OGSA Data Replication Services Working Group

GGF8
Wednesday, June 25, 2003

OREP Session at GGF8

- Quick review of group details and charter

- Existing Replica Location Service grid service specification
    - Concerns raised since last meeting

- Toward a More Service-Oriented RLS Design
    - Dataset services
    - ReplicaSet services
    - OGSA Indexes and ServiceGroups

- Discussion of higher-level Replication Services (subscription, consistency, …)
    - Identify those interested

- Follow-on meeting(s) before GGF9

OGSA Data Replication Services Working Group

- **Co-chairs:**
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- **Secretary:**
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- **Web site:**
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- **Mailing list**
  - orep-wg@ggf.org
  - Subscribe by sending email to majordomo@ggf.org with body subscribe orep-wg

Working Group Description
(From Charter)

- The OGSA Data Replication Services Working Group (OREP) is intended to create, review and refine grid service specifications for data replication services. These specifications will conform to the Grid Services Specification being developed by the OGSI Grid Service Infrastructure Working Group.

- Initially, the working group will focus on a specification for Replica Location Services, which maintain and provide information about data location.

Working Group Milestones

- Document: "OGSA Local Replica Catalog Grid Service Specification," first draft submitted at GGF7 in March 2003. Final specification expected in March 2004.

- Document: "OGSA Replica Location Index Grid Service Specification," first draft to be submitted at GGF8 in June 2003. Final specification expected in March 2004.

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- Document: "OGSA Copy and Registration Grid Service Specification," first draft to be submitted at GGF9 in October 2003. Final specification expected June 2004.

- Document: "OGSA Data Subscription Grid Service Specification," first draft to be submitted at GGF9 in October 2003. Final specification expected June 2004.

- Document: "OGSA Data Consistency Service Specification," first draft to be submitted at GGF10 in March 2004.

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# Layered Architecture for Data Replication Services

Consistency Service(s)
(E.g., Subscription-based Consistency Services)

Reliable Replication Services (RRS)
(Copy data reliably and register with RLS)

Replica Location Service (RLS)
(Distributed registry of mappings between
logical names & target names)

Grid Service Specification
for the Replica Location Service

Replica Location Indexes
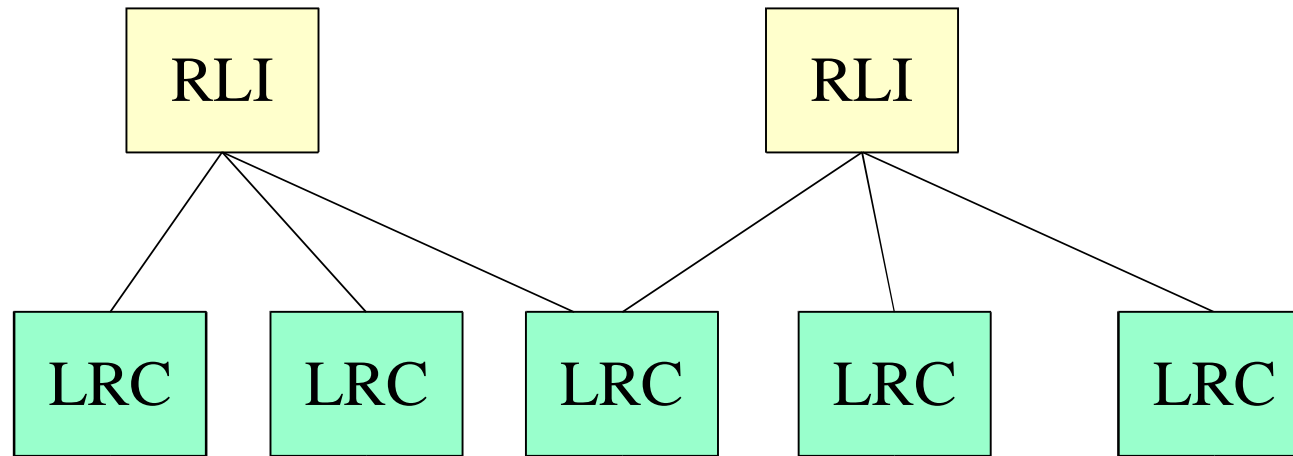
Local Replica Catalogs

- LRCs contain consistent information about logical-to-physical mappings on a site or storage system

- RLIs nodes aggregate information about LRCs

Converting the RLS to a Grid Service

- Actually two grid services:
  - Local Replica Catalog Service
  - Replica Location Index Service

Functions of LRC

- Manipulations (creates, deletes) of logical-name-to-target-name mappings

- Manipulations of user-defined attributes on logical or target names

- Query on mappings or attributes

- Provide soft state updates to subscribing services (e.g., RLI)

Specifying a Grid Service

- Specify Service Data Descriptions
  - Metadata about the LRC service
  - Dynamic data about the state of the service
  - Can use PortType methods to query or subscribe to service data

- Specify PortTypes
  - Collections of methods: operations and messages

- Bindings
  - Specify how the operations and messages previously defined will be transmitted.

LRC Grid Service Specification: Use of Standard Grid Service PortTypes

- **NotificationSource PortType**
  - Implements Subscribe method
  - Allows clients to subscribe to receive notifications of changes in service data state

- **GridService PortType**
  - Implements FindServiceData method
  - Allows querying service data

LRC Grid Service Specification: Additional PortTypes

- **ServiceAdministration PortType**
  - For configuring the LRC service
  - E.g., defining or removing user-defined attributes

- **MappingsAdministration PortType**
  - For creating, deleting mappings and user-defined attributes

- **QueryMappings PortType**
  - For name-based and attribute-based queries of LRC mappings

LRC Grid Service Specification: Subscribing to Soft State Updates

- State information is specified as Service Data Elements (SDEs) of the LRC Grid Service

- Define two types of service data for soft state updates
  - List of logical names
  - Bloom filter summary of LRC state

- A client subscribes to these SDEs using the NotificationSource PortType's *subscribe* method

- Subscription means the client is notified of changes in SDEs

- A service (or an administrator) can subscribe itself (or another service) to soft state updates

Managing RLS Membership

- A distributed Replica Location Service consists of a number of LRC and RLI services

- The RLS should respond to changes in membership (when LRCs or RLIs join the RLS or fail)

- Membership management issues related to LRC:
    - Initiating and configuring subscriptions to LRC soft state updates
    - Deal with changes to subscription characteristics
    - React to subscriber failures

LRC Grid Specification: Simple Approach to Membership Management

- Use the NotificationSource PortType and its **subscribe** method

- Another service (or an administrator) subscribes itself (or another service) to LRC soft state service data elements

- A subscription request causes the creation of a subscription service instance, which can be used by clients to manage the subscription lifetime

- The LRC service continues to send soft state updates to the subscriber until the subscription lifetime expires

Concerns Raised About the Current RLS Grid Service Specification

- **Access control**
  - Insufficient control over who is allowed to create mappings
  - No validity guarantees for mappings

- **Namespace management**
  - Uniqueness of names
  - Support for hierarchical namespaces

- **Interface needs to be more general**
  - Currently too specific to Globus-EDG RLS design/implementation

OREP Session at GGF8

- Quick review of working group formation and charter

- Existing Replica Location Service grid service specification
  - Concerns raised since last meeting

- **Initial Ideas on A More Service-Oriented RLS Design**
  - **Dataset services**
  - **ReplicaSet services**
  - **OGSA Indexes and ServiceGroups**

- Discussion of higher-level Replication Services (subscription, consistency, …)
  - Identify those interested

- Follow-on meeting(s) before GGF9

Treating Datasets as Services

- Would apply to files, file systems, databases,…

- Global names
  - Datasets are uniquely and globally names by Grid Service Handles (GSHs)

- Standard mechanisms for data access, lifetime management, etc.
  - All properties of OGSI-compliant services
  - Implement Grid Service port type
  - Support introspection on service data elements
  - OGSI lifetime management

Initial Thoughts on Moving
Toward a Service-Oriented RLS

1. Grid Service Wrappers around existing RLS

3. LRC Target Names become GSHs

5. Use of general Grid Service indexing mechanisms

7. Name Space Management via a Logical Naming Authority

9. Representing Replica Sets as Services

11. ReplicaSets and/or Indexes Implemented as ServiceGroups

Option 1: Grid Service Wrappers around existing RLS

- Provide Grid service wrappers around existing Local Replica Catalog (LRC) and Replica Location Index (RLI) services

- RLS mappings between logical and target names are independent of the GSHs that name dataset services

- This option is reflected in the first version of the Local Replica Catalog specification

- Advantage: Allows us to use OGSI-compliant mechanisms to access RLS components

- Disadvantage: Does not allow us to take advantage of other OGSA machinery
    - Introspection on dataset service data
    - Subscription, index mechanisms, serviceGroups, etc.

Option 2: LRC Target Names Become GSHs

- Store the GSHs of datasets in the target entries of LRC mappings
  - LRC mappings from logical names to the GSHs that point to replica datasets

- Design of the RLI is unchanged

- Advantage: Allows us to locate datasets that are represented as Grid services

- Disadvantage: Does not allow us to use other OGSA machinery

Option 3: Use of general Grid Service indexing mechanisms

- Replace specialized LRC and RLI indexes with general OGSA index mechanisms
  - E.g., port types and SDEs being developed for use in OGSA information services and elsewhere
  - Information provider sends info to an index service

- A dataset would provide information about itself to an indexing Grid service

- Advantages:
  - Exploit commonalities with other OGSA components
  - Avoid developing separate index service

- Requires acceptable performance from general index services

Option 4: Name Space Management via a Logical Naming Authority

- The logical name associated with a dataset would become a service data element (SDE) of that dataset

- A Logical Naming Authority (LNA) would assert validity of mapping from a logical name to dataset
  - Sign the mapping
  - Any unsigned mapping is considered invalid

- Registration of a new replica mapping requires:
  - A client requests a signed mapping from a LNA with whom the client has a trust relationship
  - Signed mapping is associated with dataset as SDE
  - Signed mapping is registered with an LRC

Option 5: Representing Replica Sets as Services

- The logical names registered in RLS catalogs can be thought of as defining equivalence sets of replicas

- Can represent not only individual datasets but also sets of replicas as Grid services
  - Benefit from the OGSI mechanisms (global names, service data, lifetime management)

- *replicaSet services*

- The GSH for a replicaSet could then be used as the logical name for the replicated dataset

Option 5 (continued)

- Advantage: replicaSet service provides natural point for controlling the registration of new replicas in the equivalence class
  - Effectively serve as Logical Naming Authorities
  - Enforce policies for access control
  - Only allow clients with trust relationship to add new dataset services as members of the equivalence set

- Advantage: replicaSet service can also enforce policies for replica coherence

Option 5 (continued)

- A client may directly inspect a replicaSet
  - Must respond to queries about its service data, including information about its members
  - Replica location functionality

- No longer require the LRC and RLI services of the current RLS design from a functionality perspective
  - Providing such indexes may be useful for performance and reliability reasons
  - Aggregating information about replicaSet services can provide more efficient discovery of replica datasets

Option 6: ReplicaSets and/or Indexes Implemented as ServiceGroups

- Can implement *replicaSet* as a **ServiceGroup**
    - A Grid service that maintains information about a group of other Grid services
    - ServiceGroup entries consist of a locator and content information describing the member service

- Advantage: Make use of ongoing development of Service Group port types
    - Including add and remove methods of the ServiceGroupRegistration port type

- Can also implement LRC/RLI catalogs as ServiceGroups

Next Steps for Replica Location Service

- Define dataset service
    - In cooperation with DAIS WG, OGSI WG, others?
    - Produce a data model and grid service specification, including service data elements and port types

- Define replicaSet service
    - Including their service data elements and port types
    - Determine whether to implement as ServiceGroup

- Produce grid service specification for RLS index service
    - Based on OGSA indexing mechanisms
    - Determine whether to implement as ServiceGroup

- Follow-on meetings before GGF9

Next Steps for Higher-Level Replication Services (Subscription, Consistency,…)

- Identify those interested in specifying a general replication service

- Follow-on meetings between now and GGF9 to produce a draft grid service specification

Discussion

- Proposed follow-on meetings:
  - Week of July 28th
  - Week of September 8th

- Location of meetings

- Changes to milestones/goals of group?