The EU DataGrid – Information and Monitoring Services

The European DataGrid Project Team

http://www.eu-datagrid.org

Aim

◆ **The aim of the Information and Monitoring Service is to deliver a flexible infrastructure that provides information on both**

    1. The EU DataGrid itself

        • Mainly for the middleware packages

    2. Grid applications

        • For users

◆ **The current system is based on MDS which only offers the first service - to the middleware.**

    • The user may however query it to understand the status of the DataGrid

Overview of Talk

◆ Requirements of an information and monitoring service

◆ Globus MDS (Metacomputing Directory Service or Monitoring and Discovery Service as it is now called)

- OpenLDAP, a hierarchical database

- EDG GRIS/GIIS hierarchy

- EDG information providers

- Searching the information system

◆ R-GMA (Relational Grid Monitoring Architecture)

- A relational implementation of the Global Grid Forums GMA

Some Requirements of a Grid Information & Monitoring Service

◆ The system must be able to cope with nodes in a distributed environment

◆ Dynamic addition and deletion of information providers should be supported

◆ It must have a security system able to address the access to information at a fine level of granularity

◆ It must be able to work well on an unreliable Wide Area Network (WAN)

◆ The system must allow new data types to be defined

# Globus MDS

Monitoring and Discovery Services

LDAP attributes

◆ EDG currently uses Globus MDS which is built on OpenLDAP

◆ A schema describes the attributes and the types of the attributes associated with data objects

◆ Example - some attributes of SiteInfo:

- siteName: RALDEV
- sysAdminContact: grid.sysadmin@rl.ac.uk
- userSupportContact: grid.support@rl.ac.uk
- siteSecurityContact: grid.security@rl.ac.uk
- dataGridVersion: 1.2
- InstallationDate: 20020704142800Z

LDAP hierarchy

- ◆ Lightweight Directory Assess Protocol (LDAP) offers a hierarchical view of information

- ◆ The objects are arranged in a Directory Information Tree (DIT)

- ◆ One or more attributes represent the Relative Distinguished Name (RDN)

- ◆ An object is identified by its Distinguished name
  - This is its RDN with the Distinguished name of its parent

RDNs and DNs
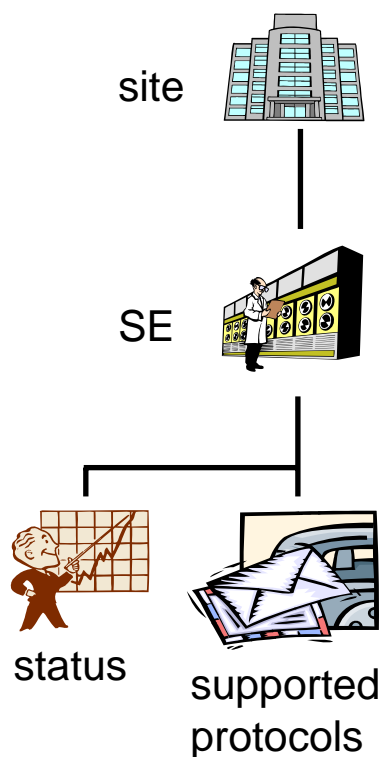
◆ RDN

- **SE**
  - seId=dev02.hepgrid.clrc.ac.uk

- **Status**
  - in=status

- **Protocols**
  - seProtocol=gridftp
  - seProtocol=rfio
  - seProtocol=file

◆ DN

- **Site**
  - Mds-Vo-name=ral-dev,Mds-Vo-name=uk,o=Grid

- **SE**
  - seId=dev02.hepgrid.clrc.ac.uk,Mds-Vo-name=ral-dev,Mds-Vo-name=uk,o=Grid

- **Status**
  - in=status,seId=dev02.hepgrid.clrc.ac.uk,Mds-Vo-name=ral-dev,Mds-Vo-name=uk,o=Grid

- **Protocols**
  - seProtocol=gridftp, seId=dev02.hepgrid.clrc.ac.uk,Mds-Vo-name=ral-dev,Mds-Vo-name=uk,o=Grid
  - seProtocol=rfio, seId=dev02.hepgrid.clrc.ac.uk,Mds-Vo-name=ral-dev,Mds-Vo-name=uk,o=Grid
  - seProtocol=file, seId=dev02.hepgrid.clrc.ac.uk,Mds-Vo-name=ral-dev,Mds-Vo-name=uk,o=Grid

site

SE

status

supported protocols

MDS GRISs & GIISs

- ◆ Information providers are scripts which when invoked by the LDAP server make available the desired information
  - Information is cached by the server to improve performance
  - LDAP was designed for use with relatively static data, not rapidly changing data

- ◆ Within MDS the EDG information providers are invoked by a local LDAP server, the Grid Resource Information Server (GRIS)

- ◆ "Aggregate directories", Grid Information Index Servers (GIIS), are used to group resources

- ◆ The GRISs use soft state registration to register with one or more GIISs

- ◆ The GIIS can then act as a single point of contact for a number of resources
  - A GIIS may represent a site, country, virtual organization, etc.

- ◆ In turn a GIIS may register with another GIIS

EDG GRIS/GIIS Hierarchy
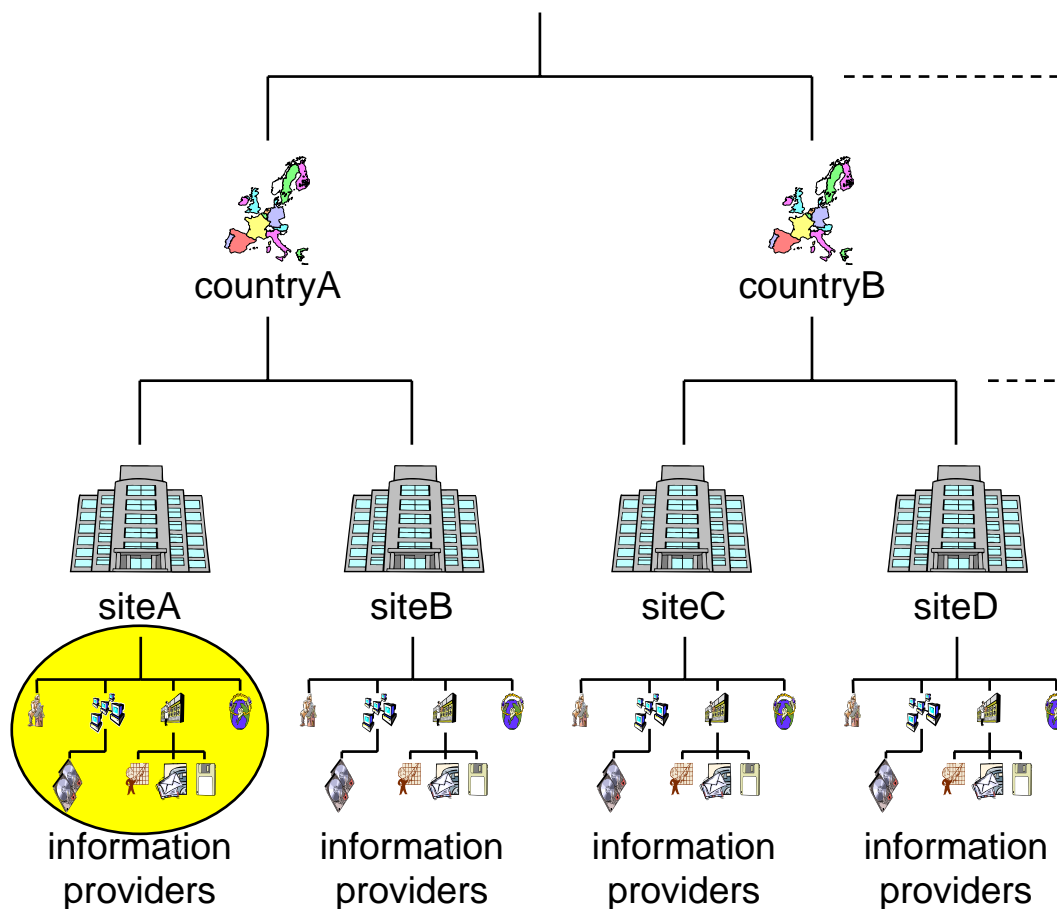
- There is a top level datagrid GIIS to which all of the country GIISs register

- Each country has a GIIS to which all of the site GIISs register

- Each Site has a Grid Information Index Server (GIIS) which acts as a single point of contact for all of the sites resources. The GRISs register with their site GIIS

- Information providers publish information to a local LDAP server known as a Grid Resource Information Server (GRIS)

datagrid

countryA   countryB

siteA   siteB   siteC   siteD

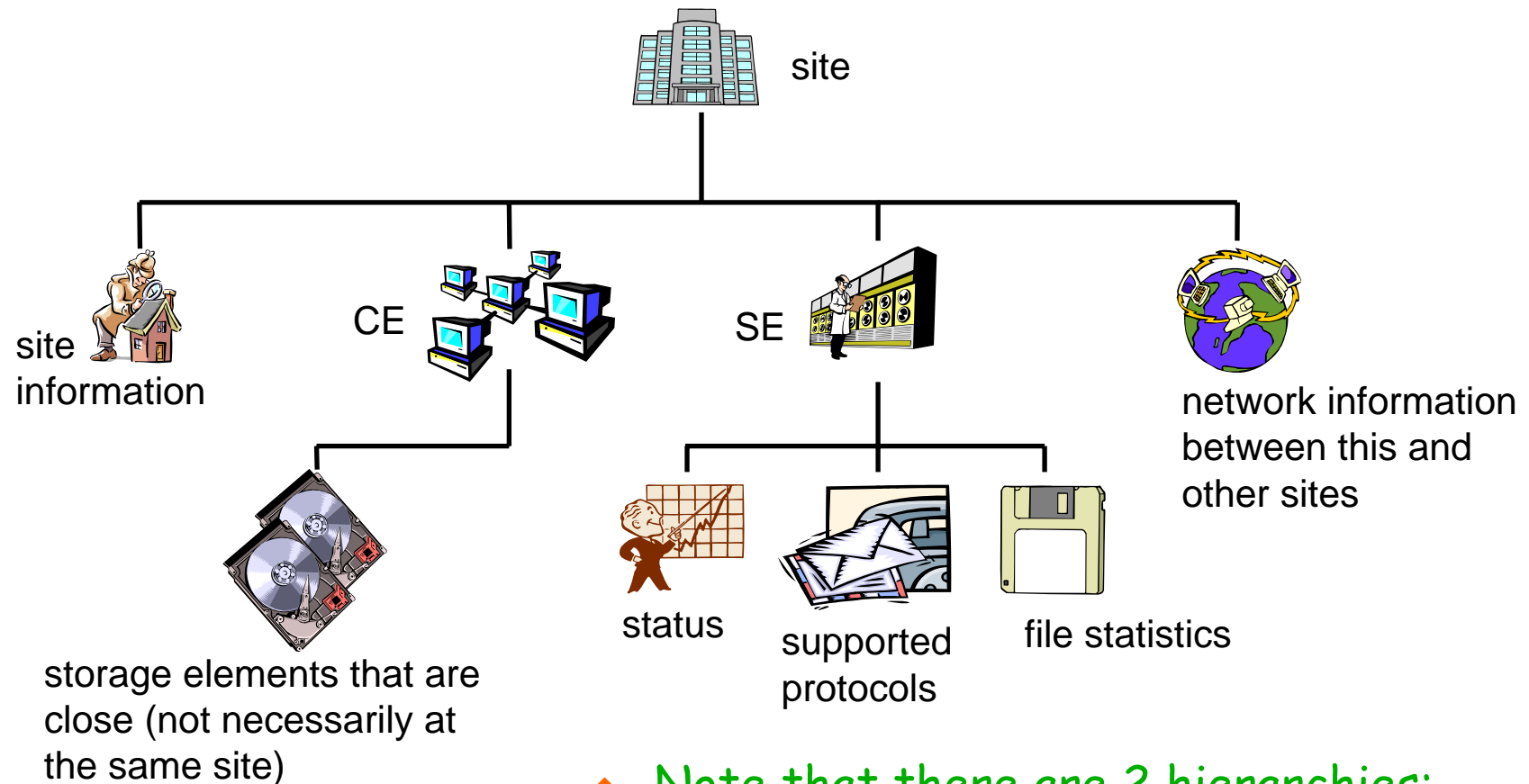information providers   information providers   information providers   information providers

EDG Information Providers

- The EDG have produced information providers:
  - Site information
  - The Computing Element
  - The Storage Element
  - Network Monitoring

- All of the EDG data objects are dynamic, they have a time stamp and a time to live (used by the cache mechanism) associated with them

EDG Information Providers & the Directory Information Tree

site

site information

CE

SE

network information between this and other sites

storage elements that are close (not necessarily at the same site)

status

supported protocols

file statistics

- ◆ Note that there are 2 hierarchies:
    - The GIIS/GRIS structure
    - The DIT

Siteinfo

in=siteinfo,Mds-Vo-name=ral-dev,Mds-Vo-name=uk,o=Grid

objectClass: SiteInfo

objectClass: DataGridTop

objectClass: DynamicObject

siteName: RALDEV

sysAdminContact: grid.sysadmin@rl.ac.uk

userSupportContact: grid.support@rl.ac.uk

siteSecurityContact: grid.security@rl.ac.uk

dataGridVersion: 1.2

installationDate: 20020704142800Z

Storage Element

seId=dev02.hepgrid.clrc.ac.uk,Mds-Vo-name=ral-dev,Mds-Vo-name=uk,o=Grid

objectClass: StorageElement

objectClass: DataGridTop

objectClass: DynamicObject

SEId: dev02.hepgrid.clrc.ac.uk

CloseCE: dev01.hepgrid.clrc.ac.uk:2119/jobmanager-pbs-M

SEtypearchitecture: disk

SEsize: 13177

SEResourceContactString: grid.support@rl.ac.uk

SEvo: wpsix, :/flatfiles/05/wpsix

Storage Element Protocols

```
seProtocol=gridftp, seId=dev02.hepgrid.clrc.ac.uk,Mds-Vo-name=ral-dev,Mds-Vo-name=uk,o=Grid
objectClass: StorageElementProtocol
objectClass: DataGridTop
objectClass: DynamicObject
SEId: dev02.hepgrid.clrc.ac.uk
SEProtocol: gridftp
Port: 2811


seProtocol=rfio, seId=dev02.hepgrid.clrc.ac.uk,Mds-Vo-name=ral-dev,Mds-Vo-name=uk,o=Grid
objectClass: StorageElementProtocol
objectClass: DataGridTop
objectClass: DynamicObject
 SEId: dev02.hepgrid.clrc.ac.uk
SEProtocol: rfio
Port: 3147


seProtocol=file, seId=dev02.hepgrid.clrc.ac.uk,Mds-Vo-name=ral-dev,Mds-Vo-name=uk,o=Grid
objectClass: StorageElementProtocol
objectClass: DataGridTop
objectClass: DynamicObject
 SEId: dev02.hepgrid.clrc.ac.uk
SEProtocol: file
```

Storage Element Status

in=status,seId=dev02.hepgrid.clrc.ac.uk,Mds-Vo-name=ral-dev,Mds-Vo-name=uk,o=Grid

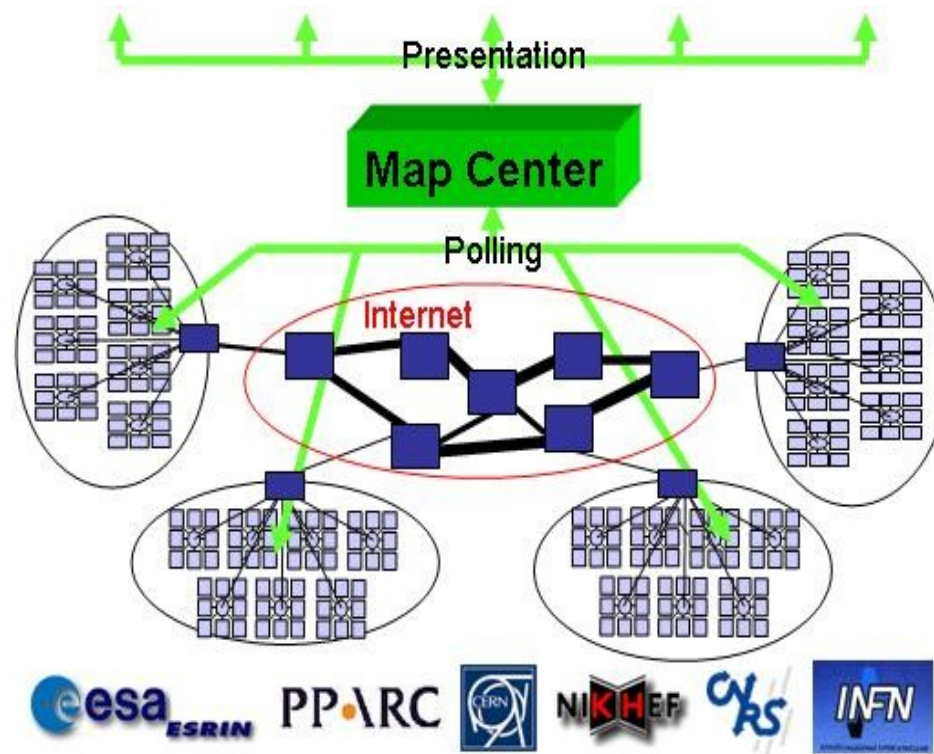objectClass: StorageElementStatus

objectClass: DataGridTop

objectClass: DynamicObject

SEfreespace: 12031

SEId: dev02.hepgrid.clrc.ac.uk

Map Centre

◆ An easy way to browse the data available in the Information and Monitoring Service is to use Map Centre

◆ http://ccwp7.in2p3.fr/mapcenter/datagrid-d/

Querying the Information & Monitoring Service

◆ Queries can be posed to the current Information and Monitoring Service using LDAP search commands:

```
$ldapsearch\
  -x\
  -H ldap://lxshare0225.cern.ch:2135\
  -b 'Mds-Vo-name=datagrid,o=grid\
  'objectclass=StorageElment'\
  seId SEsize \
  -s base|one|sub
```

"simple" authentication

uniform resource identifier

base distinguished name for search

filter

attributes to be returned

scope of the search specifying just the base object, one-level or the complete subtree

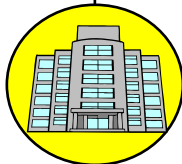# Querying the GRIS/GIIS Hierarchy

Mds-Vo-name =datagrid

Mds-Vo-name =countryA

Mds-Vo-name =countryB

Mds-Vo-name =siteA

Mds-Vo-name =siteB

Mds-Vo-name =siteC

Mds-Vo-name =siteD

◆ Mds-Vo-name=datagrid,o=grid
  • This will look at all the data

◆ Mds-Vo-name=siteB, Mds-Vo-name=countryA,Mds-Vo-name=datagrid,o=grid
  • This will look at all the data from siteB

◆ Mds-Vo-name=countryA,o=grid
  • This will look at all the data from countryA

◆ Mds-Vo-name=siteB,Mds-Vo-name=countryA,o=grid
  • This will look at all the data from siteB

◆ Mds-Vo-name=siteB,o=grid
  • This will look at all the data from siteB

R-GMA

Relational - Grid Monitoring Architecture

R-GMA

- ◆ LDAP does not allow queries over different objects
  - • I.e. you can only query based on attributes of an object (no "Joins")

- ◆ MDS is not designed for applications to publish their own data
  - • It has relatively static descriptions of the data being published – the schema.

- ◆ R-GMA is a relational implementation of the Grid Monitoring Architecture (GMA) of the GGF
  - • The relational model is very flexible and allows complex queries which make use of information in multiple objects
  - • R-GMA provides a means for anyone to publish any information on the Grid – can also do the job of the current MDS
  - • It is highly dynamic – with new Producers of information being noticed by existing Consumers

R-GMA
The Consumer Producer Model

Producer

Registry

- ◆ Use the Grid Monitoring Architecture from Global Grid Forum

- ◆ A relational implementation

- ◆ Applied to both information and monitoring

- ◆ Creates impression that you have one RDBMS per Virtual Organization

→ Command flow
→ Information flow

Consumer

Relational Approach

- **Not** a general distributed RDBMS system, but a way to use the relational model in a distributed environment where ACID properties are not generally important.

- **Producers**   announce: SQL "CREATE TABLE"
                     publish: SQL "INSERT"

- **Consumers**   collect: SQL "SELECT"

- The mediator is a component within the Consumer which locates one or more Producers and combines the information as necessary

Summary

- ◆ The current information system is Globus MDS
  - • This uses LDAP as its underlying data interface
  - • The are a number of EDG information providers

- ◆ The new Information and Monitoring Service is R-GMA
  - • Early version in 1.2
  - • It can support complex SQL queries
  - • It can return a single result set or stream data
  - • Grid applications can publish data

The End

- ◆ Information and Monitoring Services
  - • http://hepunx.rl.ac.uk/edg/wp3/