Some Aspects of

The Particle Physics Data Grid Collaboratory Pilot (PPDG)

and

The Grid Physics Network (GriPhyN)

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**PPDG**

- 6 HENP experiments including 4 labs, 4 CS groups, >25 active participants
- Atlas, BaBar, CMS, DO, JLAB, Star
- DOE 3 year SciDAC proposal - expect to know about funding very soon.
- Funding balanced towards experiments with CS funding for development and deployment.
- Joint CS and Experiment integrated deliverables.

**GriPhyN**

- 17 universities, SDSC, 3 labs, >40 active participants. 4 physics/astrophysics experiments
- Atlas, CMS, LIGO, SDSS.
- 3 years of NSF ITR funding started Sept 2000.
- Funded primarily as an IT research project 2/3 CS + 1/3 physics. CS funding focus on students and post-docs.
- Education and Outreach a focus

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PPDG Goals

› End-to-end integration and deployment in experiment production systems.

› After one experiment uses software adapt/reuse/extend for other experiments.

› Extend & interface existing distributed data access code bases with Grid middleware.

› Develop missing components and new technical solutions.

› Milestones for deliverables of the order of 1 year for each Project Activity

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PPDG End-to-End

Experiment Specific Application (Atlas, BaBar, CMS, D0, STAR JLAB)

Application-Grid interfaces

Generic Grid Services

Fabric-Grid interfaces

Experiment Specific Fabric & Hardware
PPDG to date:

- High speed (100MByte/sec) point to point file transfer,
- Common storage management adapters - HRM to SRB, HPSS, SAM, Enstore,
- File replication prototypes - BaBar, GDMP
- Input to Globus file replication management
- Collaborative work was very loosely coupled to the overall project activities

PPDG future:

- Project Activities from proposal: proposed activities
- Understand how to relate these to CS teams who are also delivering to other funded responsibilities and clients.
- Understand how to accommodate these within Experiments who have to “deliver to WBS”
PPDG CS Program & EU Data Grid WPs

• Job Description Language - WP1
• Scheduling and management of processing and data placement activities. - WP1
• Monitoring and status reporting - WP3
• Storage resource management - WP5
• Reliable replica management services - WP2
• File transfer services - WP2
• Collect and document current experiment practices and potential generalizations - WP8

PPDG has no equivalent to date to WP4
Common s/w will we use - in the best case

PPDG (and GriPhyN) include the leadership of existing Grid middleware

- Condor
- Globus
- Storage Resource Broker

It is natural/required/expected that we will use software from these groups. Existing S/w includes:

- Condor and Condor-G
- Class Ads as a component GridFTP
- Globus Replica Catalog
- Globus Replication Management
- LBL IDL definitions of HRM/DRM
- SRB as a system?

Will stimulate new services and extensions in core Grid software components

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Concerns - in the worst case

- Experiments have their own “data handling” systems at different stages of maturity developed by collaboration projects and/or consensus across many institutions and stakeholders.
  - BaBar
  - D0 SAM
  - CMS ORCA + GDMP + ??
  - ATLAS mysql catalogs??
  - JLAB Java implementation only
  - Star existing data transfers
- We will not be able to tolerate the overheads:
  - Experiments have milestones e.g. beam
  - Across experiment agreement
  - Accept s/w from outside over which we do not have complete control
  - Of not just doing it ourselves
PPDG Project Activity #1 - GDMP

- Prototype developed for Objectivity database replication for CMS Monte Carlo data between Cern and remote sites.
- As part of PPDG will add more general features e.g. support for flat files.
- Also an EUDataGrid WP2 sub-project.
- As part of both projects integrated with Globus Replica Catalog. Open question is use of Globus replica management services.
- Uses to date:
  - transfer CMS simulation data from Cern to remote sites.
  - SDSS Science database for query testing at remote site.
- Under discussion for Atlas.
- Issue in spades of how future developments get planned and executed.
- GDMP URL

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Project Activity #2. - D0 and University of Wisconsin Job Definition and Global Management layer

- Existing D0 SAM (Grid enabled) distributed data handling & resource management system - including well developed file replication and disk caching services
- Aim to make use of existing/extended Condor services - ClassAdds, Condor-g job submission layer
- Develop functionality to benefit D0 end users
  - in an architecture that provides well defined boundaries between SAM and extra services.
  - Allows reuse of concepts and design for e.g. CMS and reuse of actual software
- Condor team provides the liaising to INFN EUDG WP1 & WP1 PPDG liaison is ICL D0 collaborator.
- Define scope and deliverables by the end of June
  - Job Definition Language and Distributed Management Features - extensions to existing SAM and Condor languages for Grid
  - Interface of new s/w to SAM
  - Demonstration application
- (need a name...)

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Other PPDG-Activities to be defined soon ..

- Star file replication using Globus replica catalog and management
- BaBar data base transfer between Slac and IN2P3
- Atlas use of GDMP and Globus
- Java developments from JLAB with Globus
- Disk Resource management in Star with LBL

- Other Activities:
  - Participation in GriPhyn Discussions
  - Participation in EU/US Data Grid Coordination meeting
GriPhyN (from I. Foster All hands talk)

› Project has two complementary & supporting elements
  • IT research project: will be judged on contributions to knowledge
  • CS/application partnership: will also be judged on successful transfer to experiments
› Two associated unifying concepts
  • Virtual data as the central intellectual concept
  • Toolkit as a central deliverable and technology transfer vehicle
› Petascale Virtual Data Grids – demonstrate experiment applications using Virtual Data Concepts
GriPhyN Goals (Foster)

“Explore concept of virtual data and its applicability to data-intensive science," i.e.,
1. Transparency with respect to location
   • Known concept; but how to realize in a large-scale, performance-oriented Data Grid?
2. Transparency with respect to materialization
   • To determine: is this useful?
3. Automated management of computation
   • Issues of scale, transparency

Virtual Data Toolkit (Livny)

“.. a primary GriPhyN deliverable will be a suite of virtual data services and virtual data tools designed to support a wide range of applications. The development of this Virtual Data Toolkit (VDT) will enable the real-life experimentation needed to evaluate GriPhyN technologies. The VDT will also serve as a primary technology transfer mechanism to the four physics experiments and to the broader scientific community”.
Primary GriPhyN R&D Components

- Virtual Data Tools
- Request Planning and Scheduling Tools
- Request Execution Management Tools
- Resource Management Services
- Security and Policy Services
- Other Grid Services
- Raw data source
- Distributed resources (code, storage, computers, and network)
- Performance Estimation and Evaluation

Interactive User Tools

Individual Investigator → Production Team → Other Users
GriPhyN R&D from all-hands meeting

- Dynamic Replication Strategies for a High Performance Data Grid - University of Chicago
- Agent Grid Interfaces - Information Sciences Institute (ISI)
- Query Optimization - Caltech
- Data Base query research - UC Berkeley
- Issues in Fault Tolerance and the Grid - University of California San Diego
- NeST: Network Storage Flexible Commodity Storage Appliances - University of Wisconsin
- Prophesy: Performance Analysis & Modeling for Distributed Applications - Northwestern University
- High-performance bulk data transfers with TCP - University of Chicago
- Location-Transparent Adaptive File Caching - LBL
VDT V1.0 & Existing Components

› On going activity to implement and harden existing Grid technology by the Condor and Globus teams
› Condor job and resource management
  • Condor-G reliable and recoverable job management
  • DAGMan Basic job description, control and flow services
  • ClassAds resource publication and matching
› Globus
  • MDS-2 information service: access to static & dynamic configuration & state information
  • GRAM resource access protocol
  • GridFTP data access and transfer protocol
  • Replica catalog, replica management
  • Grid Security Infrastructure: single sign on
› SRB catalog services
GriPhyN Catalogs to date

**Transparency wrt materialization**

**Derived Metadata Catalog**
- App specific attr. id ...
- ... i2, i10
- ... ...
- ...

**Derived Data Catalog**
- Id Trans F Param Name ...
- i1 F X F.X ...
- i2 F Y F.Y ...
- i10 G Y P G(P).Y ...

**Transformation Catalog**
- Trans Prog Cost ...
- F URL:f 10 ...
- G URL:g 20 ...

**Transparency wrt location**

**Metadata Catalog**
- Name LFN ...
- X logF1 ...
- Y logF2 ...
- F.X logF3 ...
- G(1).Y logF4 ...

**Replica Catalog**
- LFN PFNs ...
- logF1 URL1
- logF2 URL2 URL3
- logF3 URL4
- logF4 URL5 URL6

**URLs for program location**
- Program storage

**URLs for physical file location**
- Physical file storage
finally…back to what is facing us in PPDG:

› How to translate the “G” word into useful & ubiquitous services
› How to actually deliver what was proposed
› How will production deployment be achieved and supported.
› Boundaries between and overlap between projects and experiment systems both in US and Europe?
› Do the US Grid projects have holes in the architecture e.g. “WP4” functionality