



Project Architecture, Middleware and Delivery Schedule

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Outline

- ◆ First year objectives
- ◆ Architecture overview
- ◆ Details of each middleware Work Package
- ◆ Job submission example
- ◆ Architecture issues and actions
- ◆ Interaction with PPDG/GriPhyN/iVDGL
- ◆ Interaction with Globus & Globus Grid Forum (GGF)
- ◆ Plans for 2002
- ◆ Summary



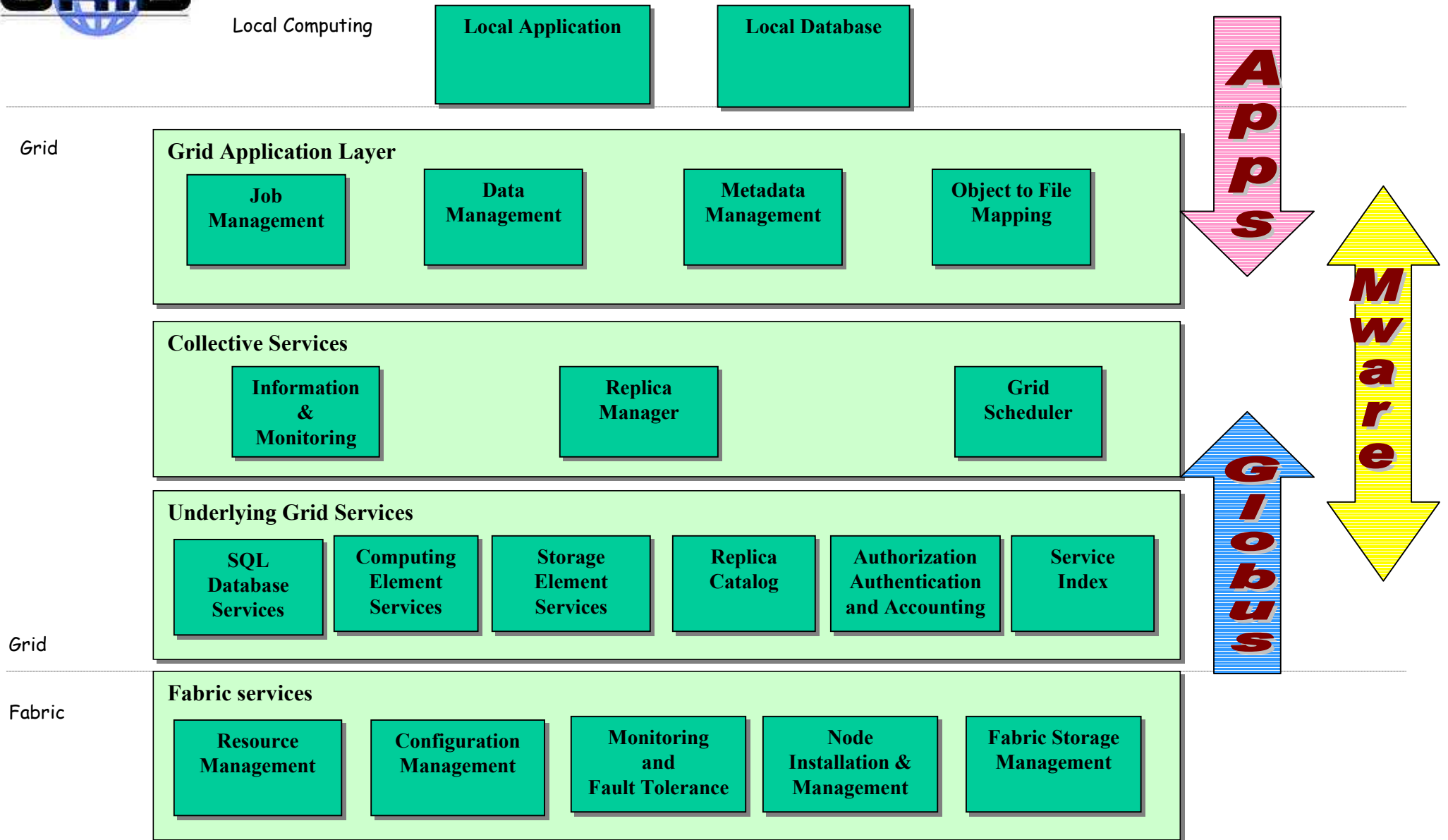
Objectives for the first year of the project

- ◆ Collect requirements for middleware
 - Take into account requirements from application groups
- ◆ Survey current technology
 - For all middleware
- ◆ Core Services testbed
 - Testbed 0: Globus (no EDG middleware)
- ◆ First Grid testbed release
 - Testbed 1: first release of EDG middleware

- ◆ WP1: workload
 - Job resource specification & scheduling
- ◆ WP2: data management
 - Data access, migration & replication
- ◆ WP3: grid monitoring services
 - Monitoring infrastructure, directories & presentation tools
- ◆ WP4: fabric management
 - Framework for fabric configuration management & automatic sw installation
- ◆ WP5: mass storage management
 - Common interface for Mass Storage Sys.
- ◆ WP7: network services
 - Network services and monitoring



DataGrid Architecture





EDG Interfaces



Application Developers

Local Application

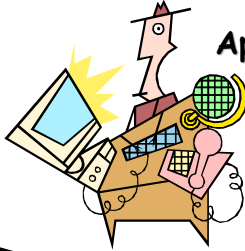
Local Database



Scientists



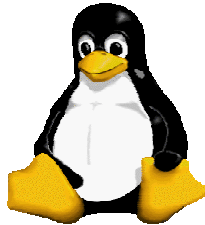
Certificate Authorities



System Managers



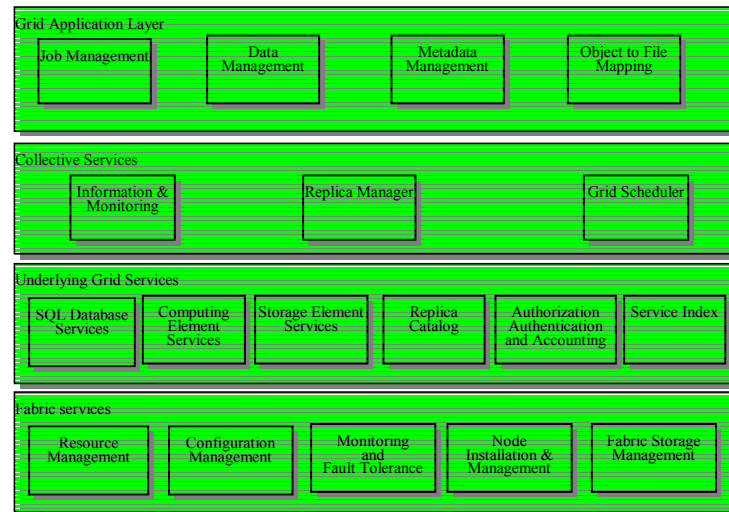
File Systems



Operating Systems



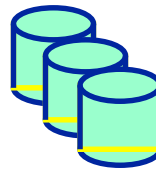
User Accounts



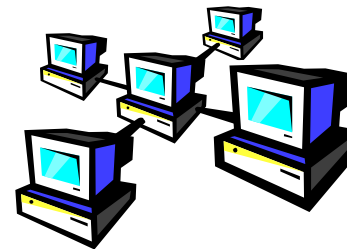
Batch Systems



Mass Storage Systems
HPSS, Castor



Storage Elements



Computing Elements



WP1: WorkLoad Management

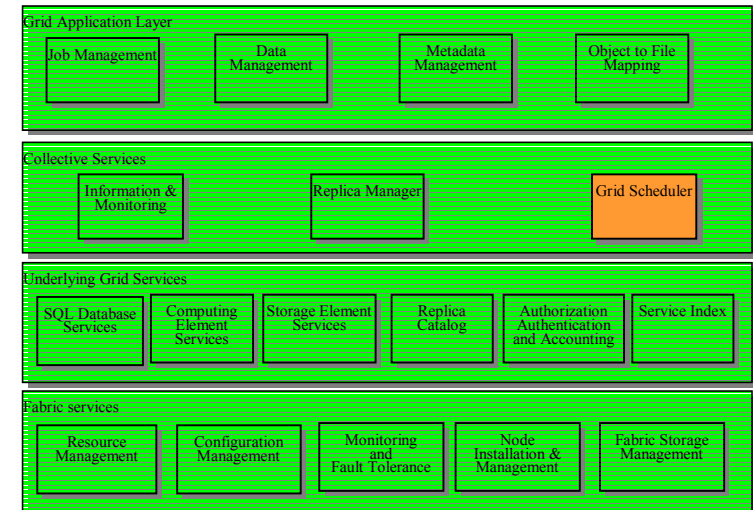


◆ Achievements

- Analysis of work-load management system requirements & survey of existing mature implementations Globus & Condor (D1.1)
- Definition of architecture for scheduling & res. mgmt. (D1.2)
- Development of "super scheduling" component using application data and computing elements requirements

◆ Issues

- Distributed nature of WP1 development groups



Components

Job Description Language

Resource Broker

Job Submission Service

Information Index

User Interface

Logging & Bookkeeping Service



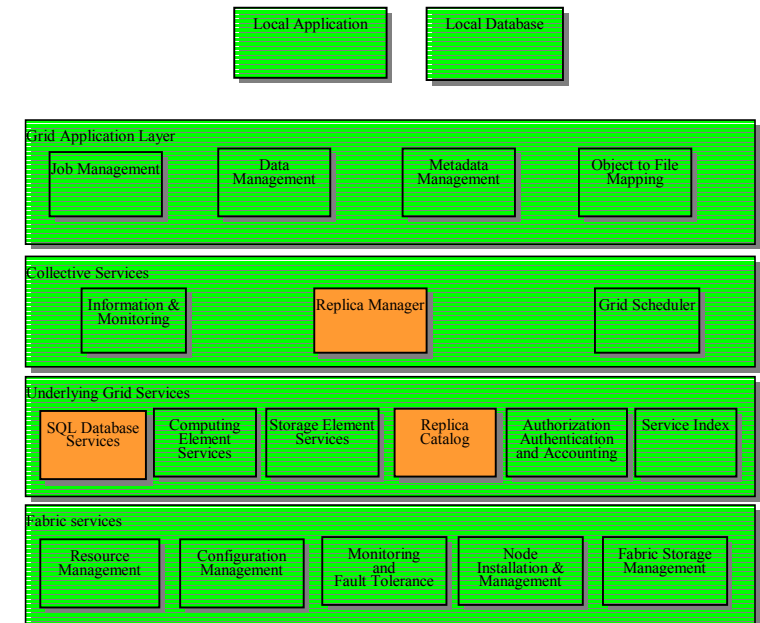
WP2: Data Management

◆ Achievements

- Survey of existing tools and technologies data access and mass storage systems (D2.1)
- Definition of architecture for data management (D2.2)
- Close collaboration with Globus, PPDG/GriPhyN & Condor
- Working with GGF on standards
- Deployment of GDMP in testbed1

◆ Issues

- Security: clear methods handling authentication and authorization



Components

SpitFire

GDMP

Replica Catalog



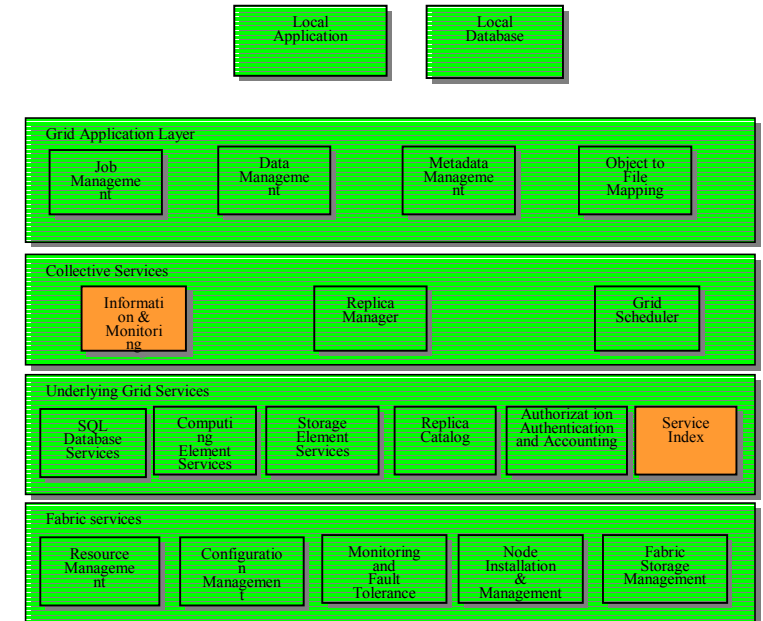
WP3: Grid Monitoring Services

◆ Achievements

- Survey of current technologies for info & monitoring in grid environments (D3.1)
- Coordination of schemas in testbed 1
- Development of Ftree caching backend based on OpenLDAP to address shortcoming in MDS v1
- Design of Relational Grid Monitoring Architecture (R-GMA) (D3.2) - to be further developed within the context of GGF
- Collaboration with Globus for Ftree and PPDG/GriPhyN for res. discovery and schemas
- GRM and PROVE adapted to grid environments to support end-user application monitoring

◆ Issues

- R-GMA development



Components

MDS/Ftree

R-GMA

GRM/PROVE



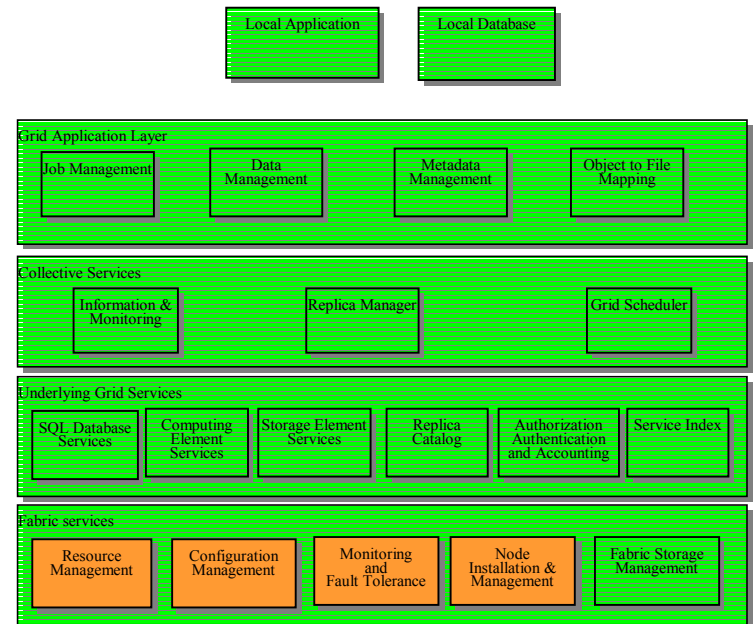
WP4: Fabric Management

◆ Achievements

- Survey of existing tools, techniques and protocols for resource specification, configuration and management, as well as integrated cluster management suites (D4.1)
- Defined an agreed architecture for fabric management (D4.2)
- Initial implementations deployed at several sites in testbed 1

◆ Issues

- Image Installation and Configuration Cache Manager components remain to be integrated



Components

LCFG

PBS & LSF info providers

Imagine installation

Config. Cache Mgr



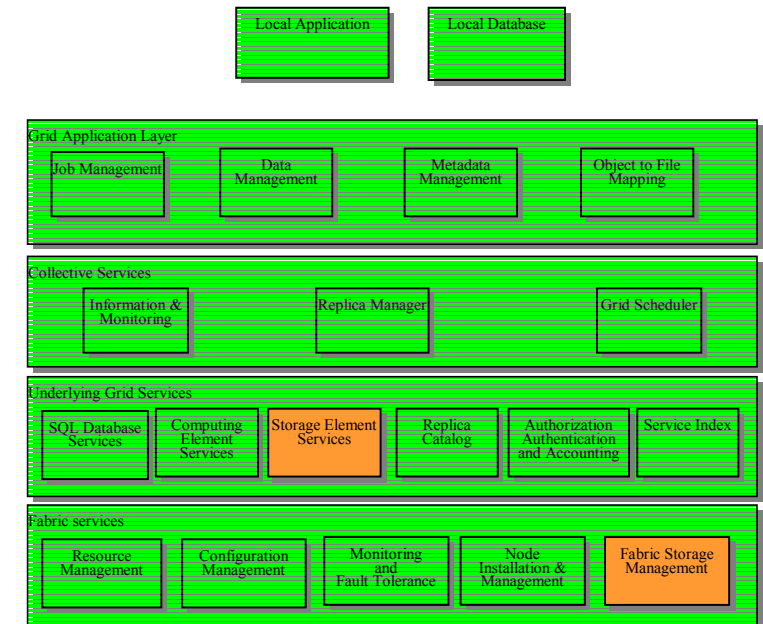
WP5: Mass Storage Management

◆ Achievements

- Review of Grid data systems, tape and disk storage systems and local filesystems (D5.1)
- Definition of Architecture and Design for DataGrid storage Element (D5.2)
- Collaboration with Globus on GridFTP/RFIO
- Collaboration with PPDG on control API
- First attempt at exchanging HSM tapes

◆ Issues

- Scope and requirements for storage element
- Interworking with other Grids



Components

SE info providers

RFIO

MSS staging



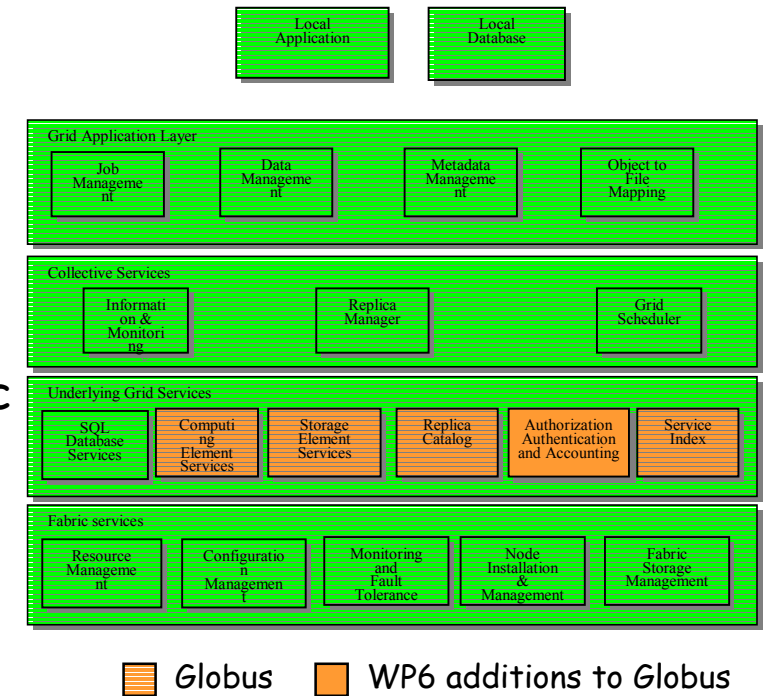
WP6: TestBed Integration

◆ Achievements

- Integration of EDG sw release 1.0 and deployment
- Working implementation of multiple VOs & basic security infrastructure
- Definition of acceptable usage contracts and creation of Certification Authorities group

◆ Issues

- Procedures for software integration
- Test plan for software release
- Support for production-style usage of the testbed



Components

Globus packaging & EDG config

Build tools

End-user documents



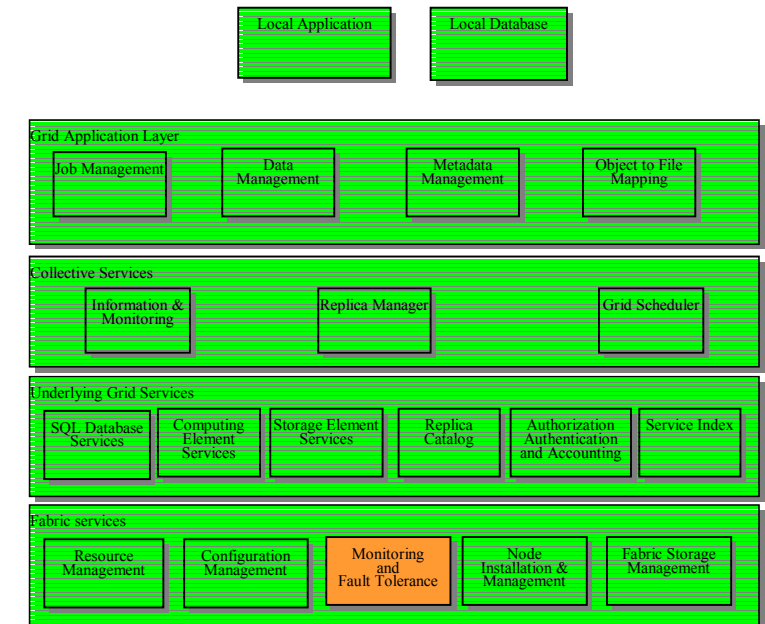
WP7: Network Services

◆ Achievements

- Analysis of network requirements for testbed 1 & study of available network physical infrastructure (D7.1)
- Collaboration with Dante & DataTAG
- Working with GGF (GHPN) & Globus (monitoring/MDS)
- Use of European backbone GEANT since Dec. 2001
- Initial network monitoring architecture defined(D7.2) and first tools deployed in testbed 1

◆ Issues

- Resources for study of security issues
- End-to-end performance for applications depend on a complex combination of components



Components

network monitoring tools:

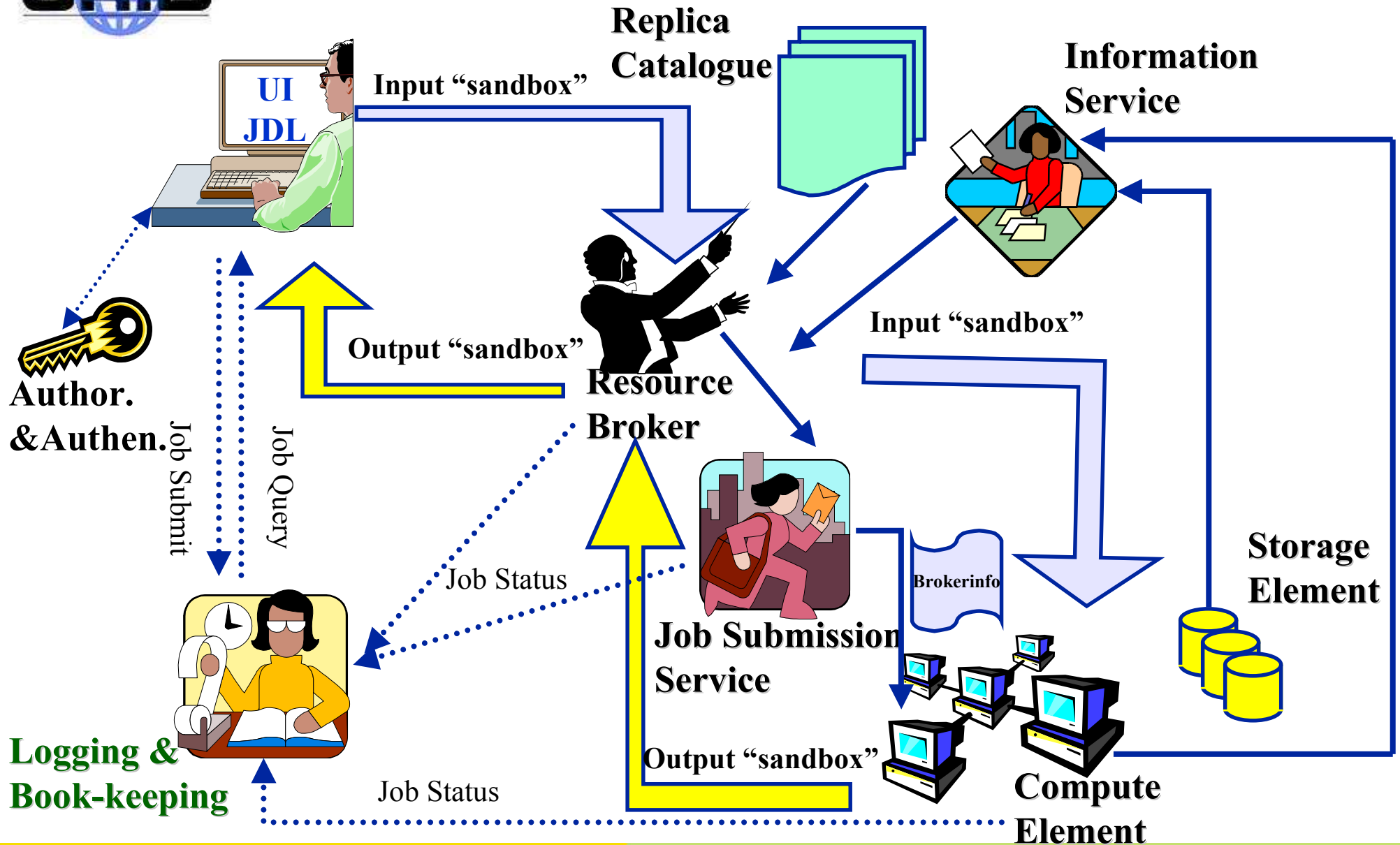
PingER

Udpmon

Iperf



A Job Submission Example





Architecture Issues and Actions

- ◆ Some concepts remain vague
 - e.g. interactive jobs
- ◆ Some boundaries are unclear
 - e.g. scope/functionality of a Storage Element
- ◆ Some requirements are not yet addressed
 - e.g. anonymous users
- ◆ The various software components are not yet fully integrated
 - e.g. Storage Element, Computing Elements & Info. Sys.
- ◆ Short term/ Long term trade-offs
- ◆ Impact of Open Grid Services Architecture
 - Forthcoming developments by Globus/IBM/GGF
- ◆ Convergence with US Grid project activities (PPDG/GriPhyN)

- ◆ The new **architecture group** will address these points taking into account our experience from testbed1 and further requirements
- ◆ Implementation of **iterative releases, nightly builds** and separation of development testbed from production testbed



Plans for 2002

- ◆ Extension of testbed
 - more users, sites & nodes-per-site
 - Split testbed into development and production sites
 - Investigate inter-operability with US grids
- ◆ Iterative releases up to testbed 2
 - incrementally extend functionality provided via each Work Package
 - better integrate the components
 - improve stability
- ◆ Testbed 2 (fall 2002) extra requirements
 - Interactive jobs
 - Job partitioning for parallel execution
 - Advance reservation
 - Accounting & Query optimization
 - Security design (D7.6)
 - ...

- ◆ Planned intermediate release schedule
 - **TestBed 1:** November 2001
 - **Release 1.1:** January 2002 ← demos
 - **Release 1.2:** March 2002
 - **Release 1.3:** May 2002
 - **Release 1.4:** July 2002
 - **TestBed 2:** September 2002
- ◆ Similar schedule will be made for 2003
- ◆ Each release includes
 - feedback from use of previous release by application groups
 - planned improvements/extension by middle-ware WPs
 - use of WP6 *software infrastructure*
 - feeds into architecture group



Interaction with PPDG/GriPhyN/iVDGL

- ◆ Work with dataTAG via the InterGrid to investigate interoperability of US and EU grids
 1. **Authentication infrastructure** - perform cross organizational authentication
 2. **Unified service discovery and information infrastructure** - discover the existence and configuration of service offered by the testbeds.
 3. **Data movement infrastructure** - move data from storage services operated by one organization to another
 4. **Authorization services** - perform some level of cross organization, community based authorization
 5. **Computational services** - coordinate computation across organizations - to allow submission of jobs in EU to run on US sites and vice versa



Interaction with Globus & GGF

- ◆ **Software Licensing** - open source agreements for all components
- ◆ **WP1**
 - Advance Reservation Infrastructure
- ◆ **WP2**
 - GDMP joint-development and overlap with plans for future Globus Replica Manager
 - GridFTP/NetLogger integration
- ◆ **WP3**
 - MDS/Ftree integration
 - Relationship between R-GMA, GGF and OGSA
- ◆ **WP4**
 - Authorization capabilities of the Globus gatekeeper
 - Use resource mgmt subsystem instead of Globus job manager
- ◆ **WP5**
 - Thread-safe GSI API
 - RFIO using GridFTP
- ◆ **WP6**
 - Packaging
 - Community Authorization Service
- ◆ **WP7**
 - Integration of MapCentre with MDS
 - Network message publication to Info. Services



Summary

- ◆ Application groups requirements defined and analysed
- ◆ Extensive survey of relevant technologies completed and used as a basis for EDG developments
- ◆ First release of the testbed successfully deployed
- ◆ Excellent collaborative environment developed with key players in Grid arena
- ◆ Project can be judged by:
 - level of "buy-in" by the application groups
 - wide-spread usage of EDG software
 - number and quality of EDG sw releases
 - positive influence on developments of GGF standards & Globus toolkit