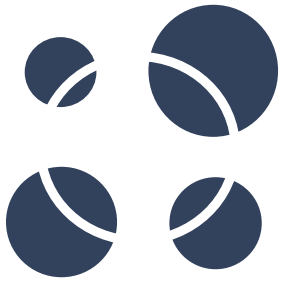
GridWorld 2006
Washington, USA
September 11, 2006



Grid Scheduling Infrastructures with the GridWay Metascheduler

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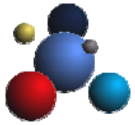
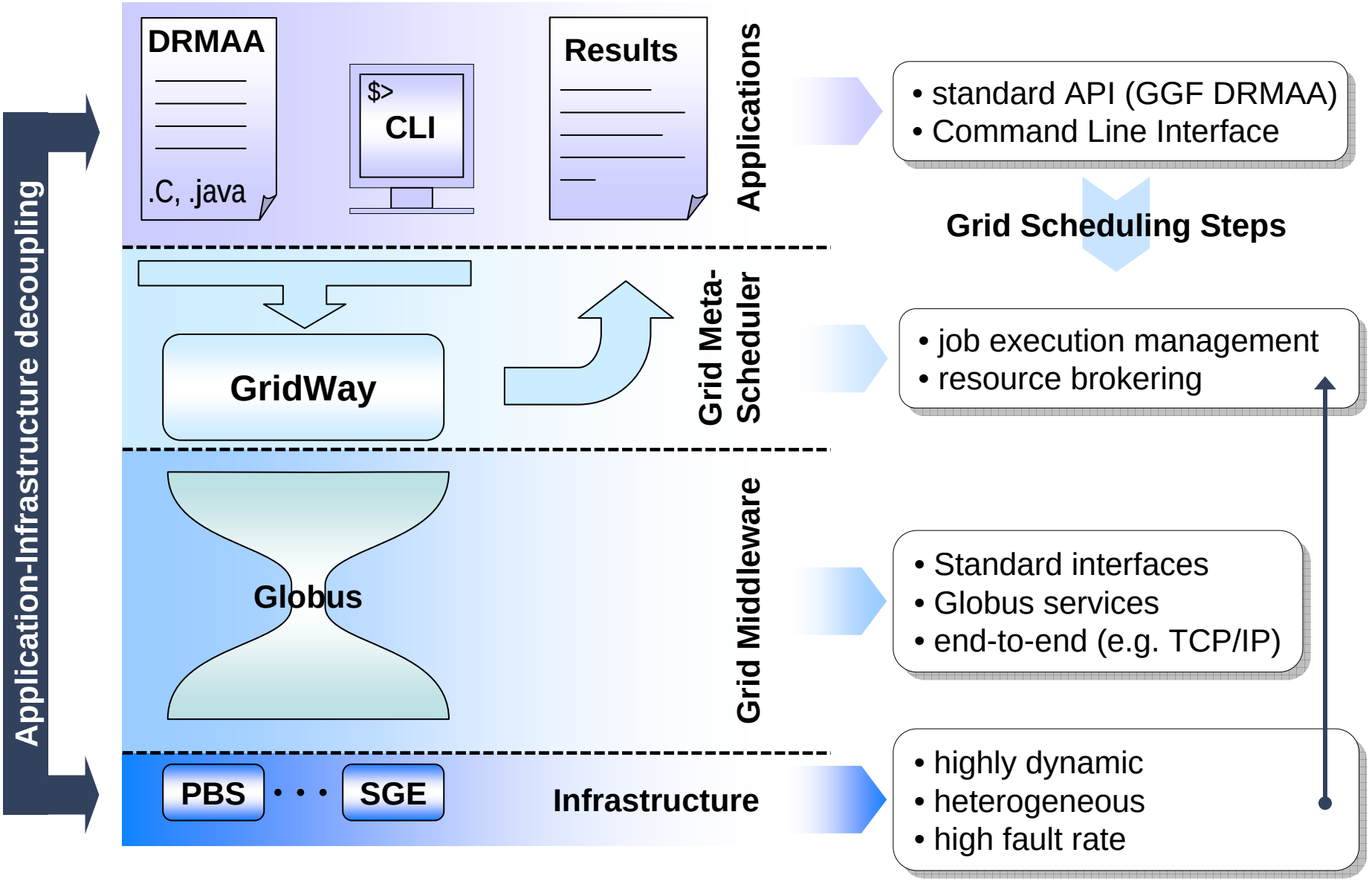
http://asds.dacya.ucm.es



Distributed Systems Architecture Group
Universidad Complutense de Madrid

Contents

1. The Global View



Scheduling Features

- **Advanced scheduling capabilities**
  - **Adaptive Scheduling**, to periodically adapt the schedule considering:
    - Applications demands
    - Dynamic characteristics of Grid resources
  - **Adaptive Execution**, to migrate running applications:
    - Availability, capacity and cost of Grid resources.
    - New requirements or preferences.
- **Different application profiles**
  - **Array jobs** (HTC)
  - **Job dependencies**, (abstract workflows)
- **Fault detection & recovery capabilities**
  - Detect and recover from the **remote failure situations**
  - Recover from **local failure.**
- **Modular scheduler architecture:** Scheduling **policies**, to prioritize jobs and users.
- **Reporting & accounting facilities**: provide detailed statistics of usage on the grid

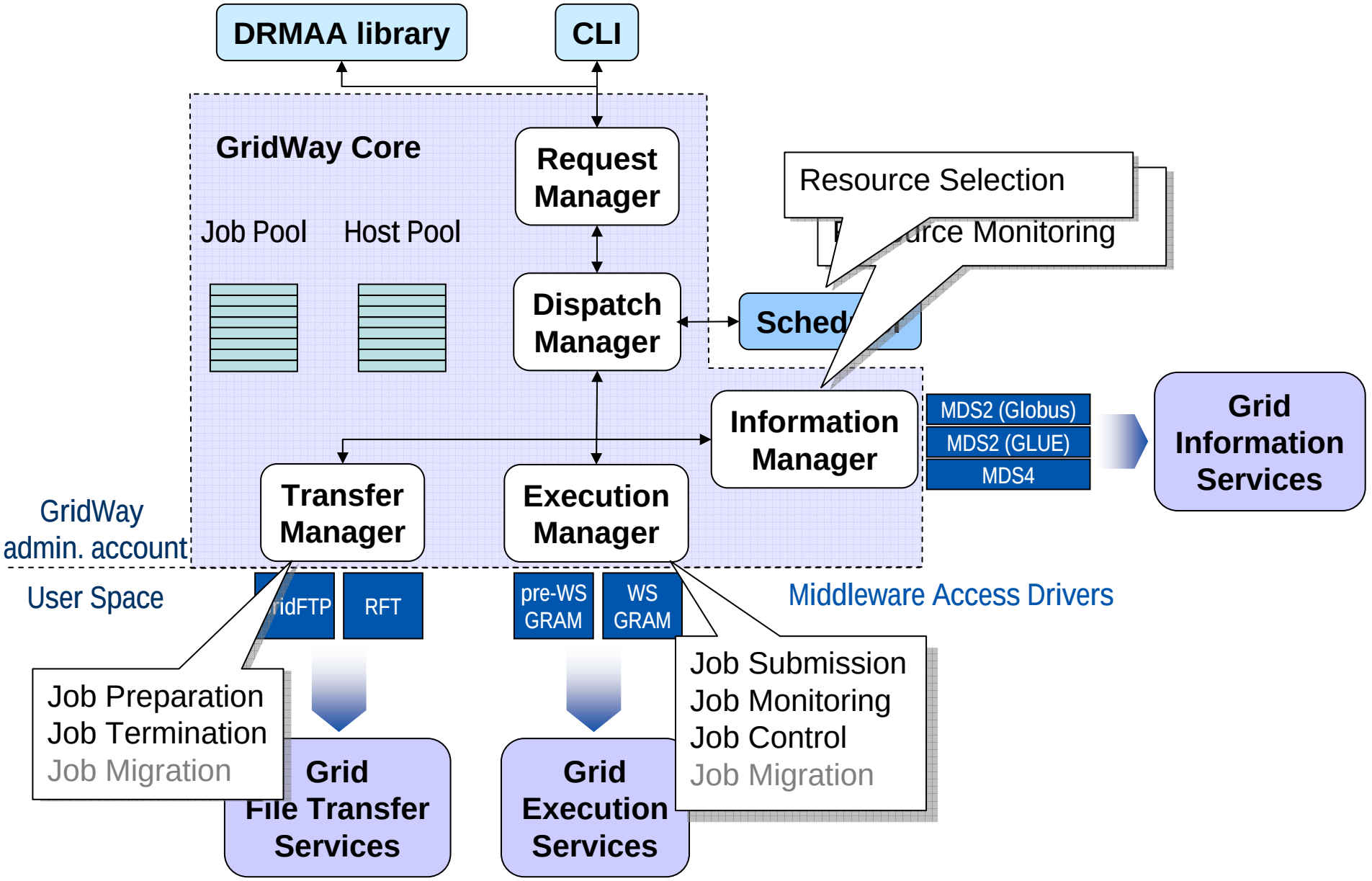
User Interface Features

- **Application compatibility**
  - **Not bounded to a specific class of application,** generated by a given programming environment
  - **Not require specific application deployment** on remote hosts
- **DRM-like Command Line Interface,** CLI similar to that found on Unix and DRM systems such as PBS or SGE
- **Standard Applications API (DRMAA)**
  - Integration of ISV's applications to GridWay
  - Compatibility with DRM systems that implements the standard, such as SGE, PBS…

Deployment Features

- **Support for multiple-users**
  - Globus installation is not required in each end-user system
  - Firewall requirements
- **Interoperability,** simultaneously interface to distinct middleware (GT WS, pre-WS, LCG)
- **Flexible and extensible architecture**
  - **Information drivers**: MDS2 (MDS schema), MDS2 (Glue schema) and MDS4
  - **Execution drivers**: pre-WS GRAM and WS GRAM
  - **Transfer drivers**: GridFTP and RFT
- **Deployment Strategies,**
  - **The installation or deployment of new services is not required**
  - Single user
  - Enterprise Grid
  - Partner Grid
  - Utility Grid

3. GridWay 5.0 Scheduling Architecture



Enterprise Grid Deployment

Infrastructure

- Non-interoperable independent platforms, managed by different DRMS
- Could be geographically distributed

Goal

- Integration of different and independent platforms
- Decoupling of Applications and local DRMS
- Improve return from IT investment

Benefits

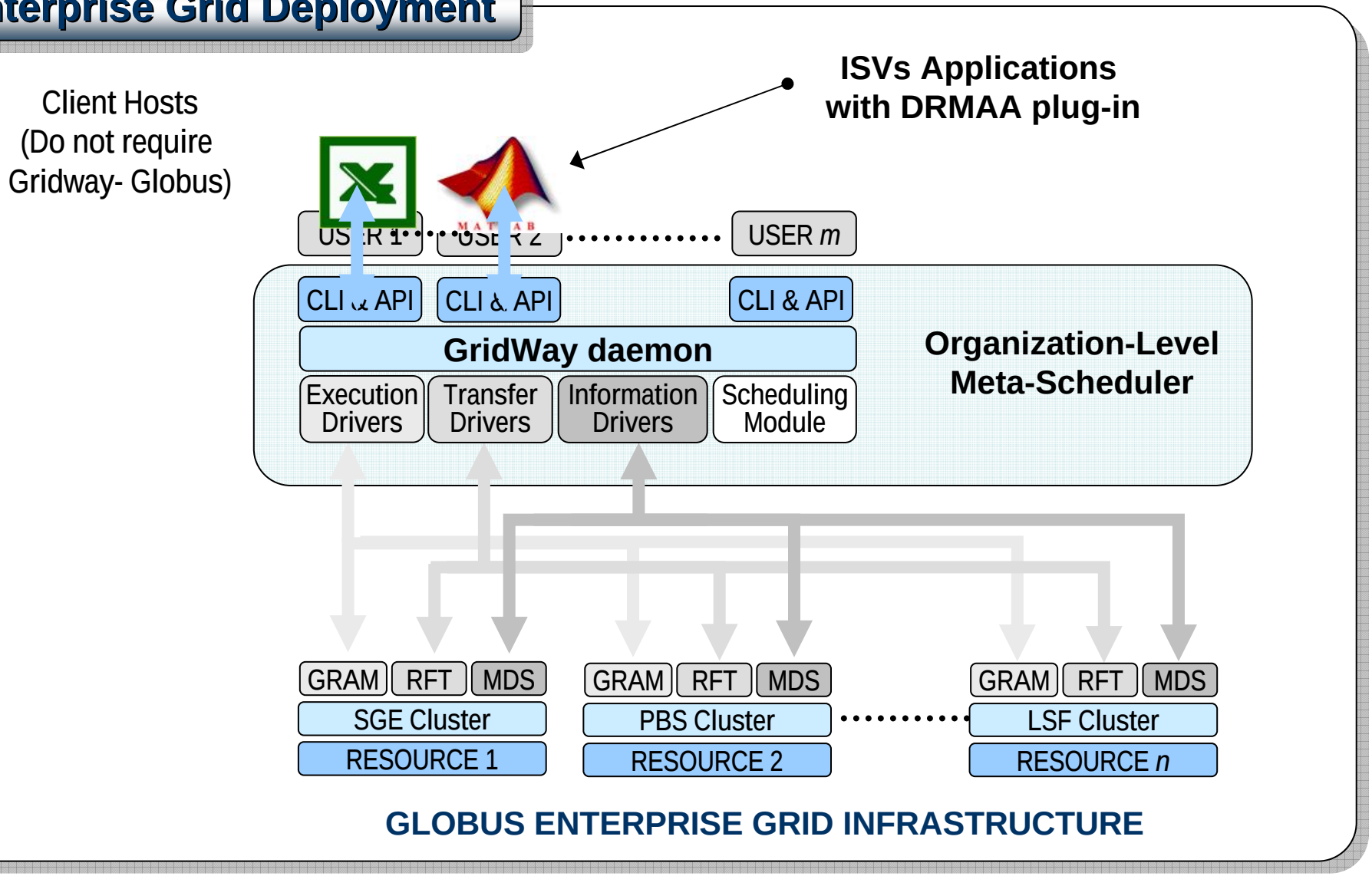
- Cost minimization
- Performance/utilization maximization

Scheduling in Enterprise Grids

Centralized Scheduling (organization-level meta-scheduler)

- Enforce enterprise usage policies
- Support for multiple users
- Centralized accounting

Enterprise Grid Deployment



Partner Grid Deployment

Infrastructure

- Non-interoperable independent platforms, managed by different DRMS
- Geographically distributed
- Different Administration Domains

Goal

- Large-scale, secure and reliable sharing of resources among partner organizations and supply-chain participants.

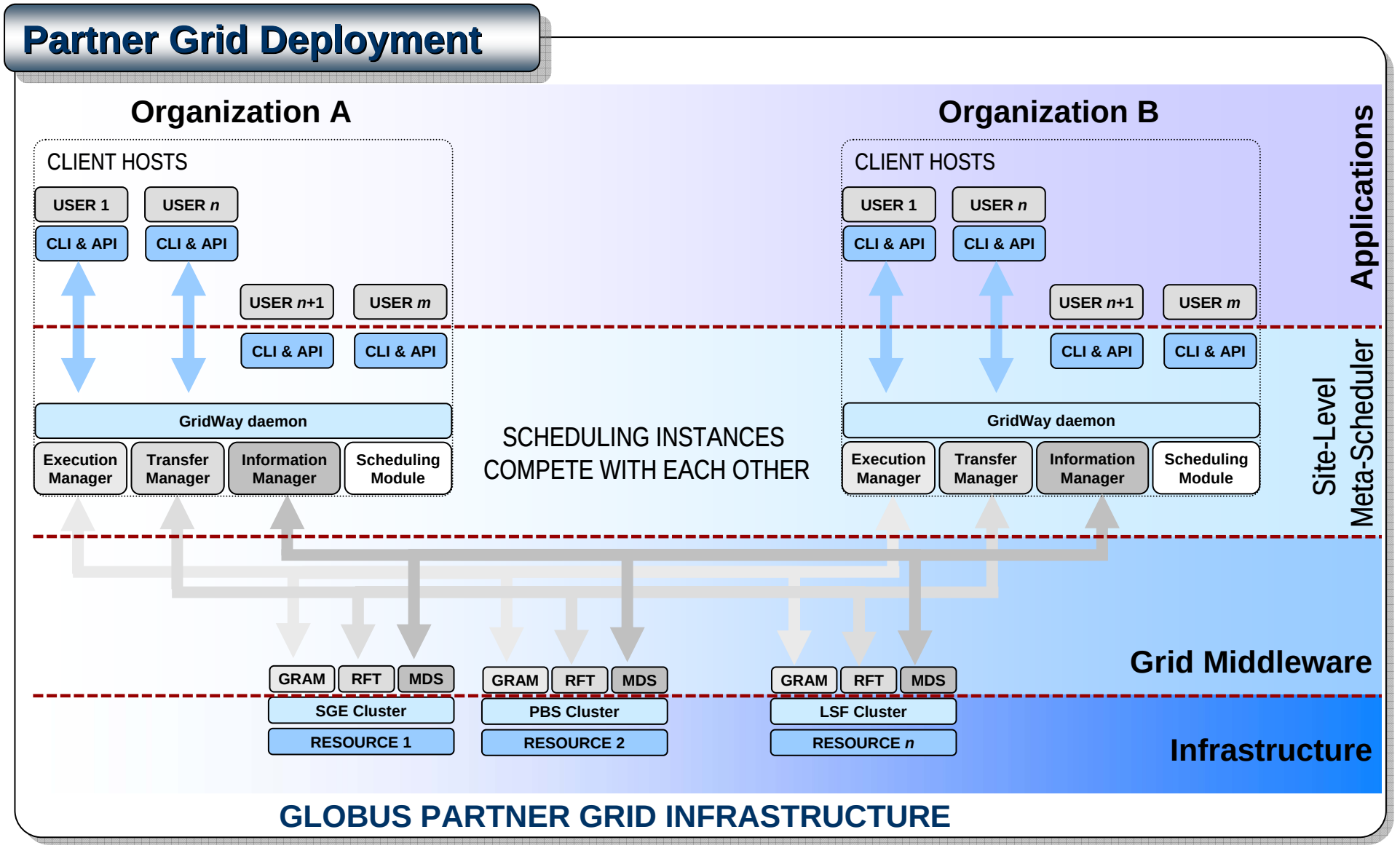
Benefits

- Access to higher computing power to satisfy peak demands
- Support collaborative projects

Scheduling in Partner Grids

Organization-Level Scheduling

- Control over client request and resource status
- Support for multiple *intra-organization* users


Partner Grid Deployment
Organization A
Organization B
CLIENT HOSTS
USER 1
USER n
CLI & API
USER n+1
USER m
GridWay daemon
Execution Manager
Transfer Manager
Information Manager
Scheduling Module
SCHEDULING INSTANCES COMPETE WITH EACH OTHER
Applications
Site-Level Meta-Scheduler
Grid Middleware
Infrastructure
GRAM
RFT
MDS
SGE Cluster
PBS Cluster
LSF Cluster
RESOURCE 1
RESOURCE 2
RESOURCE n
GLOBUS PARTNER GRID INFRASTRUCTURE

Utility Grid Deployment

Infrastructure

- Service provider infrastructure (enterprise, partner or other utility)

Goal

- Supply resources on-demand, making resource provision more agile and adaptive.

Benefits

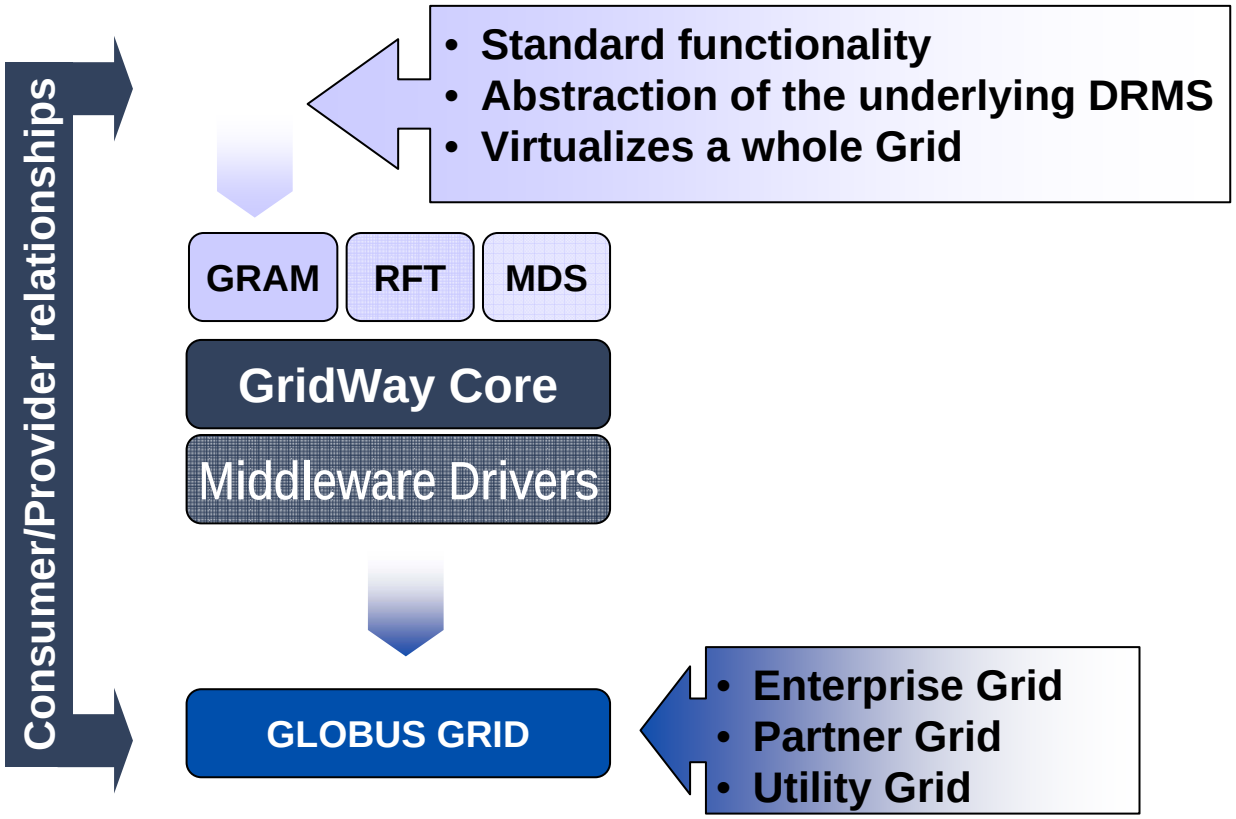
- Flexibility to adjust capacity
- Access to unlimited computational capacity
- Transform IT costs from fixed to variable

Scheduling in Utility Grids

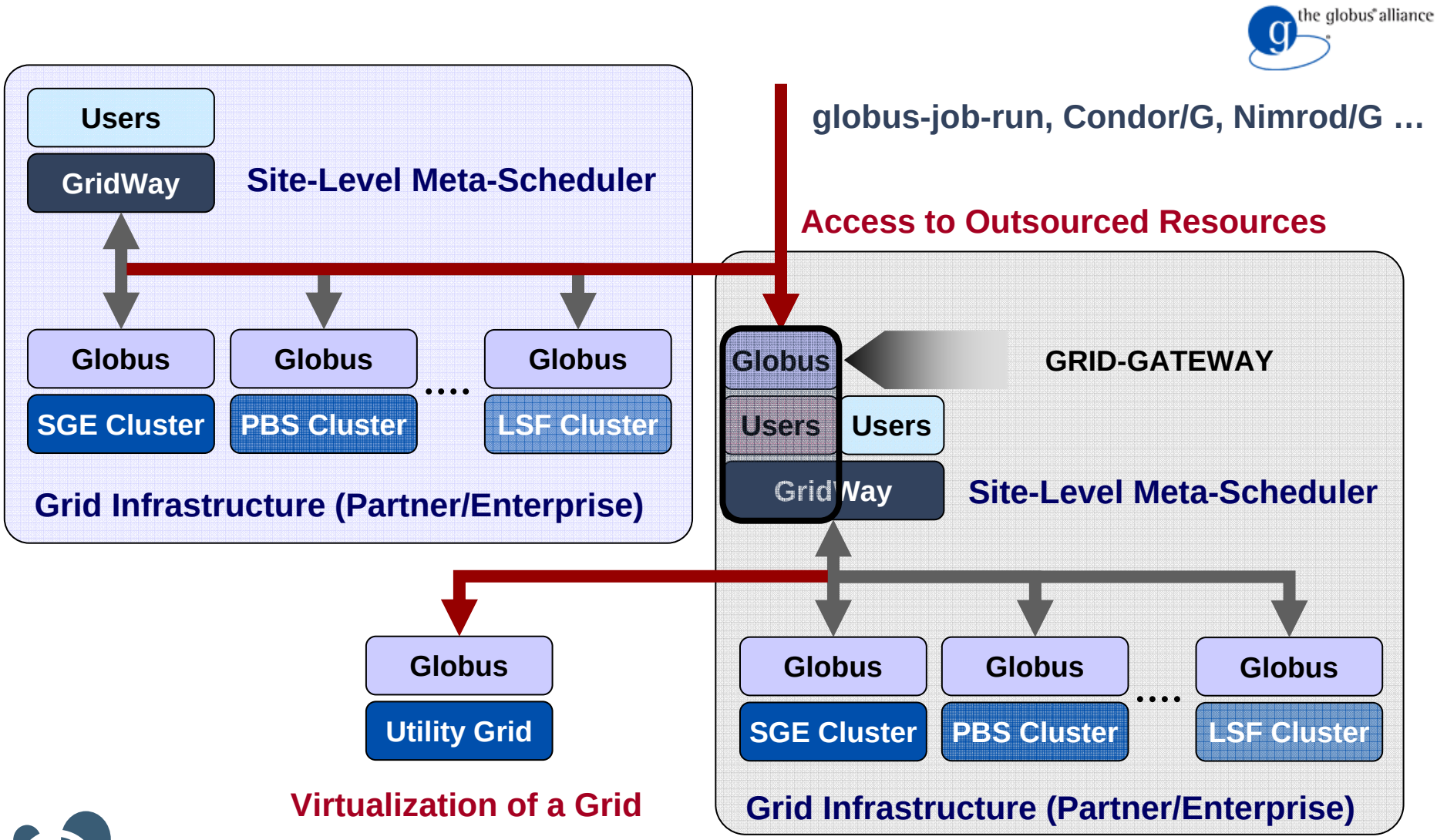
Handle the Utility just as other resource integrated in the original infrastructure

Globus & GridWay Utility Solution

- Use **Globus Toolkit** services to host a **GridWay meta-scheduler** to recursively interface to ***federated Grids***



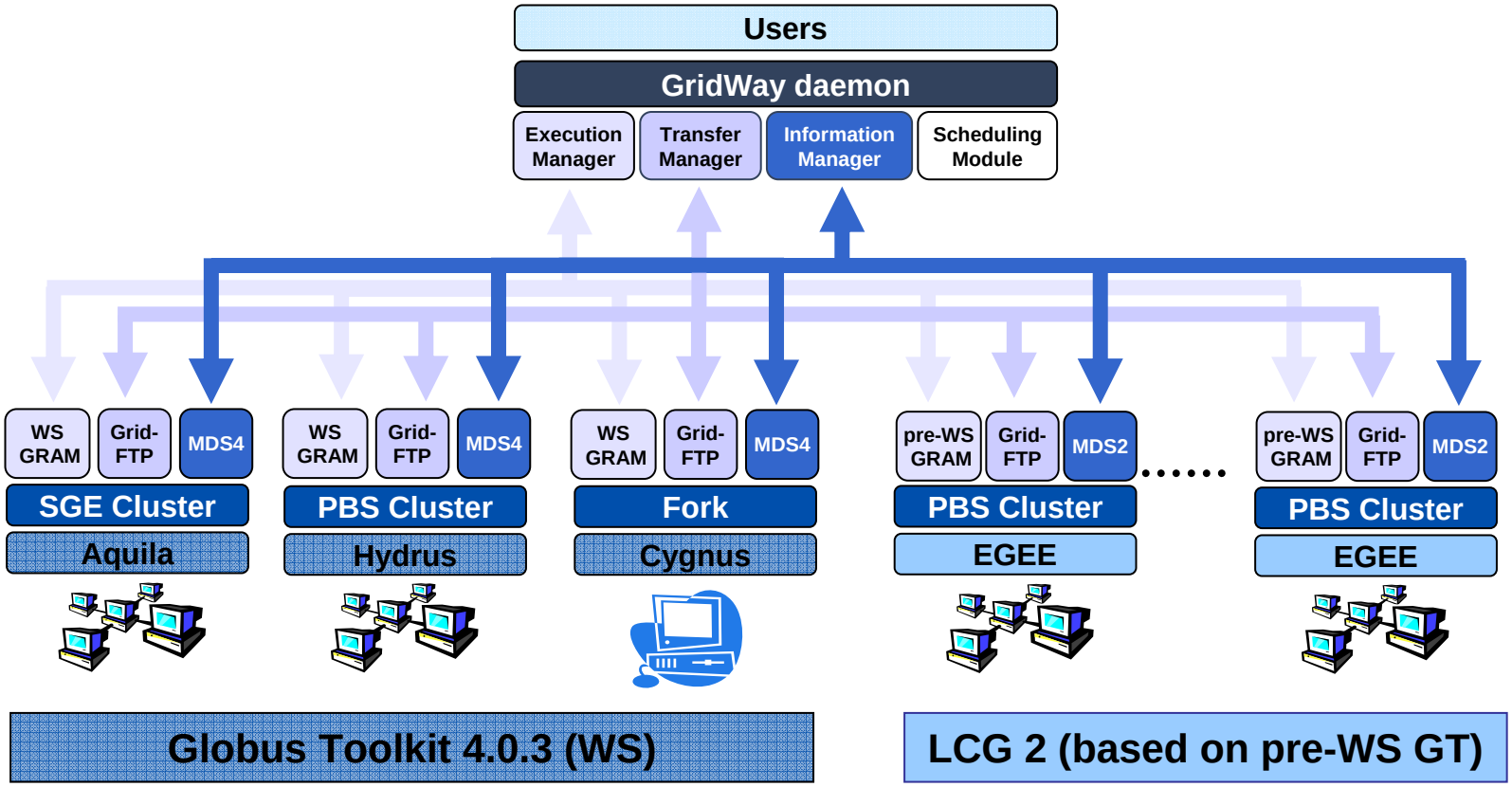
- ***Grid Technology Meets Utility Requirements by Means of its Standard Functionality for Flexible Integration of Diverse Distributed Resources***


the globus alliance
Users
GridWay
Site-Level Meta-Scheduler
globus-job-run, Condor/G, Nimrod/G ...
Access to Outsourced Resources
Globus
Globus
Globus
SGE Cluster
PBS Cluster
LSF Cluster
Grid Infrastructure (Partner/Enterprise)
Globus
GRID-GATEWAY
Users
Users
GridWay
Site-Level Meta-Scheduler
Globus
Utility Grid
Virtualization of a Grid
Globus
Globus
Globus
SGE Cluster
PBS Cluster
LSF Cluster
Grid Infrastructure (Partner/Enterprise)

GridWay

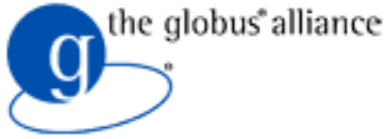
Grid Infrastructure

Information Manager: Dynamic Discovery & Selection (MDS2 & MDS4)
Execution Manager: Pre-WS and WS GRAM
Transfer Manager: GridFTP
Scheduling Module: user round-robin + flooding, (max. resources, user)



History of the Project

- Started in **2002**, first releases were only distributed on request in binary format
- First open source release, GridWay 4.0, in **January 2005**
- **GridWay 5.0 was release in June 2006 (Apache license v2)**
- In June 2006 GridWay joined the **Globus Incubator Program**



Downloads & Use Cases

- Since January 2005, more than **500 downloads from 54 different countries,** 25% are private companies and 75% are universities and research centres.
- **Enterprise/Campus Grids:**
  Grid Activities at **ESAC (ESA),** Campus grid deployed by **Universidade do Porto and Sun Microsystems**…
- **Partner Grids:**
  IRISGrid (The Spanish National Grid Infrastructure), **EGEE**, **CABGrid** (A Virtual Laboratory for Computational Astrobiology), **C2VO** (Grid infrastructure development for the implementation of a Computational Chemistry Virtual Organization), **CRO-GRID** Infrastructure, Sun Solution Center World Grid…

Development Process

- **Community – Open Source Project. Globus Development Philosophy**
- **Development Infrastructure (thanks to Globus Project!):** Mailing Lists, Bugzilla, CVS
- **You are very welcome to contribute:**
  - Reporting Bugs (gridway-user@globus.org)
  - Making feature requests for the next GridWay release (gridway-user@globus.org)
  - Contributing your own developments (bug fixes, new features, documentation)

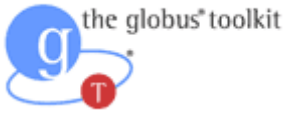
RoadMap

- **Support GridWay user Community & Bug Fixing**
- Next Release will support **Utility** deployments **out-of-the-box**
- **Incorporate new features of Globus** Projects (GRAM, GridFTP, RFT, MDS)
- Integrate with **other Globus Projects** (Virtual Workspaces)
- Detailed Roadmap:
  - **GridWay Campaigns** at bugzilla.mcs.anl.gov/globus/query.cgi
  - www-unix.mcs.anl.gov/~bacon/cgi-bin/big-roadmap.cgi#Gridway
- Release **announcements**:gridway-announce@globus.org

6. More Information: The GridWay Metascheduler

Information and download at http://www.GridWay.org

More Information and Tutorials



Grid Ecosystem at **Globus** site

Tutorial at **IBM** site

Installation on Solaris at **Sun Microsystems** site

DRMAA support and scheduling use case at **GGF** site

Thank you
for your attention!