

# GRID Middleware Development in INFN

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# Outline

- Main focus of our activities: needs of communities of physicists (aka experiments)
- Strategic Services under development

# Main focus

- Experiment-centric view of service development
  - How to let physicists do their job
  - Organizational issues
- Experiment → Virtual Organization

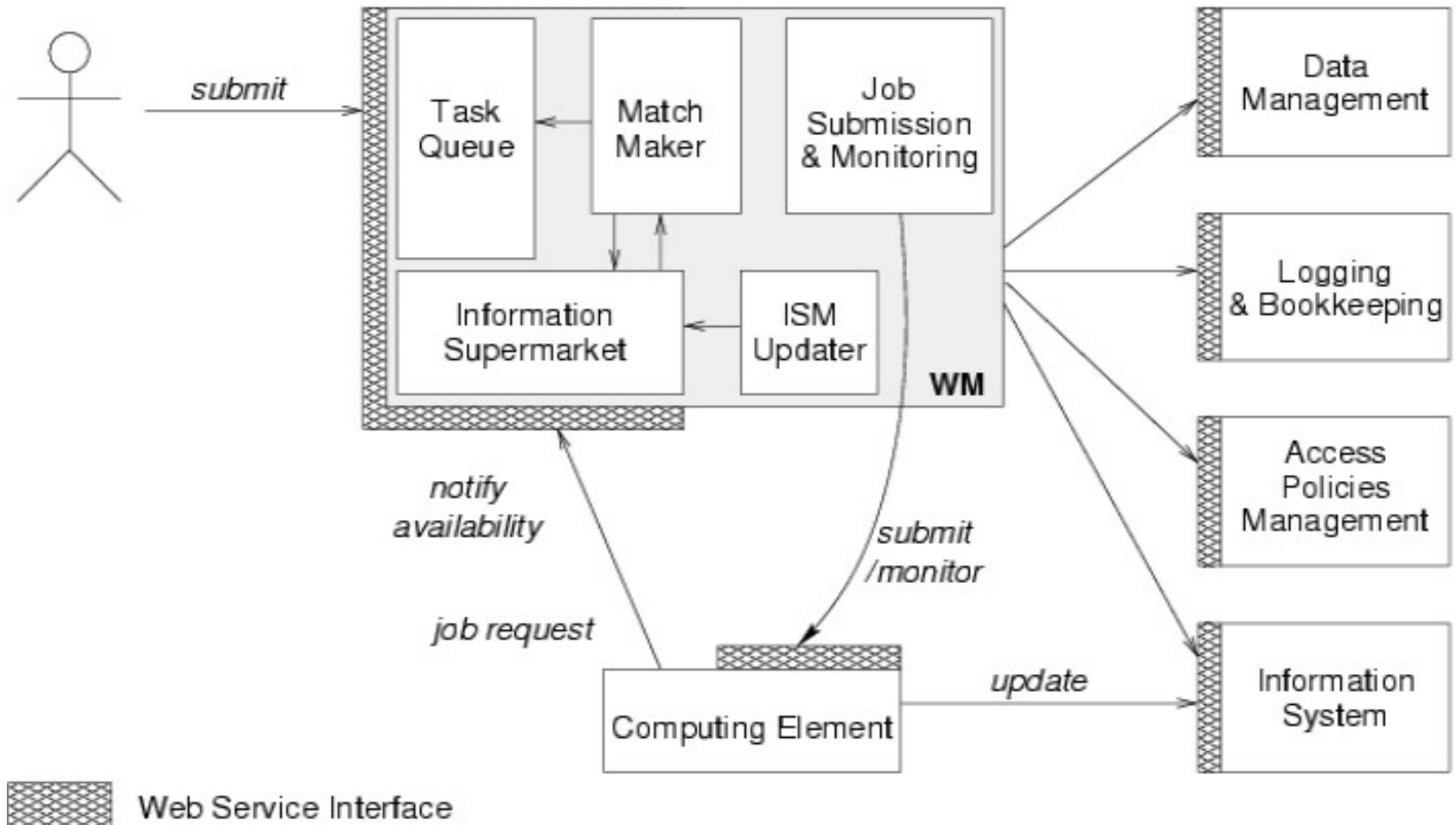
# Strategic services

- Collective
  - Job scheduling
  - Management of membership and roles in virtual organizations
  - Resource usage policies
  - Accounting
  - Monitoring
- Core
  - Computing
  - Storage

# Job Scheduling

- 5 years ago, globus provided very basic functionality: GRAM, some security, information system
- Immediate needs were:
  - How do we hide the distribution of resources to a user?
  - How do we manage a user job safely?
- First version of the Resource Broker (aka Workload Manager) relied on existing components, where possible

# Job Scheduling /2



Current internal architecture (gLite)

# Job Scheduling /3

- Flexible architecture from the beginning:
  - 1 RB per user? 1 RB per VO? 1 RB for all?
  - Not application specific
- Several re-designs/re-implementations
- Several ideas for the future
  - Application overlay network (aka pilot jobs)
  - Scalability
  - Flow control, beyond DAGs
  - ...

# GLUE Schema

- Standardization of published information by services is essential for good interoperability
- Result of a joint collaboration between EU and US projects
  - Promoted in 2002 by DataTAG and iVDGL
  - On-going
- Conceptual model (UML), mapped into LDAP, relational and XML data models



# Authorization

- Who can do what when?
- Proper authorization mechanisms are essential in order to enable the sharing of resources
- Authentication based on X509 certificates
- From grid-mapfiles...
  - mkgridmap + LDAP-VO server
- ... to VOMS and GPBox

# VOMS

- Virtual Organization Membership Service
- System to classify members of a VO on the base of a set of attributes that will be granted to them upon request and to include that information inside proxy certificates
- Other services can then extract and use such attributes from user credentials

# VOMS /2

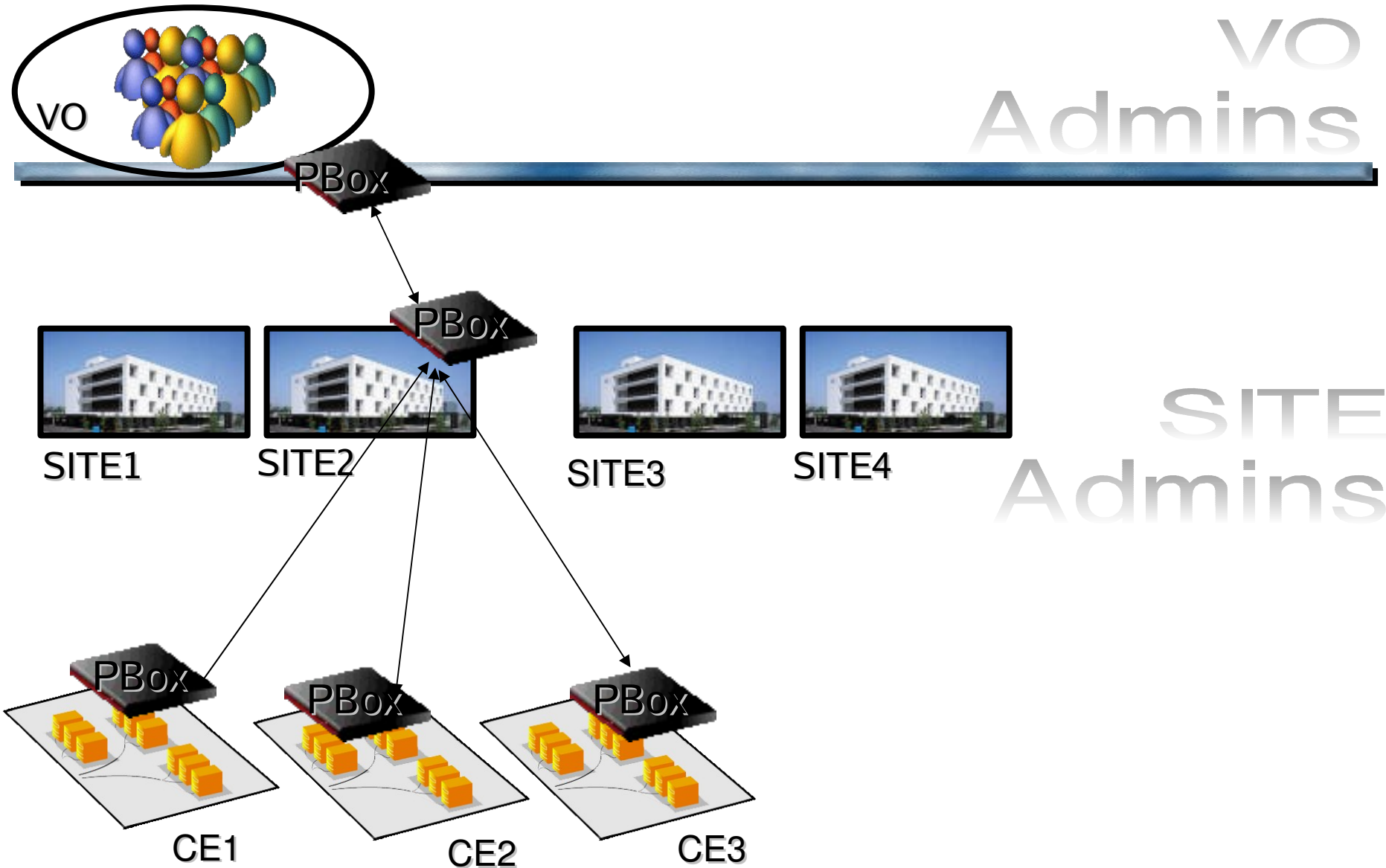
- Characteristics: scalability in terms of users and resources; fine granularity for roles
- Supported on SQL databases (MySQL and Oracle for the moment)
- Distributed with gLite and VDT

# GPBox

- Grid Policy Box
- Policy framework for Grid environments
- Policies are expressed by administrators of different domains (e.g. VO, site, resource)
- Policies are propagated appropriately through a network of Pboxes
- Clients of GPBox are Grid resources and services
  - Integration with RB, CE, SE on-going

# GPBox /2

VO  
Admins



# GPBox /3

- A Policy Decision Point (PDP) is where a resource usage request is matched against the set of current policies
- A Policy Enforcement Point (PEP) is where a response from a PDP is applied
- The chosen language (XAMCL) allows to express policies such as fair share, priority access, quotas, etc.
  - Accounting information may be needed

# DGAS

- DataGrid Accounting System
- It implements Resource Usage Metering, Accounting and Account Balancing (through resource pricing)
  - Three independent layers
- Resource Usage parameters are collected on the WN and from the LRMS log files
- The information is then recorded in the Home Location Registers (i.e. the bank) of the resource and possibly of the user

# DGAS /2

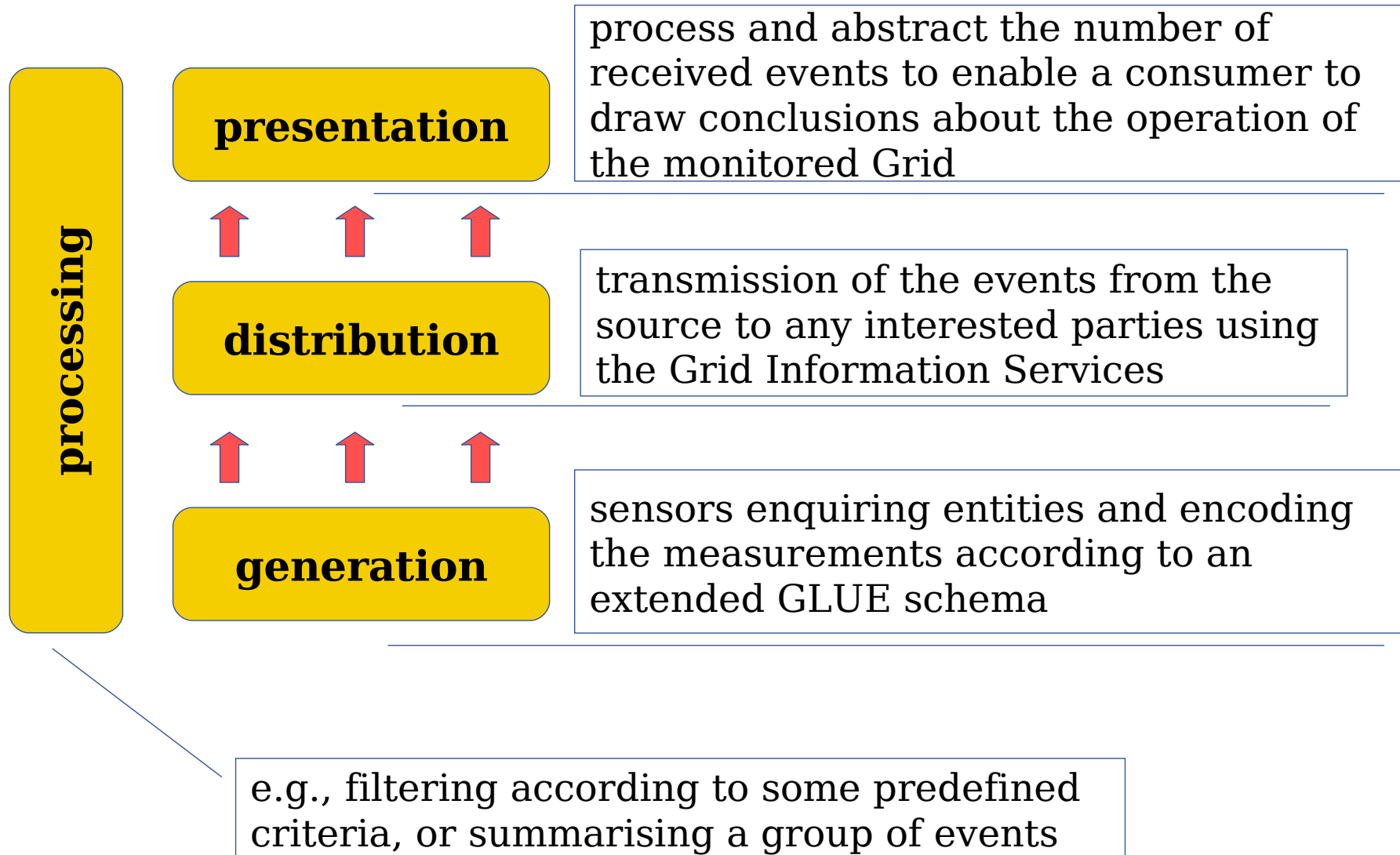
- Security
  - in particular confidentiality and authorization
- Reliability
  - Asynchronous communication
  - Retries in case of problems
- Scalability
  - Decentralized infrastructure with an arbitrary number of HLRs/PAs



# GridICE

- Grid approach for monitoring of resources/services/sites/jobs
  - RB, CE, SE, NE, BDII, user jobs
  - Classified by VO or by site
- Requirements collected from users, organizations, site administrators, Grid managers
- Integration in LCG since 2003
- Integration in gLite on-going

# GridICE /2



# Computing Element: CREAM

- Five years ago only Globus GRAM existed
  - It proved to be inadequate
  - Several patches/improvements applied to have something reasonably working
- Multiple solutions are now available or under development
  - CREAM (Computing Resource Execution and Management Service) is the INFN's proposed solution
  - At some point standardization will be needed

# CREAM /2

- Direct support for (available or planned):
  - Job Description Language (JDL)
  - I/O sandboxes
  - Job collections
  - DAGs
  - Policies via GPBox
  - MPI
  - Heterogeneous worker nodes
  - Interactive access

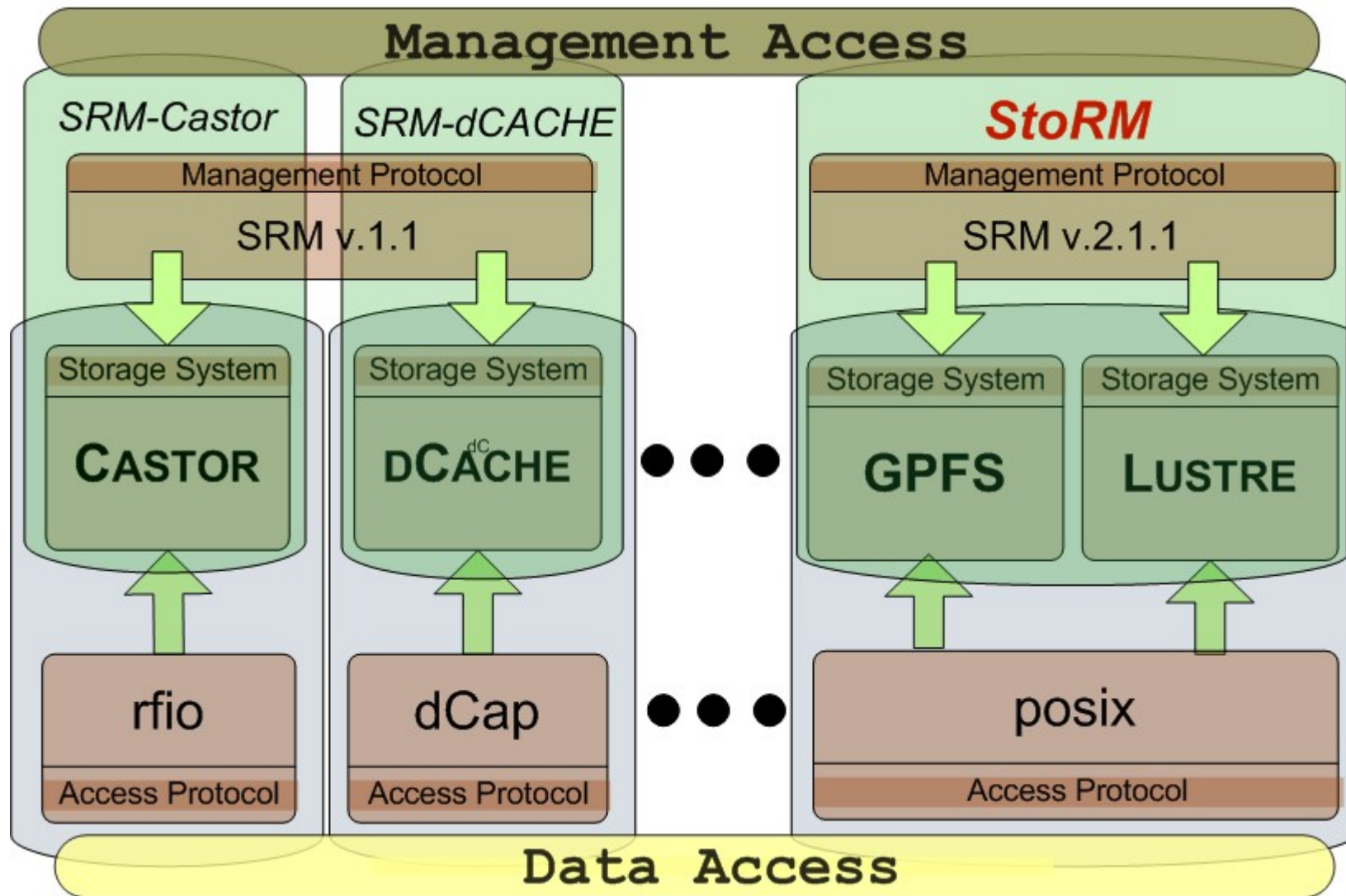
# CEMon

- CEMon is the monitoring counterpart of CREAM
  - But independent of CREAM
  - Supports polling or notifications
  - Already available in the gLite prototype

# Storage Element: StoRM

- Storage Resource Manager
- Implementation on top of a parallel FS of the SRM interface of storage management
  - File pinning
  - Disk space allocation and advanced reservation
  - Protocol negotiation
  - Security
- Not directly involved in data access
  - It allows direct posix API

# StoRM /2



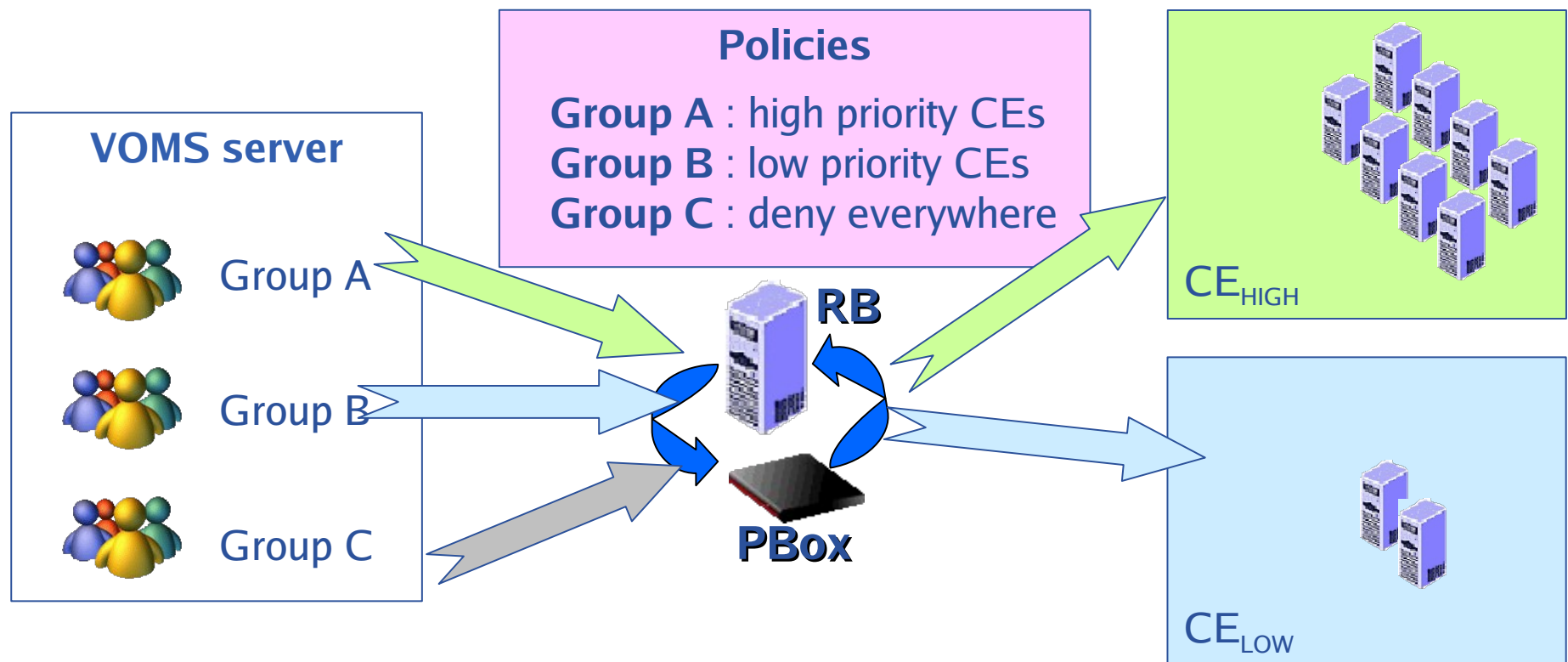
# StoRM /3

- Integrated with VOMS
  - VOMS credentials are used for local user mapping via LCMAPS
- Planned integration with GPBox
- Proof-of-concept integration with Agreement Service (i.e. advance reservation)



# Integration Example

- Enabling priorities during job scheduling
- RB + GPBox + VOMS



# Other Activities

- Constanza: data replication
- GDSE: Grid access to databases
- Agreement Service: advance reservation
- Network Element: collection of networking information