chair , HEPCCC chair,..
- Will be discussed at the next HEPCCC meeting on March 22

Long term plans

- Ramping up plans of all present Tier1s in phase with the LCG plans :
  - ~10% of total LHC needs in each Tier1 in 2007
- Tier2 plans in Tier1 countries require consolidation
- Bring new Tier1s in ?
  - (Brazil, Netherlands,...?)

Conclusions

- ⌘ Tier1 building up well under way in each country:
  - ⬒ Hardware, Personnel, Participation in Grid testing
  - ⬒ Long term plans in hand
- ⌘ Important to define tasks, specifications, minimum requirements
  - ⬒ Tier2 roles, relationship with Tier1
- ⌘ Tighten human links between Tier1s

Figure 1: RDCCG - Analysis of Components and Services

management
2.6

1.2

FZK tape archive
1.1

software server interactive login **ALICE**
1.3.1

software server interactive login **ATLAS**
1.3.2

8x

1.5.1

compute nodes CPU intensive
1.4.1

compute nodes I/O intensive
1.4.2

compute nodes communication intensive ??
1.4.3

1.6 Data tape archive PBytes

GRID backbone

1.7.1 Data server 1

Data server 2

Data server n

SAN fabric

ALICE ATLAS .... Data Pool Volume Management
1.7.2

software installation service
1.8

licence service
1.9

certification authority
1.12

firewall
1.13

Grid services
1.14

infrastructure
2.1

user support
2.2

training and education
2.3

documentation
2.4

R & D
2.5

FZK backbone

software server interactive login **other science**
1.3.9

software server interactive login **TEST; R&D**
1.3.10

compute nodes TESTING; R&D
1.4.4

Data server R&D
1.7

system monitoring & management
1.10

network address translation
1.11

batch and background; invisible for users private network ??

WAN

Data Import Data Export Tier-0/1/2

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Guy Wormser, LCG worshop

23-nov-2001

Running SAN for Grid

Compute Nodes: I/O clients for
nfs, cifs, root, scp, gass, ftp, s-ftp, http, https, ...

Grid backbone 128 GBit/s

MDC

I/O server for
nfs, cifs, root, scp, gass, ftp, s-ftp, http, https, ...

SAN   SANergy, qfs, gfs, ...

High Throughput Cluster:
Direct SAN access (>300 MB/s)

disk subsystems

tape robotics

Answers to Original Questions

- –the list of planned centers - Rutherford Appleton Laboratory, UK Tier1
- - single/multi-experiment regional centers - all 4 LHC experiments plus BaBar.
- - what resources will be available (hardware, people) see slide
- - will the center support tier2 centers? Yes
- - when will the regional center start to exist? Now
- - what are the plans to participate in testbed and data challenges in the next years
  - EDG testbed1,2,3 EDG development testbed, DataTAG/GRIT, + LCG testbeds
  - Alice, Atlas, CMS, and LHCb data challenges
- - what do you think are the political questions to sort out before the regional centers can work together seamlessly?
- (for instance the plan foresees that Tier1 centers are used by the whole collaboration and not only by the scientists in the nation of the center)
- - computer security - a political approach to persuading sites to trust each other would be useful
- - acceptable use policies - very important
- - is the funding coming with strings attached? (a la: accessible only for local country) No, as long as experiments are supported by UK then collaborators can use us.