MULTIPLE VIRTUAL DATABASES TO SUPPORT MULTIPLE VOS IN R-GMA

A.J.Wilson, R.Byrom, L.A.Cornwall, M.S.Craig, A.Duncan, S.M.Fisher, S.Hicks, R.P.Middleton, J.A.Walk, CCLRC - Rutherford Appleton Laboratory, UK

Abstract

R-GMA is a relational implementation of the GGF's Grid Monitoring Architecture (GMA). In some respects it can be seen as a virtual database (VDB), supporting the publishing and retrieval of time-stamped tuples. The scope of an R-GMA installation is defined by its schema and registry. The schema holds the table definitions and, in future, the authorization rules. The registry holds a list of the available producers and consumers. At present, while it is possible to have multiple installations, a user can only use one at a time and hence cannot access tables in another installation. We plan to introduce multiple VDBs, where each VDB is defined by its own registry and schema. In this paper we explain the basic idea of R-GMA, why we need multiple VDBs to support multiple VOs, and how we will implement them. We also discuss the possible need to create some VDBs not related to end-user VOs. We also explain why we do not plan to provide a catalogue of VDBs as a part of R-GMA.

AN INTRODUCTION TO R-GMA

The Relational Grid Monitoring Architecture (R-GMA) is being developed as a generic information and monitoring system as part of the EGEE project. It offers powerful capabilities for monitoring in a distributed environment.

R-GMA provides a framework to publish and retrieve information using a producer/consumer model defined by the GMA standard [1] from the GGF. In this model, applications publish data using a producer, and a consumer is used to retrieve the data. This is done via the R-GMA API using SQL style commands. The properties that define the producer are stored within a registry so that when a consumer is created, it can query the registry to find producers that satisfy its search criteria. Once a list of producers is found, data then flows directly from the producer to the consumer. R-GMA provides consumer, producer, registry and schema services. The schema holds a list of table definitions and, in the future, the authorization rules.

Further details can be found on the R-GMA web site [2] and the JRA1-UK web site [3] with a full description of the R-GMA specification in the Information and Monitoring Service (R-GMA) System Specification [4].

A SINGLE VIRTUAL DATABASE

R-GMA provides a flexible infrastructure in which producers of information can be dynamically created and deleted from a registry, and tables can be dynamically added and removed from a schema. From a user's perspective, an R-GMA installation appears as a single virtual database (VDB). The scope of an R-GMA VDB is defined by its schema and registry (see Fig 1). There is exactly one registry for the VDB. However, for reasons of resilience and scalability, multiple replicas of the registry can be created for the VDB. The registry holds the details of all producers that are publishing to tables in the VDB, and it also holds the details of continuous consumers who wish to be notified of changes to the list of producers.

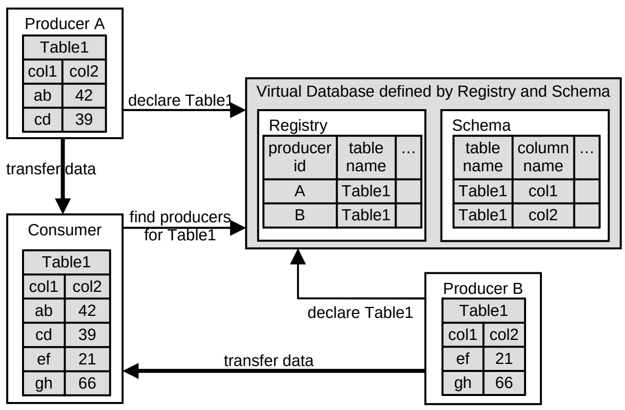

Figure 1: R-GMA, a virtual database

Currently, producers and consumers can only interact with a single VDB. Since creating multiple VDBs is a natural way to create different name spaces, we intend to remove this limitation.

MULTIPLE VIRTUAL DATABASES

Each virtual database has its own registry and schema. In HEP today, an experiment typically has just one Virtual Organisation (VO) but we imagine it would be responsible for one or more virtual databases (VDB). The VDB concept has no direct link with that of the VO except that someone must be responsible for the administration of a VDB, and this responsibility might well be assumed by a VO.

Publishing and Querying Across Virtual Databases

When data are inserted into a producer, the data are published into a specific VDB. It is possible for a producer service to publish to more than one VDB (see Fig 2).

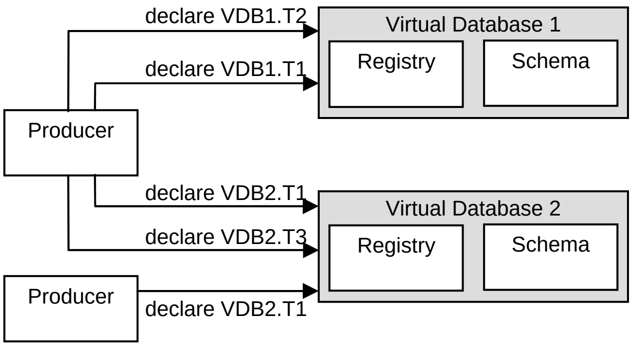

Figure 2: Publishing to multiple virtual databases.

Queries may include data from several VDBs. We use the normal SQL syntax of a database prefix before the table name to specify the VDB. SQL joins across tables in multiple VDBs are supported. In addition a special union syntax has been defined: "SELECT * FROM {VDB1,VDB2}.T" to indicate that the query should be evaluated over the union of the tuples from table T in VDB1 and VDB2 (Fig 3). It requires that the tables T from the two VDBs are identical. The keyword UNION is not used as it would introduce too many other possible queries that are not supported.

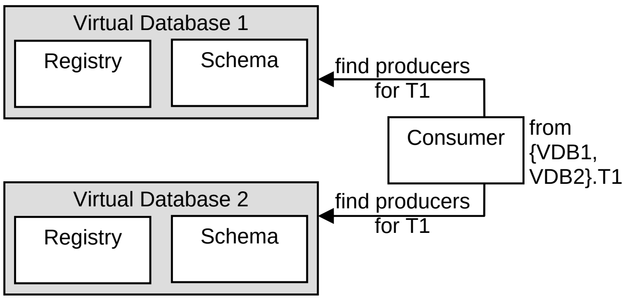

Figure 3: Consuming from multiple virtual databases.

Registry and Schema Services

As stated above there is exactly one registry per VDB and for reasons of resilience and scalability, multiple replicas of the registry can be created for each VDB.

Each replica exists as a registry instance in a registry service (see Fig 4) and a single registry service can host replicas from multiple VDBs. Each instance has its own database on the server and is created by the service at the request of a suitably privileged user. There would be a requirement that a VDB name must be "globally unique" – in fact the real constraint would be that a site would not be able to offer a service to different VDBs with clashing names. The registry service also handles queries for registries that it is not hosting, by locating another registry service that is hosting a working replica of the requested registry and forwarding the query there. In this way, users, producer services and consumer services only ever need to make direct contact with their local registry service.

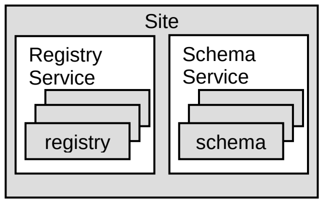

Figure 4: Registry and schema services host multiple virtual databases.

The registry service is responsible for authenticating all users and services that connect to it, and for authorizing all operations and all requests to access the registries it is hosting.

A schema service does the same job for schemas.

The user would need to ensure that the server he was using supported the set of VDBs in which he was interested.

The Need for Common Tables

Some information may be of interest to a large number of VOs, for example the GLUE tables, which holds information on available resources. There would appear to be two ways of handling this. There could be a special VDB defined for resource providers. This could have authorization rules to ensure that only resource owners can publish information about their own resources. Alternatively each VO with an interest in GLUE, which would include all LCG VOs, defines the same table in a VO defined VDB. The resources then publish information to the VDBs of the VOs they serve.

Discovering Virtual Databases

We do not plan to provide any general way to determine what VDBs exist globally as this would imply some kind of global registry of VDBs. If someone wished to use R-GMA to create such a global registry, it would be possible. A VDB could be created with a table or tables where other VDB creators are invited to publish their VDB names and registry and schema endpoints, but this will not be a feature provided by R-GMA.

SUMMARY

R-GMA is a grid information and monitoring system that provides producer, consumer, registry and schema services for use by grid users and other components. It is based on a powerful data model and provides the ability for users to define their own schema and to provide and request information using an API based on a subset of SQL.

Currently R-GMA acts as a single virtual database. We will implement multi-VDB support to make the R-GMA system more scalable to meet the various needs of different VOs.

ACKNOWLEDGMENTS

This work was funded through contributions from the European Commission program INFSO-RI-508833 through the EGEE project and by PPARC through the GridPP program.

REFERENCES

[1] B. Tierney et al. A Grid Monitoring Architecture. http://www-didc.lbl.gov/GGF-PERF/GMA-WG/documents.html, GGF, 2002.
[2] R-GMA. http://www r-gma.org/
[3] JRA1-UK. http://hepunx.rl.ac.uk/egee/jra1-uk/
[4] JRA1-UK. Information and Monitoring Service (R-GMA) System Specification. https://edms.cern.ch/document/490223/, EGEE, 2004.