PPDG
The Particle Physics Data Grid

Making today's Grid software work for HENP experiments,
Driving GRID science and technology.
(www.ppdg.net)

Richard P. Mount

November 15, 2000

PPDG

- Who is involved?
- How is it funded?
- What has it achieved?
- How does it fit in to the big Grid picture?
- How is it relevant for LHC?

PPDG Collaborators

California Institute of Technology	**Harvey B. Newman,** Julian J. Bunn, Koen Holtman, Asad Samar, Takako Hickey, Iosif Legrand, Vladimir Litvin, Philippe Galvez, James C.T. Pool, Roy Williams
Argonne National Laboratory	**Ian Foster**, Steven Tuecke **Lawrence Price,** David Malon, Ed May
Berkeley Laboratory	**Stewart C. Loken**, Ian Hinchcliffe, **Doug Olson**, Alexandre Vaniachine **Arie Shoshani,** Andreas Mueller, Alex Sim, John Wu
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Fermi National Laboratory	**Victoria White**, Philip Demar, Donald Petravick **Matthias Kasemann,** Ruth Pordes, James Amundson, Rich Wellner, Igor Terekhov, Shahzad Muzaffar
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San Diego Supercomputer Center	**Margaret Simmons,** Reagan Moore,
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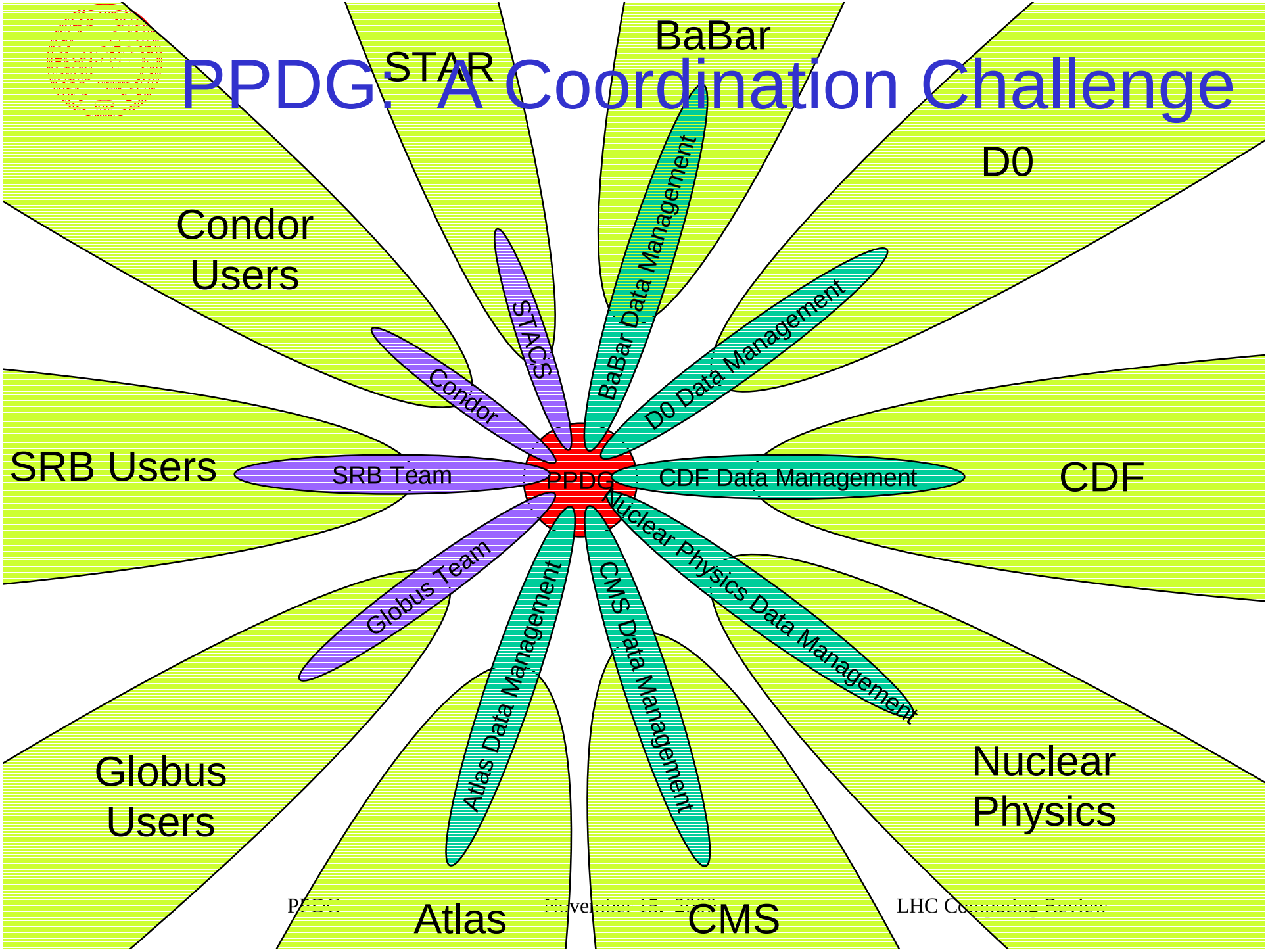
Thomas Jefferson National Accelerator Facility	**Chip Watson,** Ian Bird, Jie Chen
University of Wisconsin	**Miron Livny**, Peter Couvares, Tevfik Kosar

PPDG Collaborators

	Particle Physics	Accelerator Laboratory	Computer Science
ANL	X		X
LBNL	X		X
BNL	X	X	x
Caltech	X		X
Fermilab	X	X	x
Jefferson Lab	X	X	x
SLAC	X	X	x
SDSC		X	
Wisconsin		X	

PPDG: A Coordination Challenge



PPDG Funding

- FY 1999:
  - PPDG NGI Project approved with $1.2M ($2M requested) from DoE Next Generation Internet program.
- FY 2000
  - DoE NGI program not funded
  - $1.2M funded by DoE/OASCR/MICS ($470k) and HENP ($770k)
- FY 2001+
  - Proposal (to be written) for DoE/OASCR/MICS and HENP funding in SciDAC context. Likely total FY2001 request: ~$3M.

Initial PPDG Goals

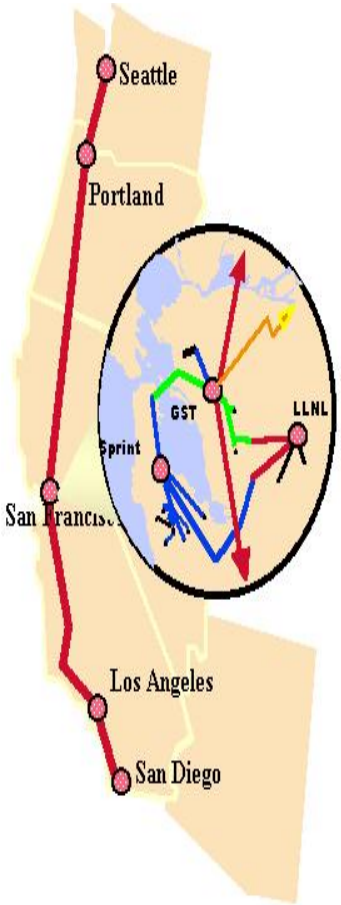
Implement and Run two services in support of the major physics experiments at BNL, Fermilab, JLAB, SLAC:

- **"High-Speed Site-to-Site File Replication Service";**
  Data replication up to 100 Mbytes/s
- **"Multi-Site Cached File Access Service":**
  Based on deployment of file-cataloging, and transparent cache-management and data movement middleware

Using middleware components already developed by the collaborators.

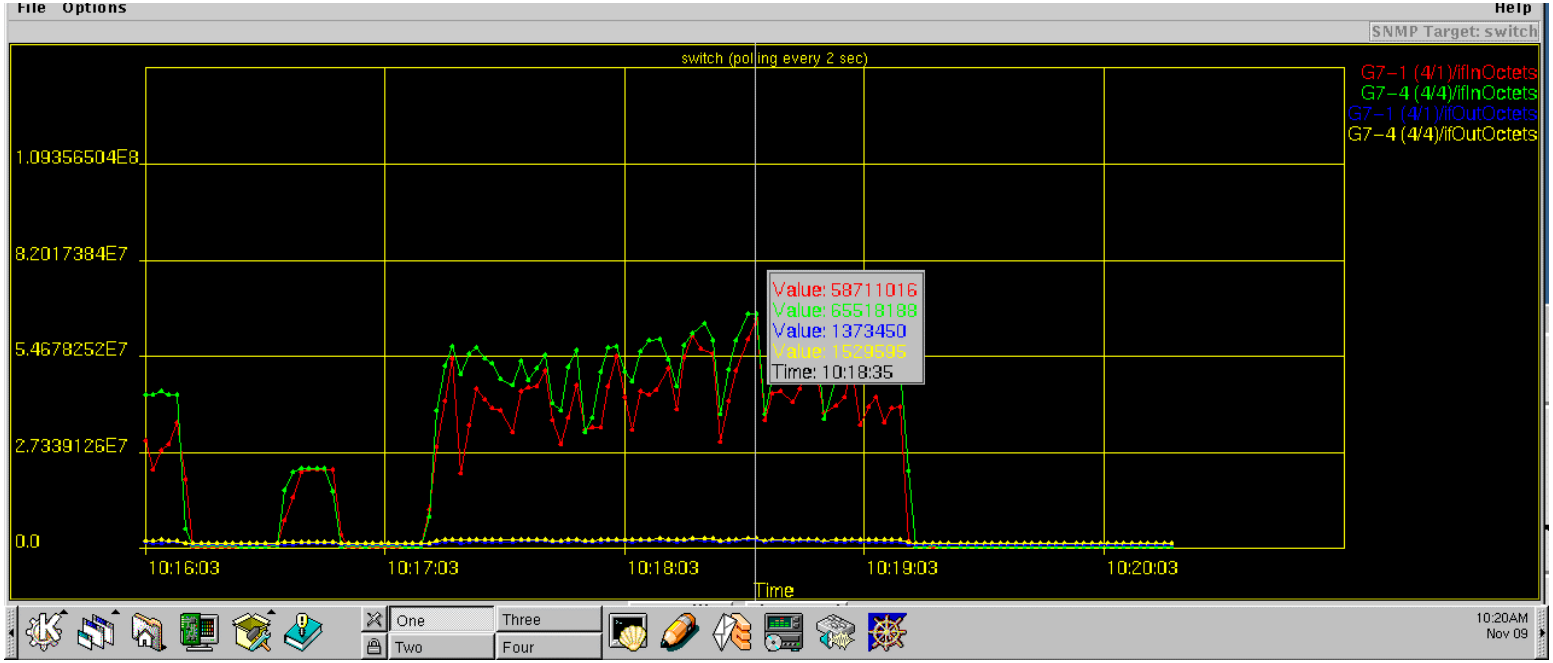
PPDG Site-to-Site Replication Service

Progress: 100 Mbytes/s Site-to-Site



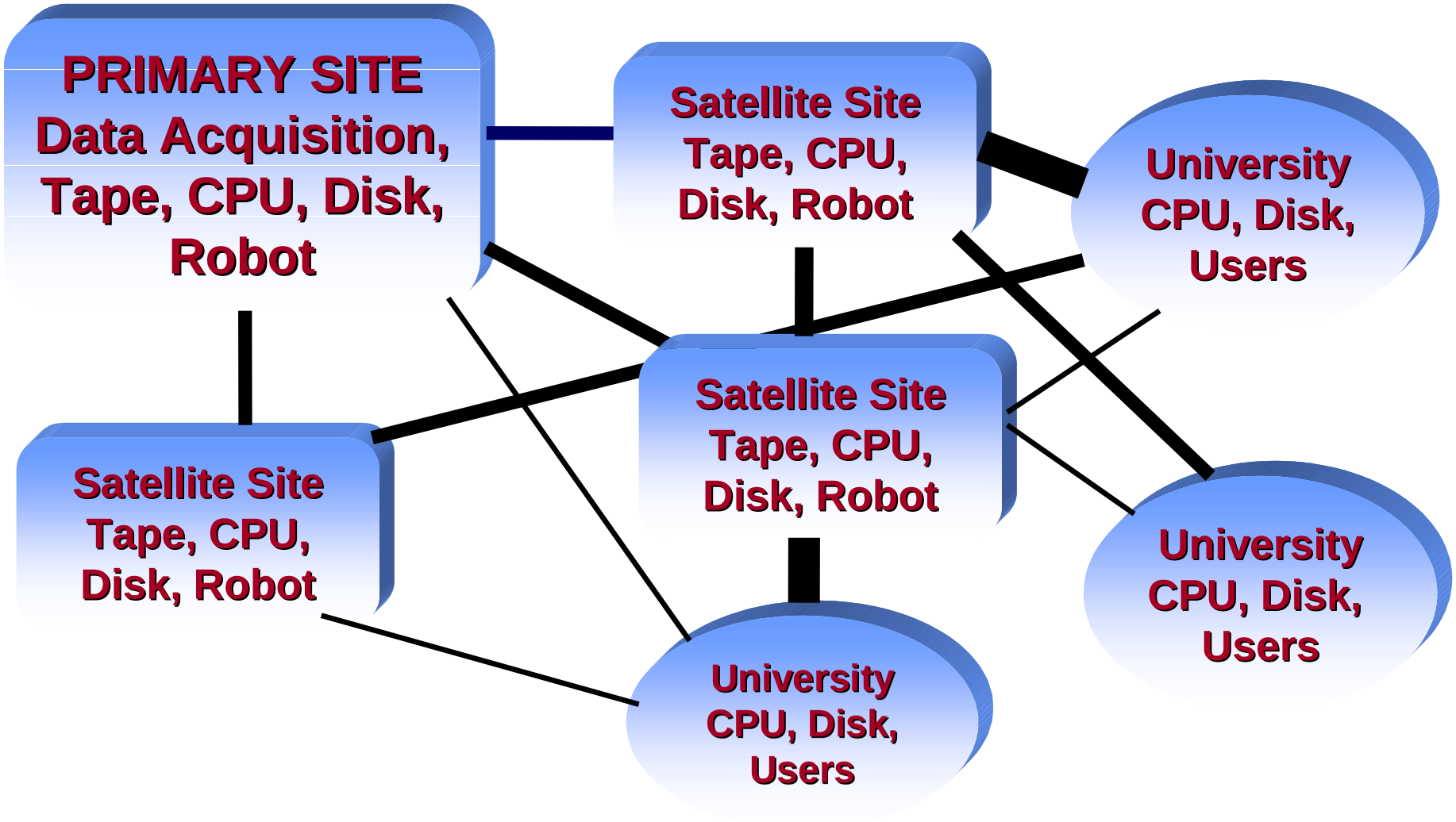
- Focus on SLAC – Caltech over NTON at OC48 (2.5 gigabits/s);
- Fibers in place;
- SLAC Cisco 12000 with OC48 and 2 × OC12 in place;
- Caltech Juniper M160 with OC48 installed;
- 990 Mbits/s achieved between SC2000 and SLAC.

Throughput from SC2000 to SLAC



Up to 990 Mbits/s using two machines at each end plus multi-stream TCP with large windows

PPDG Multi-site Cached File Access System



PPDG Cached File Access Progress

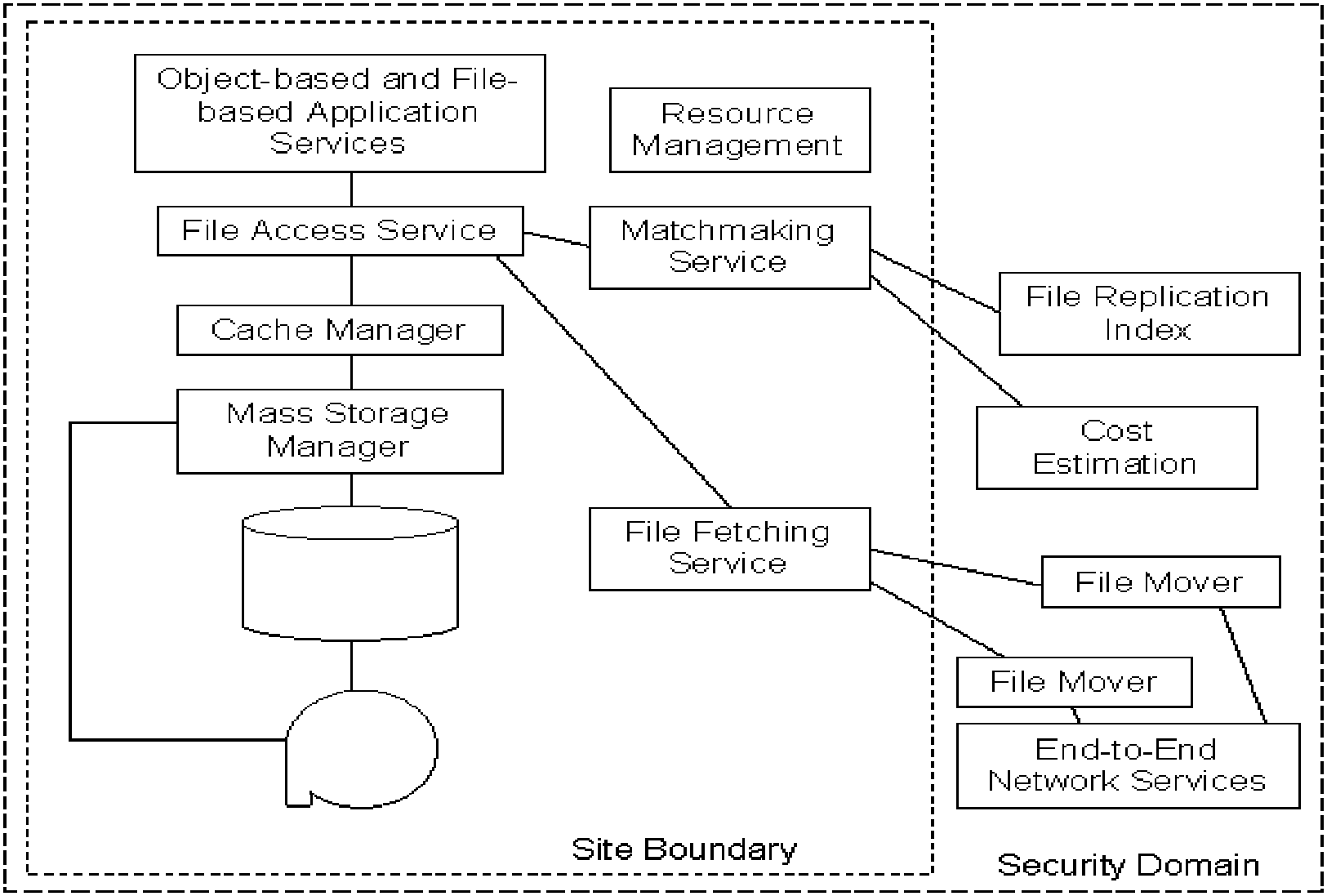
- Demonstration of multi-site cached file access based mainly on SRB*. (LBNL, ANL, U.Wisconsin)
- Development of HRM storage management interface and implementation in SRB and SAM (D0 data management)

* Storage Resource Broker (SDSC)

Test of PPDG Storage Management API (HRM)

- 2 separate Clients request and get files from:
  - SRB catalog and HPSS – LBL and Wisconsin
  - D0 SAM catalog, disk cache and Enstore storage system – Fermilab and Wisconsin. Demo'd at SC2000.
- Agreed on common Storage Resource Management interface.
- Next step – Client that requests and gets files from each/both storage management systems – goal to meet the PPDG "multi-site file caching file access" across 2 existing grid components.

PPDG: Initial Architecture



Initial PPDG "System" Components

Middleware Components (Initial Choice): See PPDG Proposal Page 15

Object and File-Based Application Services	**Objectivity/DB (SLAC enhanced)** **GC Query Object, Event Iterator, Query Monitor** **FNAL SAM System**
Resource Management (but begin to deploy resource discovery & mgmnt tools)	**Start with Human Intervention**
File Access Service	**Components of OOFS (SLAC)**
Cache Manager	**GC Cache Manager (LBNL)**
Mass Storage Manager	**HPSS, Enstore, OSM (Site-dependent)**
Matchmaking Service	**Condor (U. Wisconsin)**
File Replication Index	**MCAT (SDSC)**
Transfer Cost Estimation Service	**Globus (ANL)**
File Fetching Service	**Components of OOFS**
File Movers(s)	**SRB (SDSC); Site specific**
End-to-end Network Services	**Globus tools for QoS reservation**
Security and authentication	**Globus (ANL)**

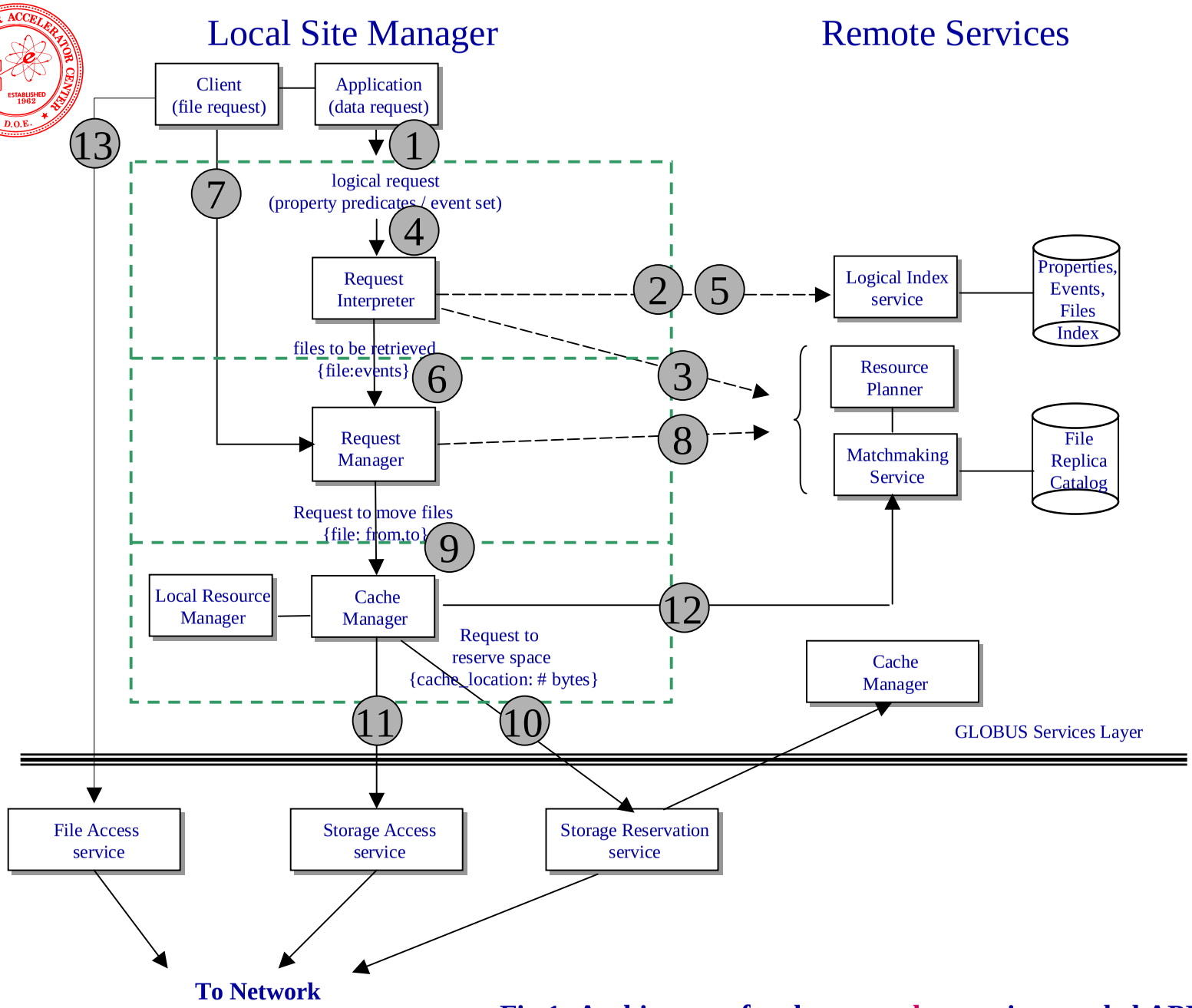
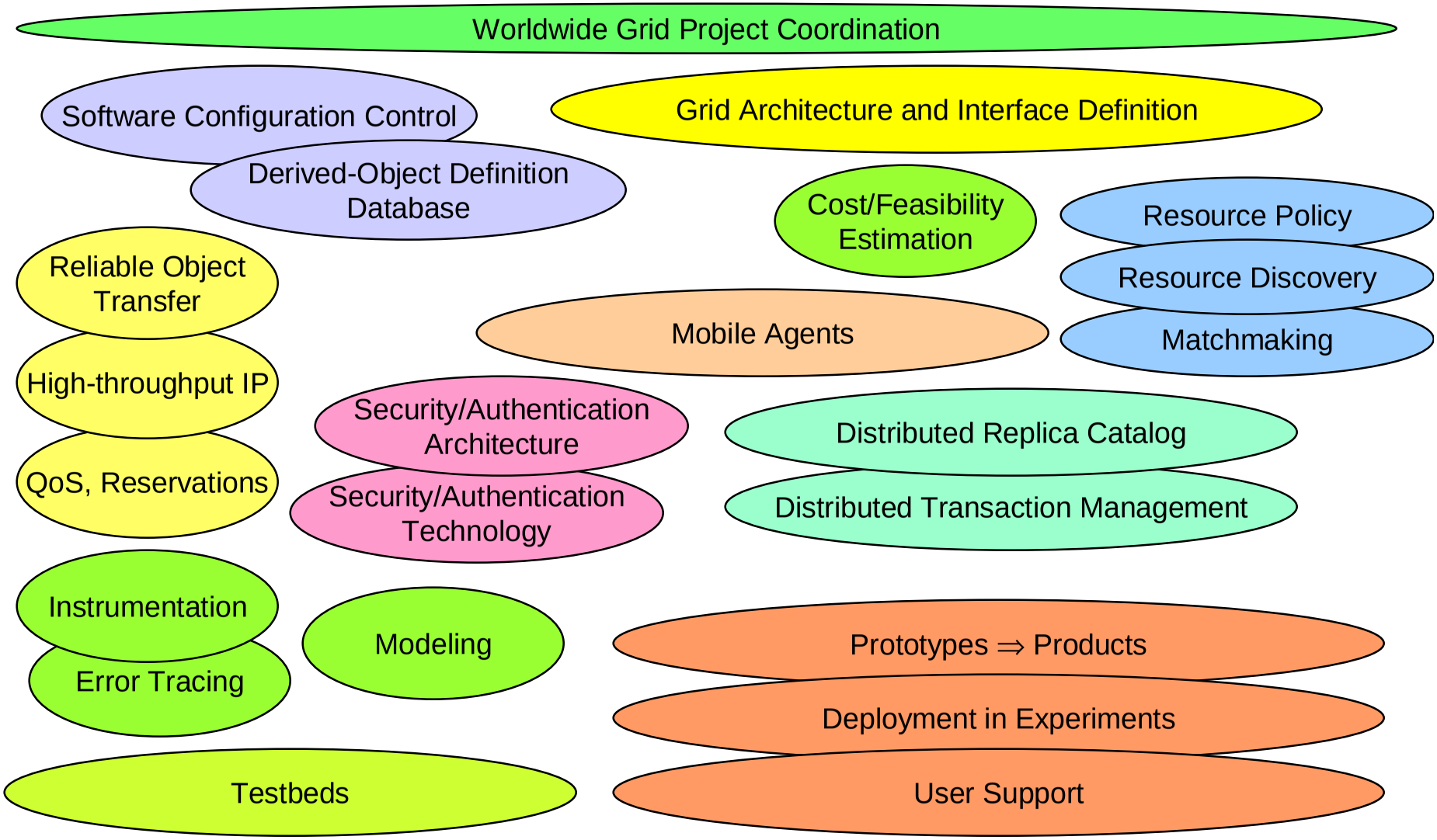


Fig 1: Architecture for the general scenario - needed APIs

Current PPDG Focus: File Replication Service

- Use cases from BaBar, D0, CMS, etc.
- Typical target: BaBar SLAC-Lyon transfers
  (current low-tech approach absorbs about 2 FTE).
- Replica catalog distinct from Objectivity catalogs;
- GRIDftp transfer.
- Globus inter-site security.

The Big Grid Picture



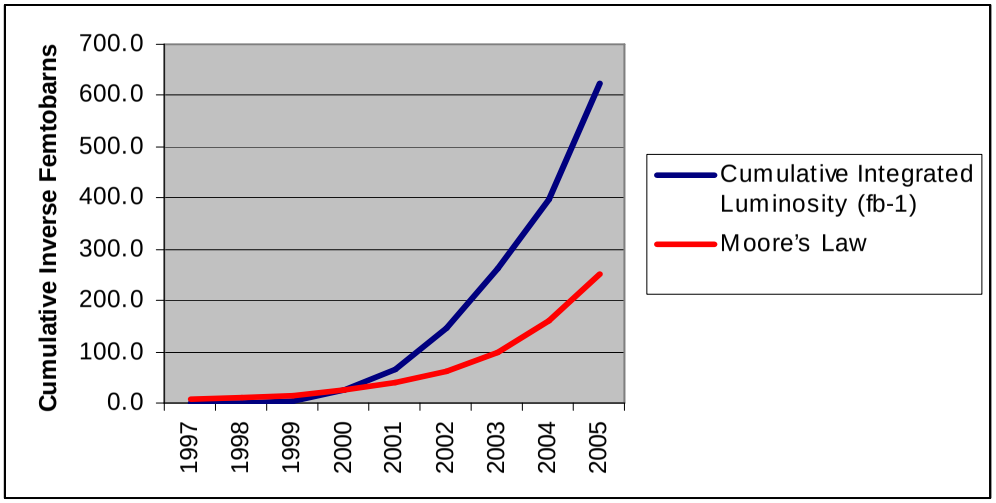
The Big Grid Picture

- Grid projects must become coordinated (in progress);
- Progress in the commercial world must be exploited;

PPDG in the Big Grid Picture

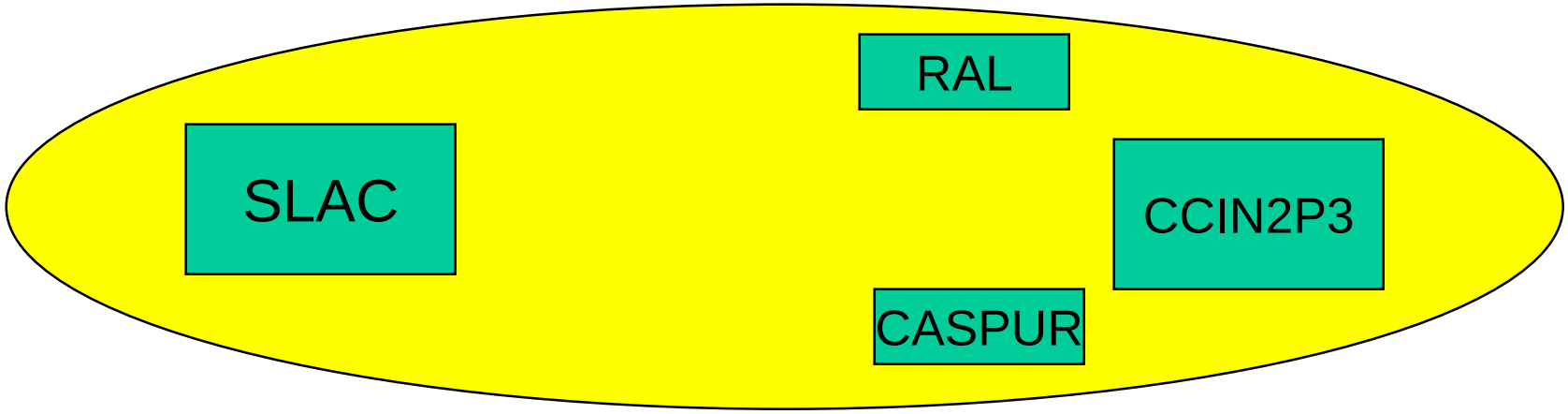
- Rapid deployment of Grid software in support of HENP experiments;
- Drive and contribute to Grid architecture:
  - Architecture must define interfaces between evolving components;
- Design and develop new Grid middleware components (deliverables to be defined in consultation with GriPhyN, EU-DataGrid …):
  - Focus on rapid delivery to HENP experiments (to validate concepts, get feedback and be useful).

PPDG and LHC? BaBar Example



PPDG-SLAC-IN2P3-BaBar plan to implement Grid components allowing SLAC + CCIN2P3 + … to become an (adequately) integrated data analysis resource.

Delivery of useful service: scheduled for end 2001



PPDG and LHC

- US LHC groups are strong participants in PPDG;
- Computer scientists in PPDG see the LHC challenge as the leading opportunity to advance the science of data-intensive Grids;
- PPDG, GriPhyN and EU-DataGrid are creating coordinated management and joint working groups:
  - Interoperable systems with consistent components.