Software for Distributed Systems
The EMI Product Portfolio

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Greater Context of Talk

[3] Digital Agenda for Europe


27/03/2012 2nd EMI Technical Conference, Munich
Past & What is EMI?
10.000 ft Perspective

other scientific software tools

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Present Achievements

- Middleware jointly developed & maintained
- Release process harmonized with policies
- Open Standards adoption increased & refined
- Explored several ways for sustainability
EMI FactSheets Available

Check out the factsheets of EMI products.


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ARC CE Added Value

- Used to submit and manage a wide range of applications running on computational resources of DCIs

Communication

‘Where HTTP is the standard communication protocol for traditional Web-based distributed systems, the Simple Object Access Protocol (SOAP) forms the standard for communication with Web services...’

ARC CE Features

- Use the ARC CE as a light-weight system to execute applications across geographically distributed computing services and their underlying resources
- Take advantage of a client/server architecture that implements the functionality of a Computing Element (CE) accessing a wide variety of available batch systems
- Interoperate with other EMI services by using the EMI Execution Service via a SOAP-based Web service Interface
CREAM CE Added Value

• Used to submit and manage applications running on DCI resources

Servers – General Design Concurrent Server

‘A concurrent server does not handle the request itself, but passes it to a separate thread or another process, after which it immediately waits for the next incoming request…’

CREAM CE Features

• Use the CREAM CE as a powerful system to execute applications across geographically distributed computing services and their underlying resources
• Take advantage of a client/server architecture that implements the functionality of a Computing Element (CE) accessing a wide variety of available batch systems
• Interoperate with other EMI services by using the EMI Execution Service via a SOAP-based Web service Interface
• A C++ based Command Line Interface (CLI) is available and other clients can be easily created
• CREAM provides hooks for accounting and offers data-staging functionality
UNICORE Added Value

• Used to submit and manage applications optimized for HPC

Firewalls – Application-level Gateway

‘... the other type of firewall is an application-level gateway. In contrast to a packet-filtering gateway, which inspects only the header of network packets, this type of firewall actually inspects the content of an incoming or outgoing message’

UNICORE Features

- Use the UNICORE system as a powerful system to execute applications across geographically distributed computing services and their underlying resources
- Take advantage of a three-tier architecture that implements the functionality of a Computing Element (CE) accessing a wide variety (~13) of available batch systems
- Benefit from the maturity and reliability of accessing medium and large-scale HPC resources with key characteristics since ~15 years
- Deploy a solution that is specifically optimized for sensitive security environments that have less impact on site security policies
Data in Distributed Systems
dCache Added Value

• Used to store data in a distributed fashion without end-users being aware where their data is stored (‘transparency’)

Distribution Transparency

‘An important goal of a distributed system is to hide the fact that its processes and resources are physically distributed across multiple computers.’

dCache Features

• Use the dCache SE as a service in order to transparently provide access to disk-based storage systems as well as tertiary storage (e.g. tapes) known for better cost-efficiency.
• Take advantage of a strong client/server architecture that implements the functionality of a Storage Element (SE) offering a variety of access protocols (e.g. POSIX, etc.).
• Migrate data from one resource to another without affecting end-users.
• Interoperate with other EMI storage services by using the Storage Resource Manager (SRM) 2.2 standard as Web service Interface or the HTTP-based WebDAV standard.
StoRM Added Value

• Used to store data and information in different underlying disk-based storage systems
  – One standard interface: SRM

Open Distributed System

‘An open distributed system is a system that offers services according to standard rules that describe the syntax and semantics of those services...’

StoRM Features

• Use the StoRM SE as a service that is specifically optimized for (parallel) disk-based storage systems such as the General Parallel File System (GPFS) or Lustre

• Take advantage of a strong client/server architecture that implements the functionality of a Storage Element (SE) offering a variety of access protocols (e.g. POSIX, etc.)

• Provide a stable storage interface with StoRM to end-users while the underlying file system and/or storage system might change over time

• Interoperate with other EMI storage services by using the Storage Resource Manager Open Grid Forum (SRM) 2.2 standard as Web service Interface

• The modular architecture decouples StoRM from the different underlying file systems
DPM Added Value

- Lightweight storage solution for DCI sites offering a simple way to create disk-based Grid storage elements and their management

Protocols

‘The collection of protocols used in a particular system is called a protocol suite or protocol stack...’

DPM Features

- Use the DPM SE as a lightweight service in order to transparently provide access to disk-based storage systems.
- Install a client/server architecture that supports many protocols for file access such as Remote File Input/Output (RFIO), XROOT, HTTP, GridFTP, and NSF4.1.
- Interoperate with other EMI storage services by using the Storage Resource Manager (SRM) 2.2 standard.
- Take advantage of a system focused on manageability such as ease of installation and configuration as well as low effort of maintenance.
- Leverage all the required functionality for your grid storage solution including support for multiple disk server nodes, different space types or multiple file replicas in disk pools.
• Provide high robustness, scalability and performance registry using a federated model (with no centralized, single entry point)

Scalability

‘... scalability is one of the most important design goals for developers of distributed systems... if more users or resources need to be supported, we are often confronted with the limitations of centralized services, data, and algorithms...’

EMIR Features

- Use EMIR ReSTful interface to register and query the services
- Employ flexible, standardized and expressive information model to represent the services (GLUE2 information model)
- Setup authorization and access control with XACML policies or ACLs
- Write easy your own clients to interact with the service (WADL available)
Distributed Systems Security
VOMS Added Value

• Attribute Authority (AA) releasing signed security credentials with information beyond pure identities (roles, groups, project, etc.)

Protection Domains - Authorization based on groups and roles of users

‘One approach is to construct groups of users...related to having groups as protection domains, is also possible to implement protection domains as roles’

VOMS Features

- Use VOMS as an AA server to obtain signed security credentials with attributes of end-users (e.g. role possession, group/project membership) used during authorization
- Take advantage of a client/server architecture that is able to store identities and manage them in hierarchical groups
- Access and easily configure VOMS using its complementary voms-admin tool
- Interoperate by using the Security Assertion Markup Language (SAML) 2.0 standard via SOAP-based Web service interfaces or X.509 Attribute Certificates
- Engage in being among the first users that take advantage of the new Representational State Transfer (REST) VOMS interface
UVOS Added Value

- Attribute Authority (AA) releasing signed security credentials with information beyond pure identities (roles, groups, project, etc.)

Protection Domains - Authorization based on groups and roles of users

‘One approach is to construct groups of users...related to having groups as protection domains, is also possible to implement protection domains as roles’

UVOS Features

• Use UVOS as an AA server to obtain signed security credentials with attributes of end-users (e.g. role possession, group/project membership) used during authorization

• Take advantage of a client/server architecture that is able store identities and other identifiable servers and organize them in hierarchical groups if needed

• Access and configure UVOS using its client and a lightweight VO authentication Web component optimized for a usage within browsers

• Interoperate with other services by using the Security Assertion Markup Language (SAML) 2.0 standard via SOAP-based Web service interfaces
ARGUS Added Value

- Used to derive authorization decisions

Protection Domains - Authorization based on groups and roles of users

“One approach is to construct groups of users...related to having groups as protection domains, is also possible to implement protection domains as roles’

ARGUS Features

• Use ARGUS as a system to render consistent authorization decisions across geographically distributed services (computing, data, portals, etc.)

• Take advantage of a client/server architecture that implements the functionality of a Policy Enforcement Point (PEP)

• Manage policies through a Policy Administration Point (PAP) and its admin tool

• Interoperate with other services by using the Extensible Access Control Markup Language (XACML) standard via a SOAP-based Web service Interface
More Information
Future: Science Soft Activities

- Collaborate in a more open & flexible way
- Enhance ‘users choice’ via standard adoptions
- Join sustainability plans based on several pillars in Grid community
- Find new partners...

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EMI References

- EMI Website
  http://www.eu-emi.eu/
- ‘ScienceSoft’ Web site (concept phase)
  http://www.sciencesoft.org
General References

[2] EMI Product FactSheets
[3] Digital Agenda for Europe
http://ec.europa.eu/information_society/digital-agenda/index_en.htm