Information and Monitoring

The European DataGrid Project Team

http://www.eu-datagrid.org

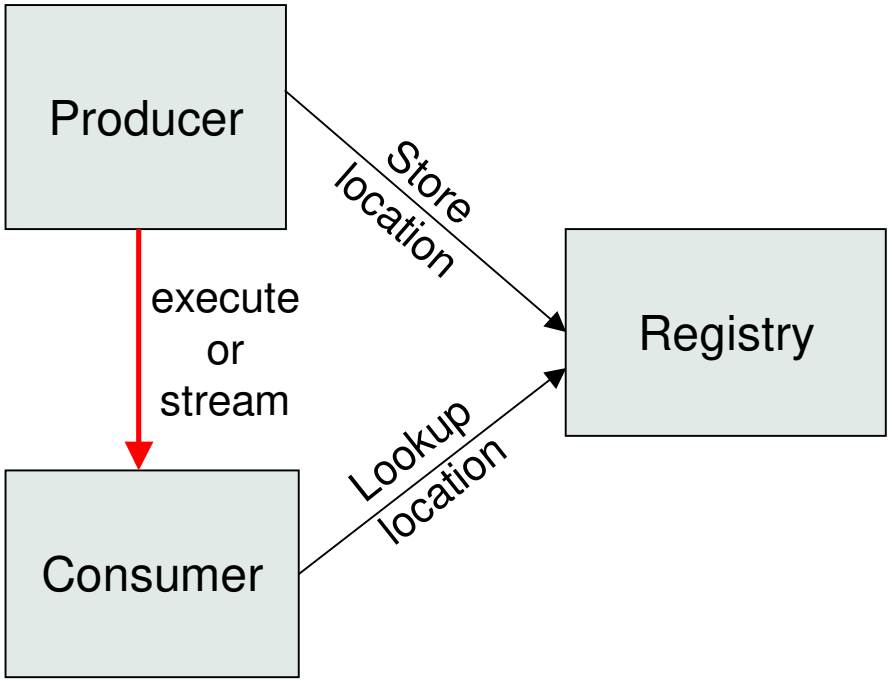
Contents

- Grid Information Systems
- GMA and R-GMA
- Topologies of components
- APIs and Tools
- Info-Providers
- Deployment
- GLUE Schema

Features of a grid information system

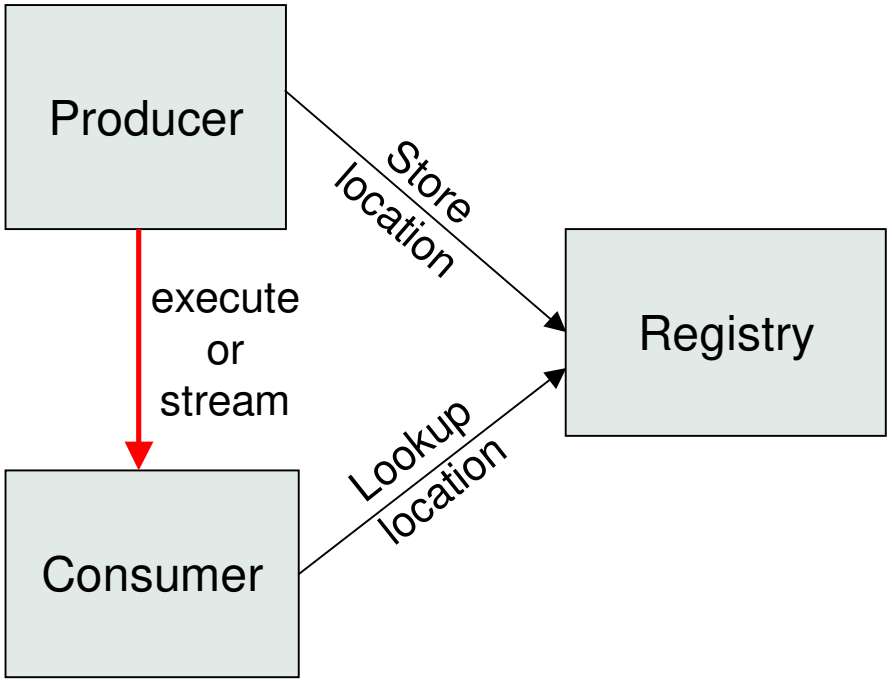
- Provides information on both:
  - The Grid itself
    - Mainly for the middleware packages
    - The user may query it to understand the status of the Grid
  - Grid applications
    - For users
- Flexible infrastructure
  - Able to cope with nodes in a distributed environment with an unreliable network
  - Dynamic addition and deletion of information producers
  - Security system able to address the access to information at a fine level of granularity
  - Allow new data types to be defined
  - Scaleable
  - Good performance
  - Standards based

GMA



- From GGF
- Very simple model
- Does not define:
  - Data model
  - Data transfer mechanism
  - Registry implementation

R-GMA



- Use the GMA from GGF
- A relational implementation
  - Powerful data model and query language
    - All data modelled as tables
    - SQL can express most queries in one expression
- Applied to both information and monitoring
- Creates impression that you have one RDBMS per VO

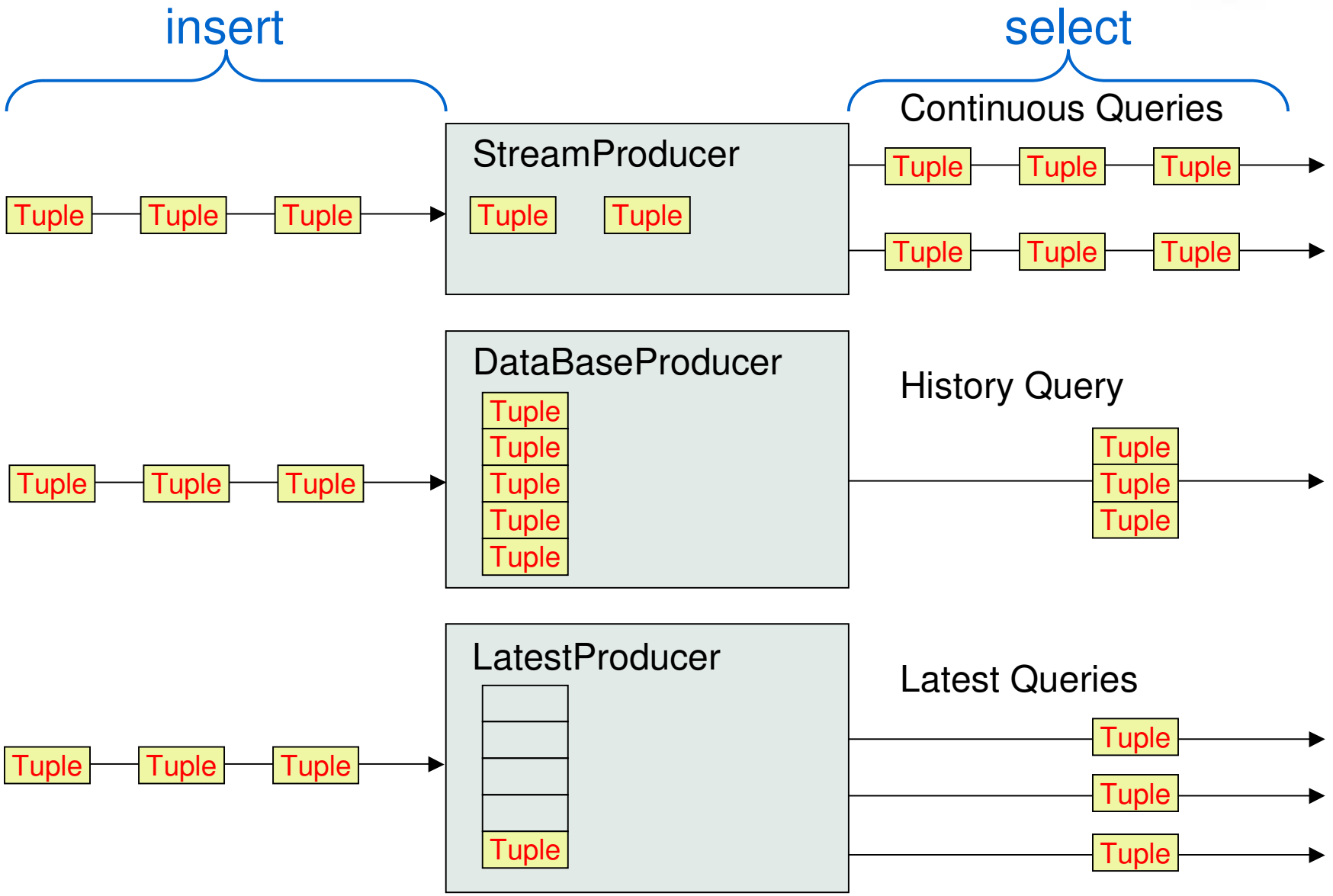
Relational Data Model in R-GMA

- Not a general distributed RDBMS system, but a way to use the relational model in a distributed environment where global consistency is not important
- Producers announce: SQL "CREATE TABLE"
  publish: SQL "INSERT"
- Consumers collect: SQL "SELECT"
- Some producers, the Registry and Schema make use of RDBMS as appropriate – but what is central is the relational model

Data Transfer: Producer ➡ Consumer

- Consumer can issue one-off queries
  - Similar to normal database query
- Consumer can also start a continuous query
  - Requests all data published which matches the query
    - As data matching the query is produced it is streamed to the Consumer
    - Can be seen as an alert mechanism

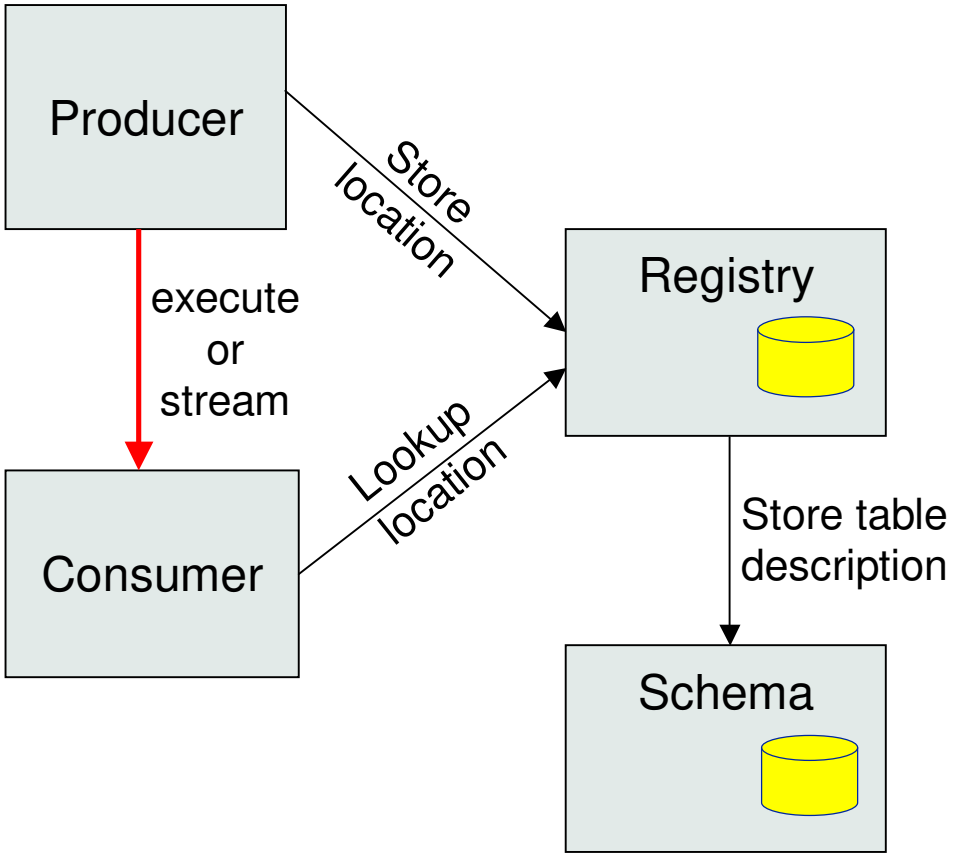
3 Kinds of Query



Producers

- StreamProducer – Supports Continuous Queries
  - In memory data structure
  - Can define minimum retention period
- ResilientStreamProducer – Supports Continuous Queries
  - Like the StreamProducer but won't lose data if system crashes
  - So slightly slower
- DataBaseProducer – Supports History Queries
  - Information not lost
  - Supports joins
  - Clean up strategy
- LatestProducer – Supports Latest Queries
  - Just holds the latest information for any "primaryish" key
  - Supports joins
- CanonicalProducer – Supports anything
  - Offers "anything" as relations
  - User has to write code to handle SQL etc.

Registry and Schema



- Registry has two main tables:
  - Producer
    - Table name
    - Predicate
    - Location
  - Consumer
    - Query
    - Location
- Schema holds description of tables
  - Column names and types of each table
- Registry predicate defines subset of "global" table

Contributions to the "global" table

CPULoad (Global Schema)				
Country	**Site**	**Facility**	**Load**	**Timestamp**
UK	RAL	CDF	0.3	19055711022002
UK	RAL	ATLAS	1.6	19055611022002
UK	GLA	CDF	0.4	19055811022002
UK	GLA	ALICE	0.5	19055611022002
CH	CERN	ALICE	0.9	19055611022002
CH	CERN	CDF	0.6	19055511022002

CPULoad (Producer 1)				
UK	RAL	CDF	0.3	19055711022002
UK	RAL	ATLAS	1.6	19055611022002

CPULoad (Producer 2)				
UK	GLA	CDF	0.4	19055811022002
UK	GLA	ALICE	0.5	19055611022002

WHERE country = 'UK' AND site = 'RAL'

WHERE country = 'CH' AND site = 'CERN'

CPULoad (Producer 3)				
CH	CERN	ATLAS	1.6	19055611022002
CH	CERN	CDF	0.6	19055511022002

Mediator

- Queries posed against a virtual data base
- The Mediator must:
  - find the right Producers
  - combine information from them
- Hidden component – but vital to R-GMA
- Will eventually support full distributed queries but for now will only merge information from multiple producers for queries on one table or over multiple tables from one producer

Queries over "global" table – merging streams

SELECT * from CPULoad WHERE country = 'UK'

CPULoad (Consumer)

Country	Site	Facility	Load	Timestamp
UK	RAL	CDF	0.3	19055711022002
UK	RAL	ATLAS	1.6	19055611022002
UK	GLA	CDF	0.4	19055811022002
UK	GLA	ALICE	0.5	19055611022002

CPULoad (Producer 1)

UK	RAL	CDF	0.3	19055711022002
UK	RAL	ATLAS	1.6	19055611022002

CPULoad (Producer 2)

UK	GLA	CDF	0.4	19055811022002
UK	GLA	ALICE	0.5	19055611022002

Mediator handles merging information from multiple producers for queries on one table

CPULoad (Producer 3)

CH	CERN	ATLAS	1.6	19055611022002
CH	CERN	CDF	0.6	19055511022002

Queries over "global" table – joining tables

SELECT Service.URI Service.emailContact
from Service S, ServiceStatus SS
WHERE (S.URI= SS.URI and SS.up='n')

Service/ServiceStatus (Consumer)

URI	emailContact
gppse02	sysad@rl.ac.uk

Service/ServiceStatus (Latest Producer)

Service

URI	VO	type	emailContact	site	secure	majorVersion	minorVersion	patchVersion
gppse01	alice	SE	sysad@rl.ac.uk	RAL	…	…	…	…
gppse01	atlas	SE	sysad@rl.ac.uk	RAL	…	…	…	…
gppse02	cms	SE	sysad@rl.ac.uk	RAL	…	…		
lxshare0404	alice	SE	sysad@cern.ch	CERN	…	…		
lxshare0404	atlas	SE	sysad@cern.ch	CERN	…	…		

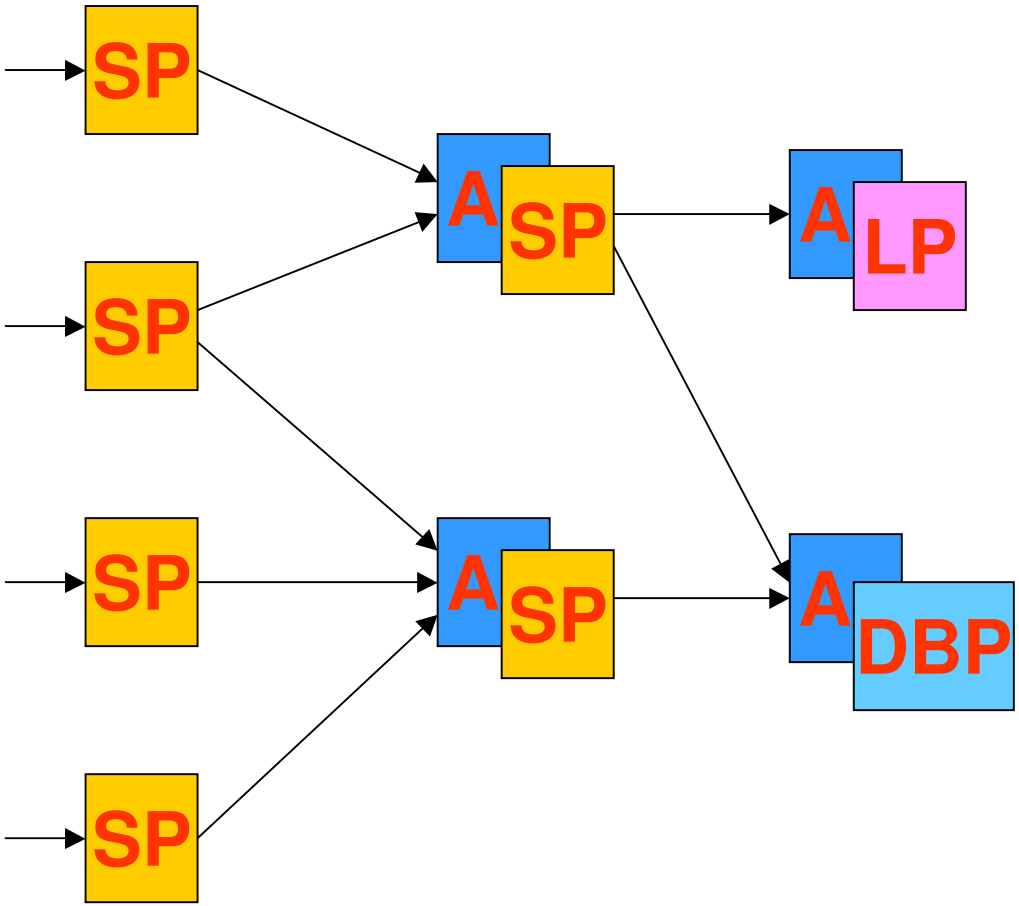
ServiceStatus

URI	VO	type	up	status
gppse01	alice	SE	y	SE is running
gppse01	atlas	SE	y	SE is running
gppse02	cms	SE	n	SE ERROR 101
lxshare0404	alice	SE	y	SE is running
lxshare0404	atlas	SE	y	SE is running

Archiver (Re-publisher)

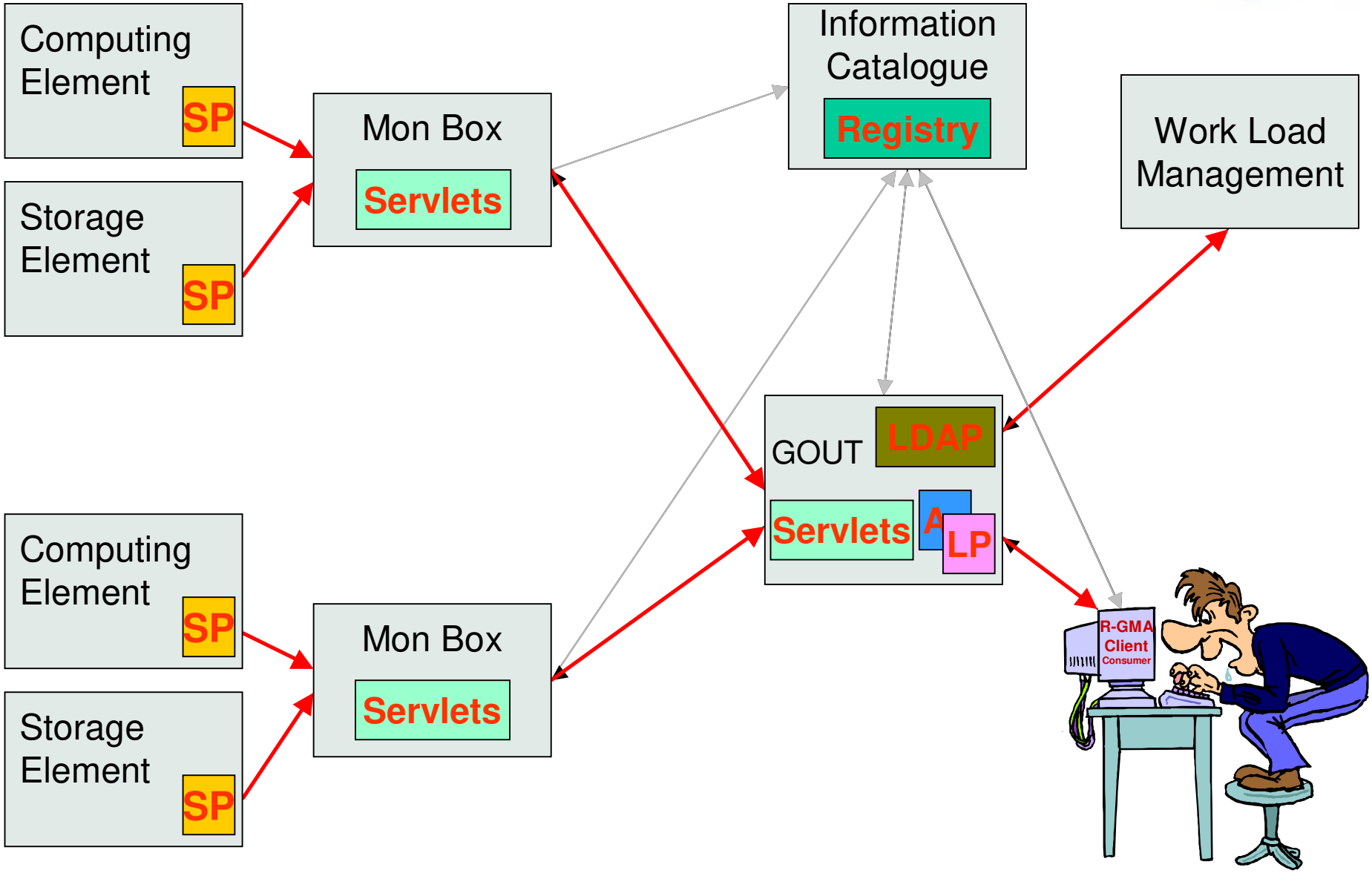
- It is a combined Consumer-Producer
  - Follows the GMA concept but packaged for ease of use
- You just have to tell it what to collect and it does so on your behalf
- Re-publishes to any kind of "Insertable" (i.e. not to the CanonicalProducer)
  - Can support joins if archiving to a DataBaseProducer or a LatestProducer

Topologies



- Normally publish via a StreamProducer SP
- Archivers A instantiated with a Producer and a Predicate.
  - May re-publish via:
    - StreamProducer
    - LatestProducer LP
    - DataBaseProducer DBP
- Must avoid cycles in the connections – i.e. must be a DAG.

Topology for EDG



APIs

- Exist in Java, C++, C, Python and Perl
- C, Python and Perl follow an object based style reflecting the Java and C++ APIs

Java

```
myProducer = new StreamProducer();
```

C++

```
myProducer= new edg::info::StreamProducer();
```

C

```
myProducer = StreamProducer_new();
```

Perl

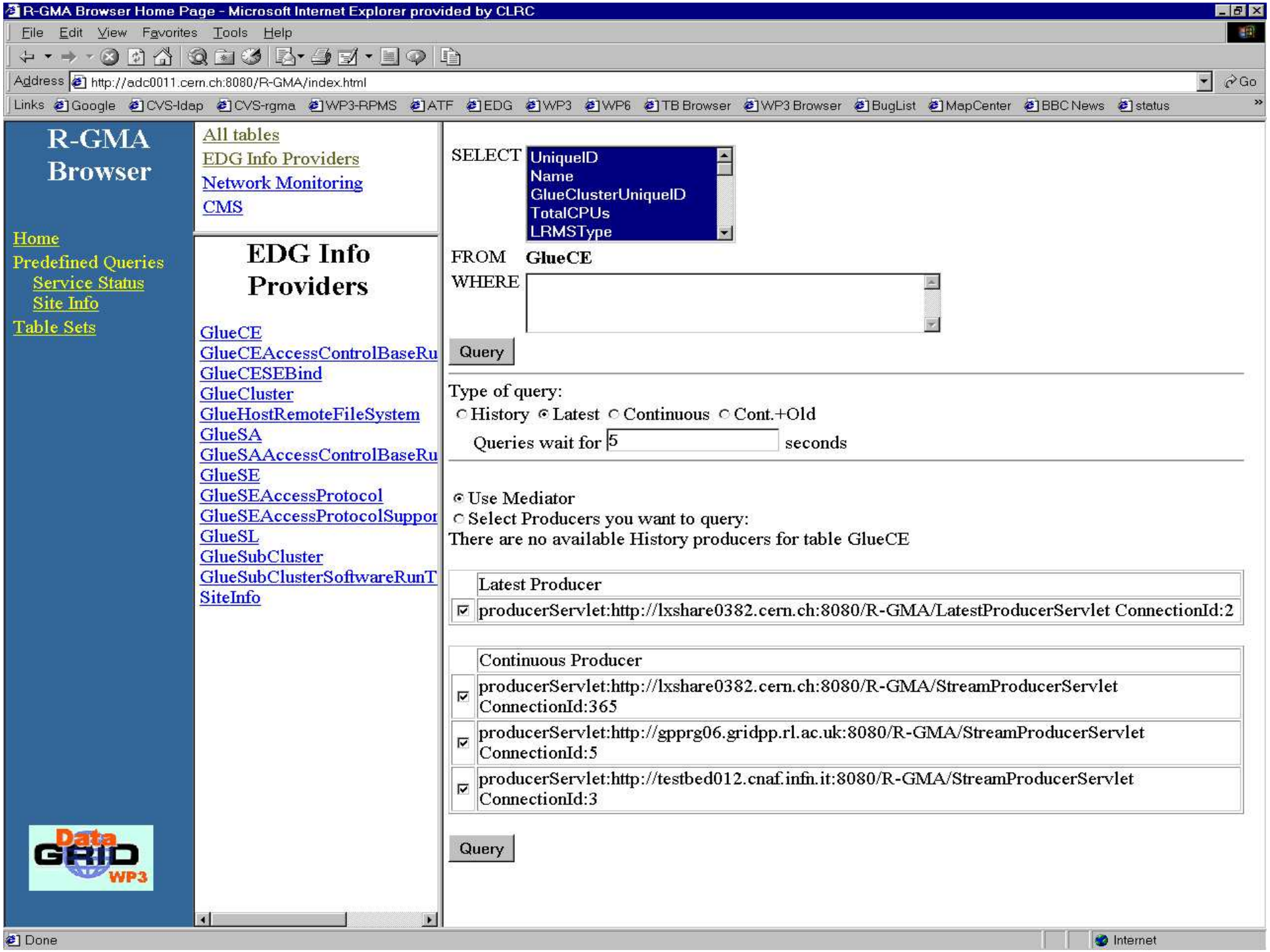
```
$myProducer = rgmainfo::StreamProducer_new();
```

Python

```
myProducer = rgmainfo.StreamProducer_new()
```

R-GMA Tools

- R-GMA Browser
  - Application dynamically generating web pages
  - Supports pre-defined and user-defined queries
- R-GMA CLI (edg-rgma)
  - Command Line Interface (similar to MySQL)
  - Supports single query and interactive modes
  - Can perform simple operations with Consumers, Producers and Archivers
- Pulse
  - R-GMA Java client-based GUI
  - Supports streaming and simple graphical displays


R-GMA Browser Home Page - Microsoft Internet Explorer provided by CLRC
File Edit View Favorites Tools Help
Address http://adc0011.cern.ch:8080/R-GMA/index.html
Go
Links Google CVS-ldap CVS-rgma WP3-RPMS ATF EDG WP3 WP6 TB Browser WP3 Browser BugList MapCenter BBC News status
R-GMA Browser
Home
Predefined Queries
Service Status
Site Info
Table Sets
All tables
EDG Info Providers
Network Monitoring
CMS
EDG Info Providers
GlueCE
GlueCEAccessControlBaseRu
GlueCESEBind
GlueCluster
GlueHostRemoteFileSystem
GlueSA
GlueSAAccessControlBaseRu
GlueSE
GlueSEAccessProtocol
GlueSEAccessProtocolSuppor
GlueSL
GlueSubCluster
GlueSubClusterSoftwareRunT
SiteInfo
SELECT
UniqueID
Name
GlueClusterUniqueID
TotalCPUs
LRMSType
FROM GlueCE
WHERE
Query
Type of query:
History Latest Continuous Cont.+Old
Queries wait for 5 seconds
Use Mediator
Select Producers you want to query:
There are no available History producers for table GlueCE
Latest Producer
producerServlet:http://lxshare0382.cern.ch:8080/R-GMA/LatestProducerServlet ConnectionId:2
Continuous Producer
producerServlet:http://lxshare0382.cern.ch:8080/R-GMA/StreamProducerServlet ConnectionId:365
producerServlet:http://gpprg06.gridpp.rl.ac.uk:8080/R-GMA/StreamProducerServlet ConnectionId:5
producerServlet:http://testbed012.cnaf.infn.it:8080/R-GMA/StreamProducerServlet ConnectionId:3
Query
Done
Internet

edg-rgma

- show tables
- describe Service
- show producers of Service
- latest select * from Service
- old continuous select * from Service

edg-rgma – Example

```
./edg-rgma \
   -c "timeout 0.1" \
   -c timeout \
   -c "str decl Service" \
   -c "str minr .2" \
   -c "str minr" \
   -c "stream INSERT into Service (URI, VO, type, secure,
     emailContact, site, majorVersion, minorVersion,
     patchVersion) values ('a','b','c','y', 'd','e',1,2,3)" \
   -c "old continuous select * from Service
```

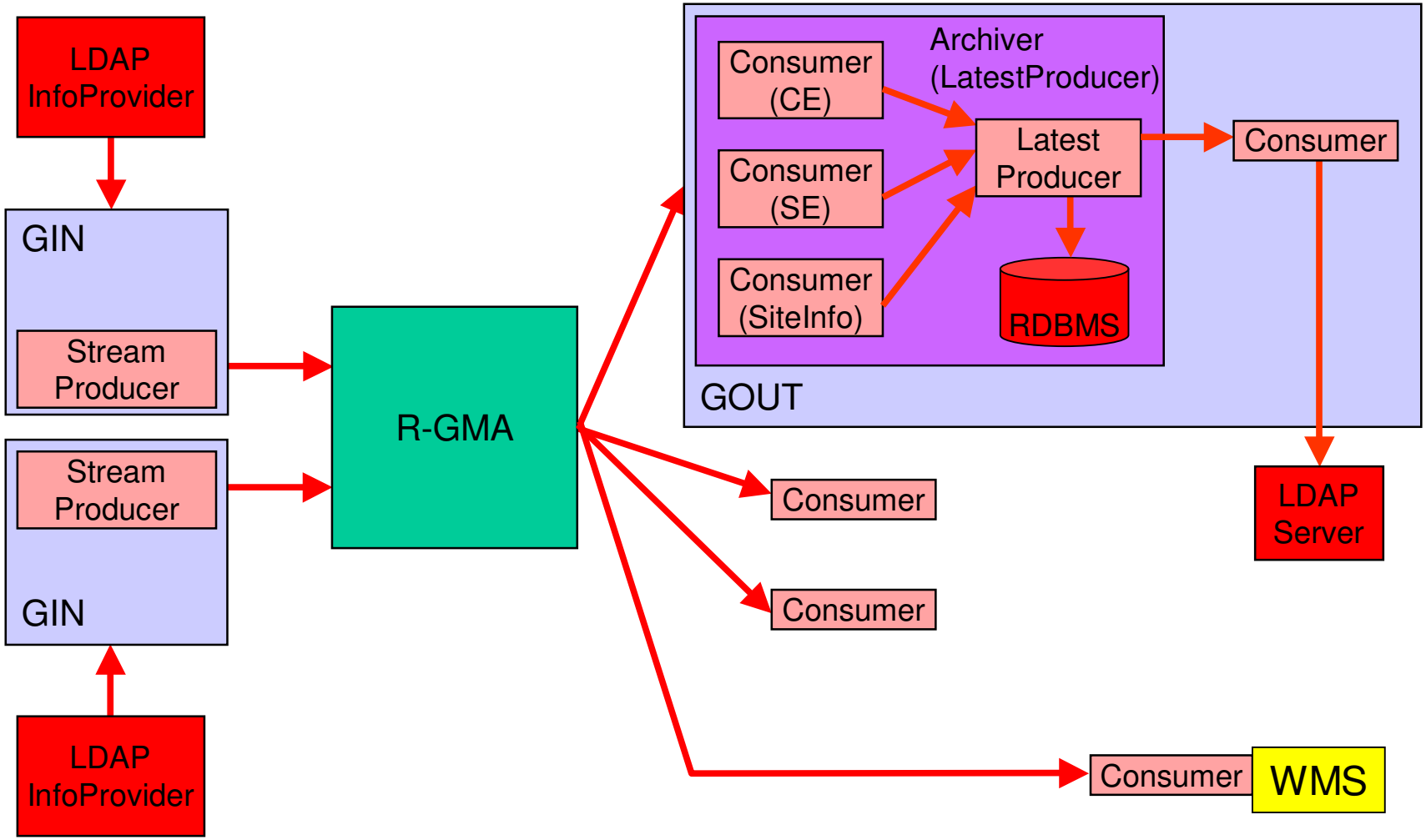
URI	VO	type	emailContact	site	secure	majorVersion	minorVersion	patchVersion	MeasurementDate	MeasurementTime
a	b	c	d	e	y	1	2	3	2003-07-08	10:26:58

1 Rows in set

EDG Information Providers

- EDG information providers
  - Software that provides information about resources and infrastructure
  - Provided by the work packages responsible for the resource
- The information providers produce data in LDIF format
  - This is a legacy from when Globus MDS was the primary information system
- R-GMA publishes the data
  - Gin (gadget in) is used to invoke the information provider scripts and publish via StreamProducers
  - Gout (gadget out) republishes the data via a LatestProducer and then to an OpenLDAP database
    - This is to provide backwards compatibility during the transition from MDS to R-GMA

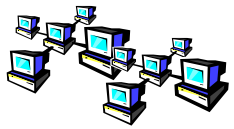
Current deployment: GIN and GOUT



The GLUE schema

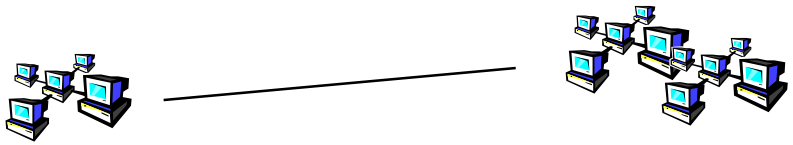
- Developed within HEP community
  - DataGrid
  - DataTAG
  - Globus
- It is a compromise - so not perfect for DataGrid
- Currently defines CEs and SEs
- Coming soon…
  - Network monitoring
  - Services

R-GMA Computing Service Tables



GlueCluster
UniqueID
Name
InformationServiceURL

R-GMA Computing Service Tables

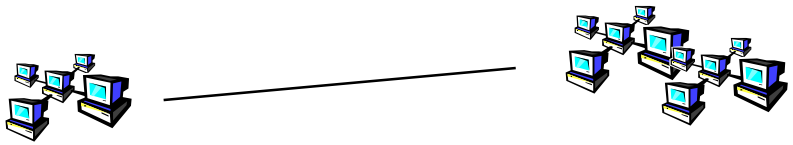


GlueSubCluster
UniqueID
Name
GlueClusterUniqueID
RAMSize
RAMAvailable
VirtualSize
VirtualAvailable
PlatformType
SMPSize
OSName
OSRelease
OSVersion
Vendor
……

GlueCluster
UniqueID
Name
InformationServiceURL

a sub cluster is a group of homogeneous machines

R-GMA Computing Service Tables



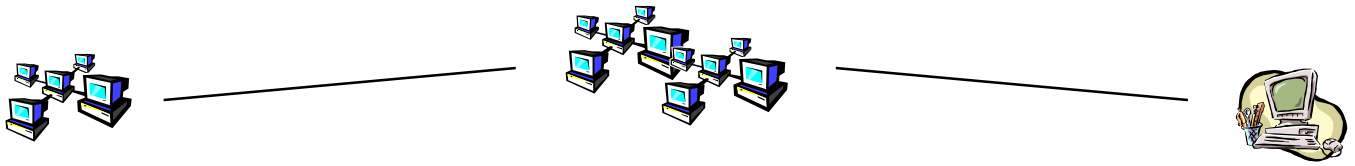
GlueSubCluster
UniqueID
Name
GlueClusterUniqueID
RAMSize
RAMAvailable
VirtualSize
VirtualAvailable
PlatformType
SMPSize
OSName
OSRelease
OSVersion
Vendor
……

GlueCluster
UniqueID
Name
InformationServiceU

GlueSubCluster SoftwareRunTime Environment
GlueSubClusterUniqueID
Value

software accessible by the nodes, e.g. ALICE-3.09.06, ALIEN-1.29.9

R-GMA Computing Service Tables

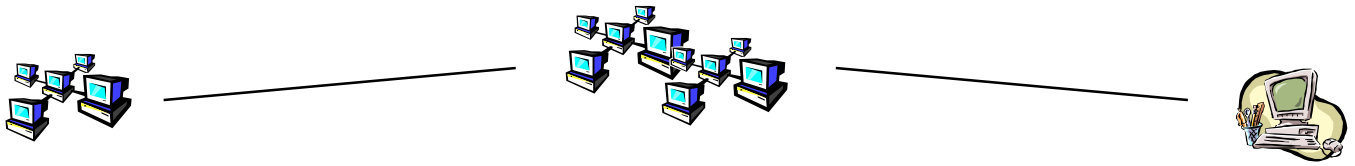


GlueCluster
UniqueID
Name
InformationServiceURL

GlueCE
UniqueID
Name
GlueClusterUniqueID
TotalCPUs
LRMSType
LRMSVersion
GRAMVersion
HostName
GatekeeperPort
RunningJobs
WaitingJobs
TotalJobs
Status
.....

a computing element relates to a queue on batch system

R-GMA Computing Service Tables



GlueCluster
UniqueID
Name
InformationServiceURL

GlueCE
UniqueID
Name
GlueClusterUniqueID
TotalCPUs
LRMSType
LRMSVersion
GRAMVersion
HostName
GatekeeperPort
RunningJobs
WaitingJobs
TotalJobs
Status
.....

authorised user

GlueCEAccessControlBaseRule
GlueCEUniqueID
Value

R-GMA Storage Service Tables

GlueSL
UniqueID
GlueSEUniqueID
Name
ArchitectureType
MaxIOCapacity
InformationServiceURL

storage library, the machine providing the storage service

R-GMA Storage Service Tables

GlueSL
UniqueID
GlueSEUniqueID
Name
ArchitectureType
MaxIOCapacity
InformationServiceURL

GlueSE
UniqueID
GlueSLUniqueID
Name
Port
CurrentIOLoad
InformationServiceURL

storage service

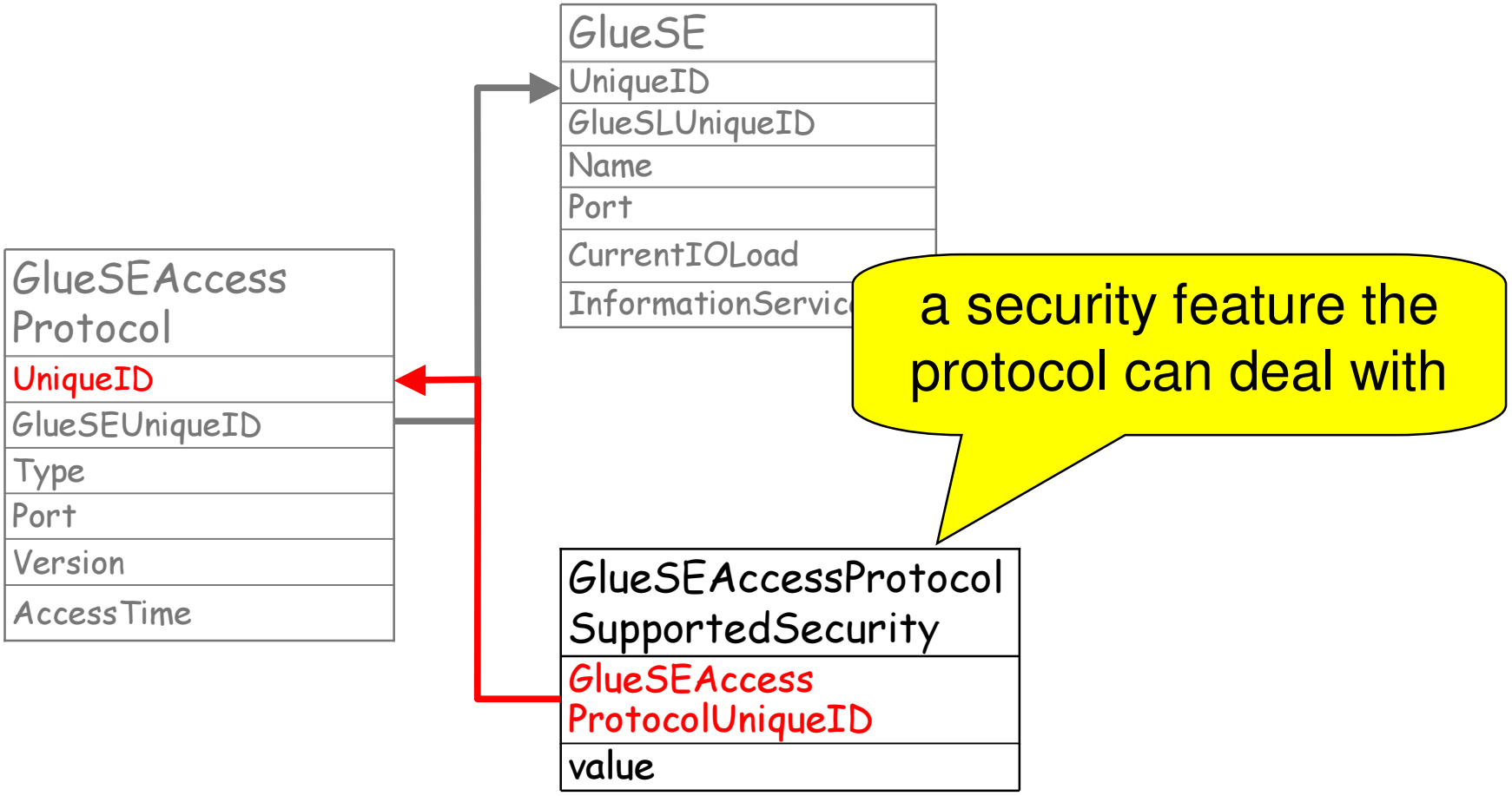
R-GMA Storage Service Tables

GlueSE
UniqueID
GlueSLUniqueID
Name
Port
CurrentIOLoad
InformationServiceURL

GlueSEAccessProtocol
UniqueID
GlueSEUniqueID
Type
Port
Version
AccessTime

a protocol supported by the storage service

R-GMA Storage Service Tables



R-GMA Storage Service Tables

GlueSE
UniqueID
GlueSLUniqueID
Name
Port
CurrentIOLoad
InformationServiceURL

GlueSA
UniqueID
Root
GlueSEUniqueID
MaxFileSize
MinFileSize
MaxData
MaxNumFiles
MaxPinDuration
Quota
FileLifeTime
AvailableSpace
UsedSpace

storage space

R-GMA Storage Service Tables

GlueSE
UniqueID
GlueSLUniqueID
Name
Port
CurrentIOLoad
InformationServiceURL

GlueSA
UniqueID
Root
GlueSEUniqueID
MaxFileSize
MinFileSize
MaxData
MaxNumFiles
MaxPinDuration
Quota
FileLifeTime
AvailableSpace
UsedSpace

authorised user

GlueSAAccess ControlBaseRule
GlueSAUniqueID
Value

R-GMA Binding Table

related GlueCE and GluseSE

GlueSE
UniqueID
GlueSLUniqueID
Name
Port
CurrentIOLoad
InformationServiceURL

GlueCESEBind
GlueCEUniqueID
GlueSEUniqueID
Accesspoint

GlueCE
UniqueID
Name
GlueClusterUniqueID
TotalCPUs
LRMSType
LRMSVersion
GRAMVersion
HostName
GatekeeperPort
RunningJobs
WaitingJobs
TotalJobs
Status
.....

Summary

- R-GMA
  - is a relational implementation of the GGF's GMA
  - has different Producer types
  - has an API available in multiple languages
  - components can be deployed in various topologies
  - mediator creates the impression of a single RDBMS
- The current EDG deployment with GIN and GOUT is backwards compatible with MDS2
- The GLUE Schema gives a data model independent view of information

Further Information

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