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GLUE v. 2.0 – Reference Realization to XML Schema

Status of This Document

This document provides information to the Grid community regarding the realization of the GLUE information model (v.2.0) as XML Schema. Distribution is unlimited. The realizations are derived from the specification document version 42 as available in the GLUE Working Group document repository.

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Abstract

The GLUE specification is an information model for Grid entities described in natural language enriched with a graphical representation using UML Class Diagrams. This document presents a realization of this information model as XML Schema.

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1. Introduction

The GLUE 2.0 Information model defined in [glue-2] is a conceptual model of Grid entities. In order to be adopted by Grid middlewares, a realization in terms of a concrete data model is needed.

This document provides the normative realization of the GLUE 2.0 conceptual model in terms of an XML Schema. The approach followed to map the entities and relationships in the conceptual model to the concrete data model are also described.

2. Notational Conventions

The key words 'MUST,' "MUST NOT," "REQUIRED," "SHALL," "SHALL NOT," "SHOULD," "SHOULD NOT," "RECOMMENDED," "MAY," and "OPTIONAL" are to be interpreted as described in RFC 2119 (see <http://www.ietf.org/rfc/rfc2119.txt>).

3. XML Schema Realization

3.1 Approach

There are many approaches to realize the GLUE conceptual model as an XML Schema. Depending on the aspects that are privileged, a different realization occurs. In this work, we decided to facilitate the writing queries.

3.1.1 Elements vs. Attributes

When defining data types in an XML Schema, two main options are available. A data can be described in term of an XML Element or an XML Attribute. Each class modeled in the conceptual model maps into an XML Element definition. Each attribute of a class in the conceptual model maps into an XML Attribute definition (this is a general rule and applies also to both ID and LocalID attributes). Exception is made for the attributes CreationTime and Validity of the Entity class. Since they can be considered as metadata about GLUE-based description of entities, they are modeled as XML attributes.

The multi-value properties of a class defined in the conceptual model are represented by using a separate XML element for each value.

Timestamp-related properties are modeled using the xsd:dateTime simple type. Every timestamp MUST be expressed using GMT Timezone: yyyy '-' mm '-' dd 'T' hh ':' mm ':' ss Z.

3.1.2 Namespace

The Open Grid Forum published a document with guidelines for identifying names uniquely and uniform in the GGF/OGF domain [ogf-ns]. Based on this document, we propose the following namespace for the XML Schema realization of GLUE 2.0:

GLUE-XSD-NS ::= 'http://schemas.ogf.org/glue/' YYYY '/' MM '/spec_2.0' ['_d' DD]? ('_r' RR)

- YYYY: year of the normative document of the GLUE 2.0 specification
- MM: month of the normative document of the GLUE 2.0 specification

- `_dDD`: optional component to be used for XSD realization of the draft specification of GLUE 2.0; DD is the number of the draft
- `_rRR`: component to be used to specify the revision number of the XSD realization; this number is relative to each conceptual model and should be increased every time that a new non-backwards compatible version is published

As a non-normative example, the namespace for the first release of the XSD realizing the GLUE 2.0 specification draft 42 is:

http://schemas.ogf.org/glue/2008/05/spec_2.0_d42_r01

3.1.3 Enumerations

In the GLUE specification, among the property types, several enumerations are defined. They belong to two main categories: closed enumerations and open enumerations.

In a closed enumeration, a list of values is defined. The value of the property **MUST** belongs to the set of defined values

In an open enumeration, a list of values is defined. The value of the property **MAY** belongs to the set of defined values. The main goal of the open enumeration is to offer a not complete list of values among which to choose. They also provide hints on how new values can be defined.

As regards the XSD realization, a closed enumeration can be modeled by restriction on a string base type. By using the element `<enumeration>`, each value can be defined. An element which type is a restricted string type in terms of a set of values is valid if and only if the value matches one of those defined. In the following XSD fragment, we show the definition of the enumeration of for the `Endpoint.HealthState` attribute:

```
<simpleType name="EndpointHealthState_t">
  <restriction base="string">
    <enumeration value="ok"/>
    <enumeration value="warning"/>
    <enumeration value="critical"/>
    <enumeration value="unknown"/>
    <enumeration value="other"/>
  </restriction>
</simpleType>
```

Concerning the open enumeration, the natural approach would be to use the `union` capability of XSD [xsd-oe, xsd-ap]. Unfortunately, this is not well supported in current implementations, therefore we decide to model them by using the `annotation` element; each enumeration value is represented by an `appinfo` sub-element. A software validating an XML document according to the defined XSD for GLUE 2 **SHOULD** be instrumented in order to consider these values. In the following XSD fragment, we show the definition of the open enumeration for the `ComputingEndpoint.Staging` attribute:

```
<simpleType name="Staging_t">
  <restriction base="string">
    <annotation>
      <appinfo>
        <enumeration value="none"/>
        <enumeration value="stagingin"/>
        <enumeration value="stagingout"/>
        <enumeration value="staginginout"/>
      </appinfo>
    </annotation>
  </restriction>
</simpleType>
```

3.1.4 Associations

In the conceptual model, several associations are represented. They can be classified in terms of the multiplicity (one-to-one, one-to-many, many-to-many), in terms of the navigability (directed, undirected) or in terms of the association type (binary, aggregation, composition, association class).

We propose realizations of the associations in XSD as follows:

- one-to-one: modeled by parent-child relationships
 - e.g.: an AdminDomain class has a directed association to a Location class; this is represented as an AdminDomain element having a child Location element
- one-to-many: modeled by parent-child relationships; the “one” is the parent, while the “many” are the children
 - e.g.: an Service class has a one-to-many association to an Endpoint class; this is represented as a Service element having zero or more child Endpoint elements
 - if the class participating in the “many” side of the relationship has other associations, then the relationship is modeled using the many-to-many approach (see the relationship among ComputingActivity and ComputingEndpoint)
- many-to-many: for each class instance involved in the association, the ‘association end’ (i.e., identifier of the class instance that participates in the association in the other side) is represented as a sub-element; each set of ‘association end’ elements are grouped by an Associations element.
 - e.g.: a ComputingEndpoint class has a many-to-many association to a ComputingShare class; this is represented as follows

```
<ComputingEndpoint>
  <ID>urn:myendpoint</ID>
  <Associations>
    <ComputingShareLocalID>share_id1</ComputingShareLocalID>
    <ComputingShareLocalID>share_id2</ComputingShareLocalID>
    ...
    <ComputingActivityID>urn:mycompact_1</ComputingActivityID>
  </Associations>
</ComputingEndpoint>
<ComputingShare>
  <LocalID>share_id1</LocalID>
  <Associations>
    <ComputingEndpointID>urn:myendpoint</ComputingEndpointID>
    ...
  </Associations>
</ComputingShare>
```

Notice that the Associations element groups all the ‘association ends’ of the related class instance.

An exception to the above rules is made for the association between the AccessPolicy/MappingPolicy with the UserDomain. Since the Policy entities contain the Rule property which implicitly identify the UserDomains to which they apply, the association between UserDomain and Policy entities is not explicitly represented. The association between AccessPolicy and Endpoint and between MappingPolicy and Share fall in the category of one-to-many relationship and are represented according to the rules above.

3.1.5 XML Document Structure

Each XML document valid with respect to the GLUE 2.0 XSD realization MUST have Domains as root element.

```
<glue:Domains
  xmlns:glue=" http://schemas.ogf.org/glue/2008/05/spec_2.0_d41_r01"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://schemas.ogf.org/glue/2008/05/spec_2.0_d41_r01 path/to/GLUE2.xsd">
  ...
</glue:Domains>
```

The children elements of the root element can be either `AdminDomain` or `UserDomain`.

In order to enable a potential client to query each type of source for information with the same query, we decide to have a fixed document structure that MUST be always used. A fixed structure is enforced by the XSD, that means it is not possible to validate just an XML fragment representing a `Service`. The ancestors `AdminDomain` and `glue:Domains` must be present as well as their mandatory elements. In the following XML document, we present a simple example of the XML document structure:

```
<glue:Domains>
  <AdminDomain>
    <ID>A</ID>
    <Services>
      <Service>
        <ID>urn:myservice1</ID>
        ...
      </Service>
      <Service>
        <ID>urn:myservice2</ID>
        ...
      </Service>
    </Services>
  </AdminDomain>
  ...
  <UserDomain>
    ...
  </UserDomain>
  ...
</glue:Domains>
```

The XML document of GLUE 2.0 related information can be published by many sources and aggregated by intermediate services. The primary sources may not know all the values for all the attributes (e.g., an OGSA-BES service may not know the ID of the `AdminDomain` to which it belongs to). In these cases, the mandatory attributes MUST be published with the UNKNOWN placeholder. High-level aggregator services will perform the merge and will complete the missing information.

3.1.6 Grouping

For elements which can have siblings of the same type in the order of $O(10)$, we decide to introduce grouping elements.

For instance, an `AdminDomain` can contain tens of services, therefore we introduce the `Services` element (see above XML Document Structure).

The current XML Schema realization defines the following grouping elements:

- `Services`
- `Activities`
- `ComputingShares`
- `ComputingActivities`
- `StorageShares`
- `ApplicationEnvironments`
- `Extensions`
- `Associations`

3.1.7 Inheritance

In the GLUE conceptual model, there are concepts which derive from other concepts by specialization. For instance both the `ComputingService` and the `StorageService` inherit from the `Service` class. In order to enable to query by the super-class, for all XML elements which represent classes involved in a generalization/specialization, we introduce an XML attribute called `BaseType` which value is fixed and equals to the name of the super-class.

For instance, both `ComputingService` and `StorageService` are a specialization of a `Service`; the elements representing them will have the `BaseType` attribute equals to `Service`. See the following example:

```
<glue:Domains>
  <AdminDomain>
    <ID>A</ID>
    <Services>
      <Service BaseType="Service">
        <ID>urn:myservice1</ID>
        ...
      </Service>
      <ComputingService BaseType="Service">
        <ID>urn:myservice2</ID>
        ...
      </ComputingService>
      <StorageService BaseType="Service">
        <ID>urn:myservice3</ID>
        ...
      </StorageService>
    </Services>
  </AdminDomain>
  ...
</glue:Domains>
```

3.1.8 Extensibility

The GLUE conceptual model defines two main “hooks” for extending the current modeled concepts and properties: the `Extension` class and the `OtherInfo` property.

Each class can be associated to instances of the `Extension` class, which carries key,value pairs. For instance, given the `ExecutionEnvironment` class, if there is the need to advertise the property “GPUModel” and “CoreLib” which are not captured by the conceptual model, this can be achieved as follows:

```
...
<ExecutionEnvironment BaseType="Resource">
  <ID>urn:myexecenv1</ID>
  ...
  <Extensions>
    <Extention Key="GPUModel">GeForge 7</Extention>
    <Extention Key="CoreLib">glibc:3.4.9</Extention>
    <Extention Key="CoreLib">libthread:2.4</Extention>
    <Extention Key="CoreLib">libpam:0.81</Extention>
  </Extensions>
</ExecutionEnvironment>
```

Some class has the property “OtherInfo” which type is string and multiplicity is multi-value. This can be used to advertise a flat list of values.

The above extension hooks are defined in the conceptual model. At the XSD level, there is the possibility of adding hooks for extensibility based on a flexible mechanism that enables content models to be extended by any elements and attributes belonging to specified namespaces. We refer to the `lax` value for the `processContent` attribute of an `xsd:any` element definition. This

option is currently not adopted. It MAY be added in a future release of the realization upon request from the community.

3.2 The Normative XML Schema Realization of GLUE 2.0

```
<?xml version="1.0" encoding="UTF-8"?>

<schema targetNamespace="http://schemas.ogf.org/glue/2008/05/spec_2.0_d42_r01"
  xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:glue="http://schemas.ogf.org/glue/2008/05/spec_2.0_d42_r01">

  <!-- BEGIN MAIN ENTITIES -->
  <complexType name="Entity">
    <attribute name="CreationTime" type="dateTime"/>
    <attribute name="Validity" type="unsignedLong"/>
  </complexType>

  <complexType name="Extension_t">
    <simpleContent>
      <extension base="string">
        <attribute name="Key" type="string"/>
      </extension>
    </simpleContent>
  </complexType>

  <complexType name="Extensions_t">
    <sequence>
      <element name="Extension" type="glue:Extension_t" minOccurs="0" maxOccurs="unbounded"/>
    </sequence>
  </complexType>

  <element name="Domains" type="glue:Domains_t"/>

  <complexType name="Domains_t">
    <complexContent>
      <extension base="glue:Entity">
        <sequence>
          <element name="AdminDomain" type="glue:AdminDomain_t" minOccurs="0" maxOccurs="unbounded"/>
          <element name="UserDomain" type="glue:UserDomain_t" minOccurs="0" maxOccurs="unbounded"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>

  <complexType name="Location_t">
    <complexContent>
      <extension base="glue:Entity">
        <sequence>
          <element name="LocalID" type="glue:LocalID_t"/>
          <element name="Name" type="string"/>
          <element name="Address" type="string" minOccurs="0"/>
          <element name="Place" type="string" minOccurs="0"/>
          <element name="Country" type="string" minOccurs="0"/>
          <element name="PostCode" type="string" minOccurs="0"/>
          <element name="Latitude" type="glue:Latitude_t" minOccurs="0"/>
          <element name="Longitude" type="glue:Longitude_t" minOccurs="0"/>
          <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>

  <complexType name="Contact_t">
    <complexContent>
      <extension base="glue:Entity">
        <sequence>
          <element name="LocalID" type="glue:LocalID_t"/>
          <element name="URL" type="anyURI"/>
          <element name="Type" type="string">
            <annotation>
              <appinfo>general</appinfo>
              <appinfo>usersupport</appinfo>
              <appinfo>sysadmin</appinfo>
            </annotation>
          </element>
          <element name="OtherInfo" type="string" minOccurs="0" maxOccurs="unbounded"/>
          <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>


```



```

    </complexContent>
  </complexType>

  <complexType abstract="true" name="Domain_t">
    <complexContent>
      <extension base="glue:Entity">
        <sequence>
          <element name="ID" type="glue:ID_t"/>
          <element name="Name" type="string" minOccurs="0"/>
          <element name="Description" type="string" minOccurs="0"/>
          <element name="WWW" type="anyURI" minOccurs="0" maxOccurs="unbounded"/>
          <element name="OtherInfo" type="string" minOccurs="0" maxOccurs="unbounded"/>
        </sequence>
        <attribute name="BaseType" fixed="Domain" use="required"/>
      </extension>
    </complexContent>
  </complexType>

  <complexType name="AdminDomain_t">
    <complexContent>
      <extension base="glue:Domain_t">
        <sequence>
          <element name="Distributed" type="boolean" minOccurs="0"/>
          <element name="Owner" type="string" minOccurs="0" maxOccurs="unbounded"/>
          <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
          <element name="Location" type="glue:Location_t" minOccurs="0"/>
          <element name="Contact" type="glue:Contact_t" minOccurs="0" maxOccurs="unbounded"/>
          <element name="Services" minOccurs="0">
            <complexType>
              <sequence>
                <element name="Service" type="glue:Service_t" minOccurs="0" maxOccurs="unbounded"/>
                <element name="ComputingService" type="glue:ComputingService_t" minOccurs="0" maxOccurs="unbounded"/>
                <element name="StorageService" type="glue:StorageService_t" minOccurs="0" maxOccurs="unbounded"/>
              </sequence>
            </complexType>
          </element>
          <element name="Associations" minOccurs="0">
            <complexType>
              <sequence>
                <element name="AdminDomainID" type="glue:ID_t" minOccurs="0" maxOccurs="unbounded"/>
              </sequence>
            </complexType>
          </element>
        </sequence>
      </extension>
    </complexContent>
  </complexType>

  <complexType name="UserDomain_t">
    <complexContent>
      <extension base="glue:Domain_t">
        <sequence>
          <element name="Level" type="unsignedInt" minOccurs="0"/>
          <element name="UserManager" type="anyURI" minOccurs="0"/>
          <element name="Member" type="string" minOccurs="0" maxOccurs="unbounded"/>
          <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
          <element name="Associations" minOccurs="0">
            <complexType>
              <sequence>
                <element name="UserDomainID" type="glue:ID_t" minOccurs="0" maxOccurs="unbounded"/>
              </sequence>
            </complexType>
          </element>
        </sequence>
      </extension>
    </complexContent>
  </complexType>

  <complexType name="ServiceProperties_t">
    <complexContent>
      <extension base="glue:Entity">
        <sequence>
          <element name="ID" type="glue:ID_t"/>
          <element name="Name" type="string" minOccurs="0"/>
          <element name="Capability" type="glue:Capability_t" minOccurs="0" maxOccurs="unbounded"/>
          <element name="Type" type="glue:ServiceType_t"/>
          <element name="QualityLevel" type="glue:QualityLevel_t"/>
          <element name="StatusPage" type="anyURI" minOccurs="0" maxOccurs="unbounded"/>
          <element name="Complexity" type="string" minOccurs="0"/>
        </sequence>
      </extension>
    </complexContent>
  </complexType>

```

```

        <element name="OtherInfo" type="string" minOccurs="0" maxOccurs="unbounded"/>
      </sequence>
      <attribute name="BaseType" fixed="Service" use="required"/>
    </extension>
  </complexContent>
</complexType>

<complexType name="Service_t">
  <complexContent>
    <extension base="glue:ServiceProperties_t">
      <sequence>
        <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
        <element name="Location" type="glue:Location_t" minOccurs="0"/>
        <element name="Contact" type="glue:Contact_t" minOccurs="0" maxOccurs="unbounded"/>
        <element name="Endpoint" type="glue:Endpoint_t" minOccurs="0" maxOccurs="unbounded"/>
        <element name="Activities" minOccurs="0">
          <complexType>
            <sequence>
              <element name="Activity" type="glue:Activity_t" minOccurs="0" maxOccurs="unbounded"/>
            </sequence>
          </complexType>
        </element>
        <element name="Associations" minOccurs="0">
          <complexType>
            <sequence>
              <element name="ServiceID" type="glue:ID_t" minOccurs="0" maxOccurs="unbounded"/>
            </sequence>
          </complexType>
        </element>
      </sequence>
    </extension>
  </complexContent>
</complexType>

<complexType name="EndpointProperties_t">
  <complexContent>
    <extension base="glue:Entity">
      <sequence>
        <element name="ID" type="glue:ID_t"/>
        <element name="Name" type="string" minOccurs="0"/>
        <element name="URL" type="anyURI"/>
        <element name="Capability" type="glue:Capability_t" minOccurs="0" maxOccurs="unbounded"/>
        <element name="Technology" type="glue:EndpointTechnology_t"/>
        <element name="Interface" type="anyURI" minOccurs="0"/>
        <element name="InterfaceExtension" type="anyURI" minOccurs="0" maxOccurs="unbounded"/>
        <element name="WSDL" type="anyURI" minOccurs="0" maxOccurs="unbounded"/>
        <element name="SupportedProfile" type="anyURI" minOccurs="0" maxOccurs="unbounded"/>
        <element name="Semantics" type="anyURI" minOccurs="0" maxOccurs="unbounded"/>
        <element name="Implementor" type="string" minOccurs="0"/>
        <element name="ImplementationName" type="string" minOccurs="0"/>
        <element name="ImplementationVersion" type="string" minOccurs="0"/>
        <element name="QualityLevel" type="glue:QualityLevel_t"/>
        <element name="HealthState" type="glue:EndpointHealthState_t"/>
        <element name="HealthStateInfo" type="string" minOccurs="0"/>
        <element name="ServingState" type="glue:ServingState_t"/>
        <element name="StartTime" type="dateTime" minOccurs="0"/>
        <element name="IssuerCA" type="glue:DN_t" minOccurs="0"/>
        <element name="TrustedCA" type="glue:DN_t" minOccurs="0" maxOccurs="unbounded"/>
        <element name="DowntimeAnnounce" type="dateTime" minOccurs="0"/>
        <element name="DowntimeStart" type="dateTime" minOccurs="0"/>
        <element name="DowntimeEnd" type="dateTime" minOccurs="0"/>
        <element name="DowntimeInfo" type="string" minOccurs="0" maxOccurs="unbounded"/>
      </sequence>
      <attribute name="BaseType" fixed="Endpoint" use="required"/>
    </extension>
  </complexContent>
</complexType>

<complexType name="Endpoint_t">
  <complexContent>
    <extension base="glue:EndpointProperties_t">
      <sequence>
        <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
        <element name="AccessPolicy" type="glue:AccessPolicy_t" minOccurs="0" maxOccurs="unbounded"/>
        <element name="Associations" minOccurs="0">
          <complexType>
            <sequence>
              <element name="ActivityID" type="glue:ID_t" minOccurs="0" maxOccurs="unbounded"/>
            </sequence>
          </complexType>
        </element>
      </sequence>
    </extension>
  </complexContent>
</complexType>

```

```

        </complexType>
      </element>
    </sequence>
  </extension>
</complexContent>
</complexType>

<complexType abstract="true" name="Share_t">
  <complexContent>
    <extension base="glue:Entity">
      <sequence>
        <element name="LocalID" type="glue:LocalID_t"/>
        <element name="Name" type="string" minOccurs="0"/>
        <element name="Description" type="string" minOccurs="0"/>
      </sequence>
      <attribute name="BaseType" fixed="Share" use="required"/>
    </extension>
  </complexContent>
</complexType>

<complexType abstract="true" name="Manager_t">
  <complexContent>
    <extension base="glue:Entity">
      <sequence>
        <element name="ID" type="glue:ID_t"/>
        <element name="Name" type="string" minOccurs="0"/>
      </sequence>
      <attribute name="BaseType" fixed="Manager" use="required"/>
    </extension>
  </complexContent>
</complexType>

<complexType abstract="true" name="Resource_t">
  <complexContent>
    <extension base="glue:Entity">
      <sequence>
        <element name="ID" type="glue:ID_t"/>
        <element name="Name" type="string" minOccurs="0"/>
      </sequence>
      <attribute name="BaseType" fixed="Resource" use="required"/>
    </extension>
  </complexContent>
</complexType>

<complexType name="ActivityProperties_t">
  <complexContent>
    <extension base="glue:Entity">
      <sequence>
        <element name="ID" type="glue:ID_t"/>
      </sequence>
      <attribute name="BaseType" fixed="Activity" use="required"/>
    </extension>
  </complexContent>
</complexType>

<complexType name="Activity_t">
  <complexContent>
    <extension base="glue:ActivityProperties_t">
      <sequence>
        <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
        <element name="Associations" minOccurs="0">
          <complexType>
            <sequence>
              <element name="EndpointID" type="glue:ID_t" minOccurs="0" maxOccurs="unbounded"/>
              <element name="UserDomainID" type="glue:ID_t" minOccurs="0" maxOccurs="unbounded"/>
              <element name="ActivityID" type="glue:ID_t" minOccurs="0" maxOccurs="unbounded"/>
            </sequence>
          </complexType>
        </element>
      </sequence>
    </extension>
  </complexContent>
</complexType>

<complexType abstract="true" name="Policy_t">
  <complexContent>
    <extension base="glue:Entity">
      <sequence>
        <element name="LocalID" type="glue:LocalID_t"/>
        <element name="Scheme" type="glue:PolicyScheme_t"/>
        <element name="Rule" type="glue:PolicyRule_t" minOccurs="1" maxOccurs="unbounded"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>

```

```

        </sequence>
        <attribute name="BaseType" fixed="Policy" use="required"/>
    </extension>
</complexContent>
</complexType>

<complexType name="AccessPolicy_t">
    <complexContent>
        <extension base="glue:Policy_t"/>
    </complexContent>
</complexType>

<complexType name="MappingPolicy_t">
    <complexContent>
        <extension base="glue:Policy_t"> </extension>
    </complexContent>
</complexType>
<!-- END MAIN ENTITIES -->

<!-- BEGIN COMPUTING ENTITIES -->
<complexType name="ComputingService_t">
    <complexContent>
        <extension base="glue:ServiceProperties_t">
            <sequence>
                <element name="TotalJobs" type="unsignedInt" minOccurs="0"/>
                <element name="RunningJobs" type="unsignedInt" minOccurs="0"/>
                <element name="WaitingJobs" type="unsignedInt" minOccurs="0"/>
                <element name="StagingJobs" type="unsignedInt" minOccurs="0"/>
                <element name="SuspendedJobs" type="unsignedInt" minOccurs="0"/>
                <element name="PreLRMSWaitingJobs" type="unsignedInt" minOccurs="0"/>
                <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
                <element name="Location" type="glue:Location_t" minOccurs="0"/>
                <element name="Contact" type="glue:Contact_t" minOccurs="0" maxOccurs="unbounded"/>
                <element name="ComputingEndpoint" type="glue:ComputingEndpoint_t" minOccurs="0"
                    maxOccurs="unbounded"/>
                <element name="ComputingShares" minOccurs="0">
                    <complexType>
                        <sequence>
                            <element name="ComputingShare" type="glue:ComputingShare_t" minOccurs="0"
                                maxOccurs="unbounded"/>
                        </sequence>
                    </complexType>
                </element>
                <element name="ComputingManager" type="glue:ComputingManager_t" minOccurs="0"
                    maxOccurs="unbounded"/>
                <element name="ToStorageService" type="glue:ToStorageService_t" minOccurs="0"
                    maxOccurs="unbounded"/>
                <element name="ComputingActivities" minOccurs="0">
                    <complexType>
                        <sequence>
                            <element name="ComputingActivity" type="glue:ComputingActivity_t" minOccurs="0"
                                maxOccurs="unbounded"/>
                        </sequence>
                    </complexType>
                </element>
                <element name="Associations" minOccurs="0">
                    <complexType>
                        <sequence>
                            <element name="ServiceID" type="glue:ID_t" minOccurs="0" maxOccurs="unbounded"/>
                        </sequence>
                    </complexType>
                </element>
            </sequence>
        </extension>
    </complexContent>
</complexType>

<complexType name="ComputingEndpoint_t">
    <complexContent>
        <extension base="glue:EndpointProperties_t">
            <sequence>
                <element name="Staging" type="glue:Staging_t" minOccurs="0"/>
                <element name="JobDescription" type="glue:JobDescription_t" minOccurs="0"
                    maxOccurs="unbounded"/>
                <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
                <element name="AccessPolicy" type="glue:AccessPolicy_t" minOccurs="0"
                    maxOccurs="unbounded"/>
                <element name="Associations" minOccurs="0">
                    <complexType>

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        <sequence>
          <element name="ComputingShareLocalID" type="string" minOccurs="0"
            maxOccurs="unbounded"/>
          <element name="ComputingActivityID" type="glue:ID_t" minOccurs="0"
            maxOccurs="unbounded"/>
        </sequence>
      </complexType>
    </element>
  </sequence>
</extension>
</complexContent>
</complexType>

<complexType name="ComputingShare_t">
  <complexContent>
    <extension base="glue:Share_t">
      <sequence>
        <element name="MappingQueue" type="string" minOccurs="0"/>
        <element name="MaxWallTime" type="unsignedLong" minOccurs="0"/>
        <element name="MaxTotalWallTime" type="unsignedLong" minOccurs="0"/>
        <element name="MinWallTime" type="unsignedLong" minOccurs="0"/>
        <element name="DefaultWallTime" type="unsignedLong" minOccurs="0"/>
        <element name="MaxCPUTime" type="unsignedLong" minOccurs="0"/>
        <element name="MaxTotalCPUTime" type="unsignedLong" minOccurs="0"/>
        <element name="MaxCPUsTime" type="unsignedLong" minOccurs="0"/>
        <element name="MinCPUTime" type="unsignedLong" minOccurs="0"/>
        <element name="DefaultCPUTime" type="unsignedLong" minOccurs="0"/>
        <element name="MaxTotalJobs" type="unsignedInt" minOccurs="0"/>
        <element name="MaxRunningJobs" type="unsignedInt" minOccurs="0"/>
        <element name="MaxWaitingJobs" type="unsignedInt" minOccurs="0"/>
        <element name="MaxPreLRMSWaitingJobs" type="unsignedInt" minOccurs="0"/>
        <element name="MaxUserRunningJobs" type="unsignedInt" minOccurs="0"/>
        <element name="MaxSlotsPerJob" type="unsignedInt" minOccurs="0"/>
        <element name="MaxStateInStreams" type="unsignedInt" minOccurs="0"/>
        <element name="MaxStageOutStreams" type="unsignedInt" minOccurs="0"/>
        <element name="SchedulingPolicy" type="glue:SchedulingPolicy_t" minOccurs="0"/>
        <element name="MaxMemory" type="unsignedLong" minOccurs="0"/>
        <element name="MaxDiskSpace" type="unsignedLong" minOccurs="0"/>
        <element name="DefaultStorageService" type="anyURI" minOccurs="0"/>
        <element name="Preemption" type="boolean" minOccurs="0"/>
        <element name="ServingState" type="glue:ServingState_t"/>
        <element name="TotalJobs" type="unsignedInt" minOccurs="0"/>
        <element name="RunningJobs" type="unsignedInt" minOccurs="0"/>
        <element name="LocalRunningJobs" type="unsignedInt" minOccurs="0"/>
        <element name="WaitingJobs" type="unsignedInt" minOccurs="0"/>
        <element name="LocalWaitingJobs" type="unsignedInt" minOccurs="0"/>
        <element name="StagingJobs" type="unsignedInt" minOccurs="0"/>
        <element name="SuspendedJobs" type="unsignedInt" minOccurs="0"/>
        <element name="PreLRMSWaitingJobs" type="unsignedInt" minOccurs="0"/>
        <element name="EstimatedAverageWaitingTime" type="unsignedLong" minOccurs="0"/>
        <element name="EstimatedWorstWaitingTime" type="unsignedLong" minOccurs="0"/>
        <element name="FreeSlots" type="unsignedInt" minOccurs="0"/>
        <element name="FreeSlotsWithDuration" type="string" minOccurs="0"/>
        <element name="UsedSlots" type="unsignedInt" minOccurs="0"/>
        <element name="RequestedSlots" type="unsignedInt" minOccurs="0"/>
        <element name="ReservationPolicy" type="glue:ReservationPolicy_t" minOccurs="0"/>
        <element name="Tag" type="string" minOccurs="0" maxOccurs="unbounded"/>
        <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
        <element name="Associations" minOccurs="0">
          <complexType>
            <sequence>
              <element name="ComputingEndpointID" type="string" minOccurs="0"
                maxOccurs="unbounded"/>
              <element name="ExecutionEnvironmentLocalID" type="string" minOccurs="0"
                maxOccurs="unbounded"/>
              <element name="ComputingActivityID" type="glue:ID_t" minOccurs="0"
                maxOccurs="unbounded"/>
            </sequence>
          </complexType>
        </element>
      </sequence>
    </extension>
  </complexContent>
</complexType>

<complexType name="ComputingManager_t">
  <complexContent>
    <extension base="glue:Manager_t">
      <sequence>
        <element name="Type" type="glue:ComputingManagerType_t" minOccurs="0"/>
        <element name="Version" type="string" minOccurs="0"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>

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<element name="Reservation" type="boolean" minOccurs="0"/>
<element name="BulkSubmission" type="boolean" minOccurs="0"/>
<element name="TotalPhysicalCPUs" type="unsignedInt" minOccurs="0"/>
<element name="TotalLogicalCPUs" type="unsignedInt" minOccurs="0"/>
<element name="TotalSlots" type="unsignedInt" minOccurs="0"/>
<element name="SlotsUsedByLocalJobs" type="unsignedInt" minOccurs="0"/>
<element name="SlotsUsedByGridJobs" type="unsignedInt" minOccurs="0"/>
<element name="Homogeneity" type="boolean" minOccurs="0"/>
<element name="NetworkInfo" type="glue:NetworkInfo_t" minOccurs="0"/>
<element name="LogicalCPUDistribution" type="string" minOccurs="0"/>
<element name="WorkignAreaShared" type="boolean" minOccurs="0"/>
<element name="WorkignAreaTotal" type="unsignedLong" minOccurs="0"/>
<element name="WorkingAreaFree" type="unsignedLong" minOccurs="0"/>
<element name="WorkingAreaLifeTime" type="unsignedLong" minOccurs="0"/>
<element name="CacheTotal" type="unsignedLong" minOccurs="0"/>
<element name="CacheFree" type="unsignedLong" minOccurs="0"/>
<element name="TmpDir" type="string" minOccurs="0"/>
<element name="ScratchDir" type="string" minOccurs="0"/>
<element name="ApplicationDir" type="string" minOccurs="0"/>
<element name="OtherInfo" type="string" minOccurs="0"/>
<element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
<element name="Benchmark" type="glue:Benchmark_t" minOccurs="0" maxOccurs="unbounded"/>
<element name="ExecutionEnvironment" type="glue:ExecutionEnvironment_t" minOccurs="0"
  maxOccurs="unbounded"/>
<element name="ApplicationEnvironments" minOccurs="0">
  <complexType>
    <sequence>
      <element name="ApplicationEnvironment" type="glue:ApplicationEnvironment_t"
        minOccurs="0" maxOccurs="unbounded"/>
    </sequence>
  </complexType>
</element>
</sequence>
</extension>
</complexContent>
</complexType>

<complexType name="Benchmark_t">
  <sequence>
    <element name="LocalID" type="glue:LocalID_t"/>
    <element name="Type" type="glue:BenchmarkType_t"/>
    <element name="Value" type="int"/>
  </sequence>
</complexType>

<complexType name="ExecutionEnvironment_t">
  <complexContent>
    <extension base="glue:Resource_t">
      <sequence>
        <element name="Platform" type="glue:Platform_t"/>
        <element name="VirtualMachine" type="boolean" minOccurs="0"/>
        <element name="TotalInstances" type="unsignedInt" minOccurs="0"/>
        <element name="UsedInstances" type="unsignedInt" minOccurs="0"/>
        <element name="UnavailableInstances" type="unsignedInt" minOccurs="0"/>
        <element name="PhysicalCPUs" type="unsignedInt" minOccurs="0"/>
        <element name="LogicalCPUs" type="unsignedInt" minOccurs="0"/>
        <element name="CPUMultiplicity" type="glue:CPUMultiplicity_t" minOccurs="0"/>
        <element name="CPUVendor" type="string" minOccurs="0"/>
        <element name="CPUModel" type="string" minOccurs="0"/>
        <element name="CPUVersion" type="string" minOccurs="0"/>
        <element name="CPUClockSpeed" type="unsignedInt" minOccurs="0"/>
        <element name="CPUTimeScalingFactor" type="float" minOccurs="0"/>
        <element name="WallTimeScalingFactor" type="float" minOccurs="0"/>
        <element name="MainMemorySize" type="unsignedLong" minOccurs="0"/>
        <element name="VirtualMemorySize" type="unsignedLong" minOccurs="0"/>
        <element name="OSFamily" type="glue:OSFamily_t" minOccurs="0"/>
        <element name="OSName" type="glue:OSName_t" minOccurs="0"/>
        <element name="OSVersion" type="string" minOccurs="0"/>
        <element name="ConnectivityIn" type="boolean" minOccurs="0"/>
        <element name="ConnectivityOut" type="boolean" minOccurs="0"/>
        <element name="NetworkInfo" type="glue:NetworkInfo_t" minOccurs="0"/>
        <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
        <element name="Benchmark" type="glue:Benchmark_t" minOccurs="0" maxOccurs="unbounded"/>
        <element name="Associations" minOccurs="0">
          <complexType>
            <sequence>
              <element name="ComputingShareLocalID" type="string" minOccurs="0"
                maxOccurs="unbounded"/>
              <element name="ApplicationEnvironmentLocalID" type="string" minOccurs="0"
                maxOccurs="unbounded"/>
              <element name="ComputingActivityID" type="glue:ID_t" minOccurs="0"
            </sequence>
          </complexType>
        </element>
      </sequence>
    </extension>
  </complexContent>
</complexType>

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        maxOccurs="unbounded"/>
    </sequence>
</complexType>
</element>
</sequence>
</extension>
</complexContent>
</complexType>

<complexType name="ApplicationEnvironment_t">
    <complexContent>
        <extension base="glue:Entity">
            <sequence>
                <element name="LocalID" type="glue:LocalID_t"/>
                <element name="Name" type="string"/>
                <element name="Version" type="string" minOccurs="0"/>
                <element name="Repository" type="anyURI" minOccurs="0"/>
                <element name="State" type="glue:AppEnvState_t" minOccurs="0"/>
                <element name="RemovalDate" type="dateTime" minOccurs="0"/>
                <element name="License" type="glue:License_t" minOccurs="0"/>
                <element name="Description" type="string" minOccurs="0"/>
                <element name="BestBenchmark" type="glue:BenchmarkType_t" minOccurs="0"/>
                <element name="ParallelSupport" type="glue:ParallelSupport_t" minOccurs="0"/>
                <element name="MaxSlots" type="unsignedInt" minOccurs="0"/>
                <element name="MaxJobs" type="unsignedInt" minOccurs="0"/>
                <element name="MaxUserSeats" type="unsignedInt" minOccurs="0"/>
                <element name="FreeSlots" type="unsignedInt" minOccurs="0"/>
                <element name="FreeJobs" type="unsignedInt" minOccurs="0"/>
                <element name="FreeUserSeats" type="unsignedInt" minOccurs="0"/>
                <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
                <element name="ApplicationHandle" type="glue:ApplicationHandle_t" minOccurs="0"
                    maxOccurs="unbounded"/>
                <element name="Associations" minOccurs="0">
                    <complexType>
                        <sequence>
                            <element name="ExecutionEnvironmentLocalID" type="string" minOccurs="0"
                                maxOccurs="unbounded"/>
                        </sequence>
                    </complexType>
                </element>
            </sequence>
        </extension>
    </complexContent>
</complexType>

<complexType name="ApplicationHandle_t">
    <sequence>
        <element name="LocalID" type="string"/>
        <element name="Type" type="glue:ApplicationHandleType_t"/>
        <element name="Value" type="string"/>
        <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
    </sequence>
</complexType>

<complexType name="ComputingActivity_t">
    <complexContent>
        <extension base="glue:ActivityProperties_t">
            <sequence>
                <element name="Name" type="string" minOccurs="0"/>
                <element name="Type" type="glue:ComputingActivityType_t" minOccurs="0"/>
                <element name="IDFromEndpoint" type="anyURI"/>
                <element name="LocalIDFromManager" type="string" minOccurs="0"/>
                <element name="JobDescription" type="glue:JobDescription_t"/>
                <element name="State" type="glue:ComputingActivityState_t"/>
                <element name="RestartState" type="glue:ComputingActivityState_t" minOccurs="0"/>
                <element name="ExitCode" type="int" minOccurs="0"/>
                <element name="ComputingManagerExitCode" type="string" minOccurs="0"/>
                <element name="Error" type="string" minOccurs="0" maxOccurs="unbounded"/>
                <element name="WaitingPosition" type="unsignedInt" minOccurs="0"/>
                <element name="UserDomain" type="string" minOccurs="0"/>
                <element name="Owner" type="string"/>
                <element name="LocalOwner" type="string" minOccurs="0"/>
                <element name="RequestedTotalWallTime" type="unsignedLong" minOccurs="0"/>
                <element name="RequestedTotalCPUTime" type="unsignedLong" minOccurs="0"/>
                <element name="RequestedSlots" type="unsignedInt" minOccurs="0"/>
                <element name="RequestedApplicationEnvironment" type="string" minOccurs="0"
                    maxOccurs="unbounded"/>
                <element name="StdIn" type="string" minOccurs="0"/>
                <element name="StdOut" type="string" minOccurs="0"/>
                <element name="StdErr" type="string" minOccurs="0"/>
            </sequence>
        </extension>
    </complexContent>
</complexType>

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<element name="LogDir" type="string" minOccurs="0"/>
<element name="ExecutionNode" type="string" minOccurs="0" maxOccurs="unbounded"/>
<element name="Queue" type="string" minOccurs="0"/>
<element name="UsedTotalWallTime" type="unsignedLong" minOccurs="0"/>
<element name="UsedTotalCPUTime" type="unsignedLong" minOccurs="0"/>
<element name="UsedMainMemory" type="unsignedLong" minOccurs="0"/>
<element name="SubmissionTime" type="dateTime" minOccurs="0"/>
<element name="ComputingManagerSubmissionTime" type="dateTime" minOccurs="0"/>
<element name="StartTime" type="dateTime" minOccurs="0"/>
<element name="ComputingManagerEndTime" type="dateTime" minOccurs="0"/>
<element name="EndTime" type="dateTime" minOccurs="0"/>
<element name="WorkingAreaEraseTime" type="dateTime" minOccurs="0"/>
<element name="ProxyExpirationTime" type="dateTime" minOccurs="0"/>
<element name="SubmissionHost" type="string" minOccurs="0"/>
<element name="SubmissionClientName" type="string" minOccurs="0"/>
<element name="OtherMessages" type="string" minOccurs="0" maxOccurs="unbounded"/>
<element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
<element name="Associations" minOccurs="0">
  <complexType>
    <sequence>
      <element name="ComputingEndpointID" type="anyURI" minOccurs="0"/>
      <element name="ComputingShareLocalID" type="string" minOccurs="0"/>
      <element name="ExecutionEnvironmentLocalID" type="string" minOccurs="0"/>
      <element name="UserDomainID" type="anyURI" minOccurs="0"/>
      <element name="ActivityID" type="anyURI" minOccurs="0" maxOccurs="unbounded"/>
    </sequence>
  </complexType>
</element>
</sequence>
</extension>
</complexContent>
</complexType>

<complexType name="ToStorageService_t">
  <complexContent>
    <extension base="glue:Entity">
      <sequence>
        <element name="LocalID" type="string"/>
        <element name="LocalPath" type="string"/>
        <element name="RemotePath" type="string"/>
        <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
        <element name="Associations" minOccurs="0">
          <complexType>
            <sequence>
              <element name="ComputingServiceID" type="anyURI"/>
              <element name="StorageServiceID" type="anyURI"/>
            </sequence>
          </complexType>
        </element>
      </sequence>
    </extension>
  </complexContent>
</complexType>

<!-- END COMPUTING ENTITIES -->

<!-- BEGIN STORAGE ENTITIES -->
<complexType name="StorageService_t">
  <complexContent>
    <extension base="glue:ServiceProperties_t">
      <sequence>
        <element name="StorageServiceCapacity" type="glue:StorageServiceCapacity_t" minOccurs="0"
          maxOccurs="unbounded"/>
        <element name="StorageAccessProtocol" type="glue:StorageAccessProtocol_t" minOccurs="0"
          maxOccurs="unbounded"/>
        <element name="StorageEndpoint" type="glue:StorageEndpoint_t" minOccurs="0"
          maxOccurs="unbounded"/>
        <element name="StorageShares" minOccurs="0">
          <complexType>
            <sequence>
              <element name="StorageShare" type="glue:StorageShare_t" minOccurs="0"
                maxOccurs="unbounded"/>
            </sequence>
          </complexType>
        </element>
        <element name="StorageManager" type="glue:StorageManager_t" minOccurs="0"
          maxOccurs="unbounded"/>
        <element name="ToComputingService" type="glue:ToComputingService_t" minOccurs="0"
          maxOccurs="unbounded"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>

```



```

    </sequence>
  </extension>
</complexContent>
</complexType>

<complexType name="StorageServiceCapacity_t">
  <complexContent>
    <extension base="glue:Entity">
      <sequence>
        <element name="LocalID" type="string"/>
        <element name="Type" type="string"/>
        <element name="TotalSize" type="unsignedLong" minOccurs="0"/>
        <element name="FreeSize" type="unsignedLong" minOccurs="0"/>
        <element name="UsedSize" type="unsignedLong" minOccurs="0"/>
        <element name="ReservedSize" type="unsignedLong" minOccurs="0"/>
        <element name="OtherInfo" type="string" minOccurs="0" maxOccurs="unbounded"/>
        <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>

<complexType name="StorageAccessProtocol_t">
  <complexContent>
    <extension base="glue:Entity">
      <sequence>
        <element name="LocalID" type="string"/>
        <element name="Type" type="glue:StorageAccessProtocolType_t" minOccurs="0"/>
        <element name="Version" type="string"/>
        <element name="MaxStreams" type="int" minOccurs="0"/>
        <element name="OtherInfo" type="string" minOccurs="0" maxOccurs="unbounded"/>
        <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
      </sequence>
    </extension>
  </complexContent>
</complexType>

<complexType name="StorageEndpoint_t">
  <complexContent>
    <extension base="glue:EndpointProperties_t">
      <sequence>
        <element name="OtherInfo" type="string" minOccurs="0" maxOccurs="unbounded"/>
        <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
        <element name="AccessPolicy" type="glue:AccessPolicy_t" minOccurs="0"
          maxOccurs="unbounded"/>
        <element name="Associations" minOccurs="0">
          <complexType>
            <sequence>
              <element name="StorageShareLocalID" type="glue:ID_t" minOccurs="0"
                maxOccurs="unbounded"/>
            </sequence>
          </complexType>
        </element>
      </sequence>
    </extension>
  </complexContent>
</complexType>

<complexType name="StorageShare_t">
  <complexContent>
    <extension base="glue:Share_t">
      <sequence>
        <element name="ServingState" type="glue:ServingState_t"/>
        <element name="Path" type="string"/>
        <element name="SharingID" type="glue:LocalID_t"/>
        <element name="AccessLatency" type="glue:AccessLatency_t"/>
        <element name="RetentionPolicy" type="glue:RetentionPolicy_t" minOccurs="0"
          maxOccurs="unbounded"/>
        <element name="ExpirationMode" type="glue:ExpirationMode_t" minOccurs="0" maxOccurs="3"/>
        <element name="DefaultLifeTime" type="unsignedInt" minOccurs="0"/>
        <element name="MaximumLifeTime" type="unsignedInt" minOccurs="0"/>
        <element name="Tag" type="string" minOccurs="0"/>
        <element name="OtherInfo" type="string" minOccurs="0" maxOccurs="unbounded"/>
        <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
        <element name="MappingPolicy" type="glue:MappingPolicy_t" minOccurs="0"
          maxOccurs="unbounded"/>
        <element name="StorageShareCapacity" type="glue:StorageShareCapacity_t" minOccurs="0"
          maxOccurs="unbounded"/>
        <element name="Associations" minOccurs="0">
          <complexType>
            <sequence>

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```

        <element name="StorageEndpointID" type="glue:ID_t" minOccurs="0"
            maxOccurs="unbounded"/>
        <element name="StorageResourceID" type="glue:ID_t" minOccurs="0"
            maxOccurs="unbounded"/>
    </sequence>
</complexType>
</element>
</sequence>
</extension>
</complexContent>
</complexType>

<complexType name="StorageShareCapacity_t">
    <complexContent>
        <extension base="glue:Entity">
            <sequence>
                <element name="LocalID" type="glue:LocalID_t"/>
                <element name="Type" type="glue:StorageCapacity_t"/>
                <element name="TotalSize" type="unsignedLong" minOccurs="0"/>
                <element name="FreeSize" type="unsignedLong" minOccurs="0"/>
                <element name="UsedSize" type="unsignedLong" minOccurs="0"/>
                <element name="ReservedSize" type="unsignedLong" minOccurs="0"/>
                <element name="OtherInfo" type="string" minOccurs="0" maxOccurs="unbounded"/>
                <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
            </sequence>
        </extension>
    </complexContent>
</complexType>

<complexType name="StorageManager_t">
    <complexContent>
        <extension base="glue:Manager_t">
            <sequence>
                <element name="Type" type="glue:StorageManagerType_t"/>
                <element name="Version" type="string" minOccurs="0"/>
                <element name="OtherInfo" type="string" minOccurs="0" maxOccurs="unbounded"/>
                <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
                <element name="StorageResource" type="glue:StorageResource_t" minOccurs="0"
                    maxOccurs="unbounded"/>
            </sequence>
        </extension>
    </complexContent>
</complexType>

<complexType name="StorageResource_t">
    <complexContent>
        <extension base="glue:Resource_t">
            <sequence>
                <element name="Type" type="glue:StorageResourceType_t"/>
                <element name="Latency" type="glue:AccessLatency_t"/>
                <element name="TotalSize" type="unsignedLong" minOccurs="0"/>
                <element name="FreeSize" type="unsignedLong" minOccurs="0"/>
                <element name="UsedSize" type="unsignedLong" minOccurs="0"/>
                <element name="ReservedSize" type="unsignedLong" minOccurs="0"/>
                <element name="OtherInfo" type="string" minOccurs="0" maxOccurs="unbounded"/>
                <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
                <element name="Associations" minOccurs="0">
                    <complexType>
                        <sequence>
                            <element name="StorageShareLocalID" type="glue:ID_t" minOccurs="0"
                                maxOccurs="unbounded"/>
                        </sequence>
                    </complexType>
                </element>
            </sequence>
        </extension>
    </complexContent>
</complexType>

<complexType name="ToComputingService_t">
    <complexContent>
        <extension base="glue:Entity">
            <sequence>
                <element name="LocalID" type="glue:LocalID_t"/>
                <element name="NetworkInfo" type="glue:NetworkInfo_t" minOccurs="0"/>
                <element name="Bandwidth" type="unsignedInt" minOccurs="0"/>
                <element name="OtherInfo" type="string" minOccurs="0" maxOccurs="unbounded"/>
                <element name="Extensions" type="glue:Extensions_t" minOccurs="0"/>
                <element name="Associations" minOccurs="0">

```

```

    <complexType>
      <sequence>
        <element name="StorageAccessProtocolLocalID" type="glue:ID_t" minOccurs="0"
          maxOccurs="unbounded" />
        <element name="ComputingServiceID" type="anyURI" />
        <element name="StorageServiceID" type="anyURI" />
      </sequence>
    </complexType>
  </element>
</sequence>
</extension>
</complexContent>
</complexType>
<!-- END STORAGE ENTITIES -->

<!-- BEGIN DATA TYPES -->
<simpleType name="Latitude_t">
  <restriction base="float">
    <minInclusive value="-90" />
    <maxInclusive value="90" />
  </restriction>
</simpleType>

<simpleType name="Longitude_t">
  <restriction base="float">
    <minInclusive value="-180" />
    <maxInclusive value="180" />
  </restriction>
</simpleType>

<simpleType name="ActivityType_t">
  <restriction base="string" />
</simpleType>

<simpleType name="PolicyScheme_t">
  <restriction base="string">
    <annotation>
      <appinfo>basic</appinfo>
      <appinfo>gacl</appinfo>
    </annotation>
  </restriction>
</simpleType>

<simpleType name="PolicyRule_t">
  <restriction base="string" />
</simpleType>

<simpleType name="EndpointTechnology_t">
  <restriction base="string">
    <annotation>
      <appinfo>webservice</appinfo>
      <appinfo>jndi</appinfo>
      <appinfo>legacy</appinfo>
    </annotation>
  </restriction>
</simpleType>

<simpleType name="EndpointHealthState_t">
  <restriction base="string">
    <enumeration value="ok" />
    <enumeration value="warning" />
    <enumeration value="critical" />
    <enumeration value="unknown" />
    <enumeration value="other" />
  </restriction>
</simpleType>

<simpleType name="QualityLevel_t">
  <restriction base="string">
    <enumeration value="production" />
    <enumeration value="pre-production" />
    <enumeration value="testing" />
    <enumeration value="development" />
  </restriction>
</simpleType>

<simpleType name="ServiceType_t">
  <restriction base="string">
    <annotation>
      <appinfo>
        <enumeration value="org.glite.wms" />
      </appinfo>
    </annotation>
  </restriction>
</simpleType>

```

```

        <enumeration value="org.glite.lb"/>
        <enumeration value="org.glite.lb"/>
    </appinfo>
</annotation>
</restriction>
</simpleType>

<simpleType name="Capability_t">
    <restriction base="string">
        <enumeration value="security.authentication"/>
        <enumeration value="security.credentialstorage"/>
        <enumeration value="security.delegation"/>
        <enumeration value="security.authorization"/>
        <enumeration value="security.identitymapping"/>
        <enumeration value="security.attributeauthority"/>
        <enumeration value="security.accounting"/>
        <enumeration value="data.transfer"/>
        <enumeration value="data.management.transfer"/>
        <enumeration value="data.management.replica"/>
        <enumeration value="data.management.storage"/>
        <enumeration value="data.naming.resolver"/>
        <enumeration value="data.naming.scheme"/>
        <enumeration value="data.access.relational"/>
        <enumeration value="data.access.xml"/>
        <enumeration value="data.access.flatfiles"/>
        <enumeration value="information.model"/>
        <enumeration value="information.discovery"/>
        <enumeration value="information.logging"/>
        <enumeration value="information.monitoring"/>
        <enumeration value="information.provenance"/>
        <enumeration value="executionmanagement.jobexecution"/>
        <enumeration value="executionmanagement.jobdescription"/>
        <enumeration value="executionmanagement.jobmanager"/>
        <enumeration value="executionmanagement.executionandplanning"/>
        <enumeration value="executionmanagement.candidatesetgenerator"/>
        <enumeration value="executionmanagement.reservation"/>
    </restriction>
</simpleType>

<simpleType name="ServingState_t">
    <restriction base="string">
        <enumeration value="production"/>
        <enumeration value="draining"/>
        <enumeration value="queuing"/>
        <enumeration value="closed"/>
    </restriction>
</simpleType>

<simpleType name="DN_t">
    <restriction base="string"/>
</simpleType>

<simpleType name="ID_t">
    <restriction base="anyURI"/>
</simpleType>

<simpleType name="LocalID_t">
    <restriction base="string"/>
</simpleType>

<simpleType name="Staging_t">
    <restriction base="string">
        <annotation>
            <appinfo>
                <enumeration value="none"/>
                <enumeration value="stagingin"/>
                <enumeration value="stagingout"/>
                <enumeration value="staginginout"/>
            </appinfo>
        </annotation>
    </restriction>
</simpleType>

<simpleType name="JobDescription_t">
    <restriction base="string">
        <annotation>
            <appinfo>
                <enumeration value="ogf:jSDL:1.0"/>
                <enumeration value="egee:jd1"/>
                <enumeration value="nordugrid:xrsi"/>
                <enumeration value="globus:rs1"/>
            </appinfo>
        </annotation>
    </restriction>
</simpleType>

```

```

        <enumeration value="condor"/>
      </appinfo>
    </annotation>
  </restriction>
</simpleType>

<simpleType name="SchedulingPolicy_t">
  <restriction base="string">
    <annotation>
      <appinfo>
        <enumeration value="fairshare"/>
        <enumeration value="fifo"/>
        <enumeration value="random"/>
      </appinfo>
    </annotation>
  </restriction>
</simpleType>

<simpleType name="ReservationPolicy_t">
  <restriction base="string">
    <enumeration value="none"/>
    <enumeration value="mandatory"/>
    <enumeration value="optional"/>
  </restriction>
</simpleType>

<simpleType name="BenchmarkType_t">
  <restriction base="string">
    <annotation>
      <appinfo>
        <enumeration value="specint2000"/>
        <enumeration value="specfp2000"/>
        <enumeration value="cint2006"/>
        <enumeration value="cfp2006"/>
        <enumeration value="bgomips"/>
        <enumeration value="linpack"/>
      </appinfo>
    </annotation>
  </restriction>
</simpleType>

<simpleType name="Platform_t">
  <restriction base="string">
    <annotation>
      <appinfo>
        <enumeration value="i386"/>
        <enumeration value="amd64"/>
        <enumeration value="itanium"/>
        <enumeration value="powerpc"/>
        <enumeration value="sparc"/>
      </appinfo>
    </annotation>
  </restriction>
</simpleType>

<simpleType name="CPUMultiplicity_t">
  <restriction base="string">
    <enumeration value="singlecpu-singlecore"/>
    <enumeration value="singlecpu-multicore"/>
    <enumeration value="multicpu-singlecore"/>
    <enumeration value="multicpu-multicore"/>
  </restriction>
</simpleType>

<simpleType name="OSFamily_t">
  <restriction base="string">
    <annotation>
      <appinfo>
        <enumeration value="linux"/>
        <enumeration value="macosx"/>
        <enumeration value="windows"/>
        <enumeration value="solaris"/>
      </appinfo>
    </annotation>
  </restriction>
</simpleType>

<simpleType name="OSName_t">
  <restriction base="string">

```

```

    <annotation>
      <appinfo>
        <enumeration value="scientificlinux"/>
        <enumeration value="scientificlinuxcern"/>
        <enumeration value="ubuntu"/>
        <enumeration value="debian"/>
        <enumeration value="centos"/>
        <enumeration value="fedora"/>
        <enumeration value="rhes"/>
        <enumeration value="mandrake"/>
        <enumeration value="suse"/>
        <enumeration value="leopard"/>
        <enumeration value="windowsxp"/>
        <enumeration value="windowsvista"/>
      </appinfo>
    </annotation>
  </restriction>
</simpleType>

<simpleType name="ApplicationHandleType_t">
  <restriction base="string">
    <annotation>
      <appinfo>
        <enumeration value="module"/>
        <enumeration value="softenv"/>
        <enumeration value="path"/>
        <enumeration value="executable"/>
      </appinfo>
    </annotation>
  </restriction>
</simpleType>

<simpleType name="License_t">
  <restriction base="string">
    <enumeration value="opensource"/>
    <enumeration value="commercial"/>
    <enumeration value="unknown"/>
  </restriction>
</simpleType>

<simpleType name="ComputingManagerType_t">
  <restriction base="string">
    <annotation>
      <appinfo>
        <enumeration value="lsf"/>
        <enumeration value="sungridengine"/>
        <enumeration value="openpbs"/>
        <enumeration value="torque"/>
        <enumeration value="torquemaui"/>
        <enumeration value="bgs"/>
        <enumeration value="condor"/>
        <enumeration value="loadleveler"/>
        <enumeration value="forkl"/>
      </appinfo>
    </annotation>
  </restriction>
</simpleType>

<simpleType name="NetworkInfo_t">
  <restriction base="string">
    <annotation>
      <appinfo>
        <enumeration value="100megabitethernet"/>
        <enumeration value="gigabitethernet"/>
        <enumeration value="myrinet"/>
        <enumeration value="infiniband"/>
      </appinfo>
    </annotation>
  </restriction>
</simpleType>

<simpleType name="ExecEnv_t">
  <restriction base="string"> </restriction>
</simpleType>

<simpleType name="AppEnvState_t">
  <restriction base="string">
    <annotation>
      <appinfo>

```

```

        <enumeration value="notinstallable"/>
        <enumeration value="installable"/>
        <enumeration value="installingmanually"/>
        <enumeration value="installingautomatically"/>
        <enumeration value="installationfailed"/>
        <enumeration value="installednotverified"/>
        <enumeration value="installedverified"/>
        <enumeration value="installedbroken"/>
        <enumeration value="pendingremoval"/>
        <enumeration value="removing"/>
    </appinfo>
</annotation>
</restriction>
</simpleType>

<simpleType name="ParallelSupport_t">
    <restriction base="string">
        <annotation>
            <appinfo>
                <enumeration value="mpi"/>
                <enumeration value="opennmp"/>
                <enumeration value="none"/>
            </appinfo>
        </annotation>
    </restriction>
</simpleType>

<simpleType name="ComputingActivityType_t">
    <restriction base="string">
        <enumeration value="single"/>
        <enumeration value="collectionelement"/>
        <enumeration value="parallelelement"/>
        <enumeration value="workflownode"/>
    </restriction>
</simpleType>

<simpleType name="ComputingActivityState_t">
    <restriction base="string">
        <annotation>
            <appinfo>
                <enumeration value="bes:pending"/>
                <enumeration value="bes:running"/>
                <enumeration value="bes:finished"/>
                <enumeration value="bes:failed"/>
                <enumeration value="bes:terminated"/>
            </appinfo>
        </annotation>
    </restriction>
</simpleType>

<simpleType name="StorageCapacity_t">
    <restriction base="string">
        <annotation>
            <appinfo>
                <enumeration value="online"/>
                <enumeration value="nearline"/>
                <enumeration value="offline"/>
                <enumeration value="cache"/>
            </appinfo>
        </annotation>
    </restriction>
</simpleType>

<simpleType name="StorageAccessProtocolType_t">
    <restriction base="string">
        <annotation>
            <appinfo>
                <enumeration value="gsiftp"/>
                <enumeration value="file"/>
                <enumeration value="nfs"/>
                <enumeration value="afs"/>
                <enumeration value="rfio"/>
                <enumeration value="gsirfio"/>
                <enumeration value="dcap"/>
                <enumeration value="gsidcap"/>
                <enumeration value="root"/>
                <enumeration value="https"/>
                <enumeration value="http"/>
            </appinfo>
        </annotation>
    </restriction>

```

```
</simpleType>

<simpleType name="AccessLatency_t">
  <restriction base="string">
    <enumeration value="online"/>
    <enumeration value="nearline"/>
    <enumeration value="offline"/>
  </restriction>
</simpleType>

<simpleType name="RetentionPolicy_t">
  <restriction base="string">
    <enumeration value="custodial"/>
    <enumeration value="output"/>
    <enumeration value="replica"/>
  </restriction>
</simpleType>

<simpleType name="ExpirationMode_t">
  <restriction base="string">
    <enumeration value="neverexpire"/>
    <enumeration value="warnwhenexpired"/>
    <enumeration value="releasewhenexpired"/>
  </restriction>
</simpleType>

<simpleType name="StorageManagerType_t">
  <restriction base="string">
    <annotation>
      <appinfo>
        <enumeration value="castor"/>
        <enumeration value="gpfs"/>
        <enumeration value="dcache"/>
        <enumeration value="tsm"/>
        <enumeration value="sse"/>
        <enumeration value="enstore"/>
      </appinfo>
    </annotation>
  </restriction>
</simpleType>

<simpleType name="StorageResourceType_t">
  <restriction base="string">
    <annotation>
      <appinfo>
        <enumeration value="disk"/>
        <enumeration value="tape"/>
        <enumeration value="optical"/>
      </appinfo>
    </annotation>
  </restriction>
</simpleType>
<!-- END DATA TYPES -->
</schema>
```


4. Security Considerations

Please refer to RFC 3552 (<http://www.ietf.org/rfc/rfc3552.txt>) for guidance on writing a security considerations section. This section is required in all documents, and should not just say “there are no security considerations.” Quoting from the RFC:

“Most people speak of security as if it were a single monolithic property of a protocol or system, however, upon reflection, one realizes that it is clearly not true. Rather, security is a series of related but somewhat independent properties. Not all of these properties are required for every application.

We can loosely divide security goals into those related to protecting communications (COMMUNICATION SECURITY, also known as COMSEC) and those relating to protecting systems (ADMINISTRATIVE SECURITY or SYSTEM SECURITY). Since communications are carried out by systems and access to systems is through communications channels, these goals obviously interlock, but they can also be independently provided.”

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6. Contributors & Acknowledgements

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10. References

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