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Using Object Identifiers in the Grid Forum Standards Process

1 Scope

This document presents an argument for the use of Object Identifiers (OIDs) by the Grid Forum. OIDs are defined in the ITU-T (formerly CCITT) document X.208 / ISO 8824[4]. Within the ITU-T document, OIDs are introduced as a mechanism to name and describe "information objects," and the Abstract Syntax Notation One (ASN.1) is described.[1] The utility of OIDs is to ensure that both the consumers and producers of objects agree on the precise definition of those objects.

The Grid Object Specification (GOS) language[2] provides a mechanism to associate OID numbers with object classes and attributes. A governing body is needed to assign OIDs to make these definitions complete. OIDs can also be of great utility to the other working groups within the Grid Forum. We also propose a possible procedure for assigning OID numbers via the Grid Forum.

2 Introduction

The information infrastructure necessary for a global scale distributed system is necessarily quite large. In such environments, it is essential that participants use a common vocabulary. The issue is the same with the myriad of software expected to interact to form this distributed system, i.e., a common, open set of protocols must be defined to ensure the correctness and robustness of the system. Extra care must be taken to remove any ambiguities.

The challenges posed by this requirement are the same as the challenges posed by the architecture of the Internet and the definition of its protocols. Rather than create conventions anew within the Grid community, the Grid Forum should utilize existing standards whenever possible, and only enhance them when there is a clear need to do so. Based on these observations, the Grid Forum should use Object Identifiers (OIDs) to define Grid Information System (GIS) object classes, attributes, and naming within the DIT (Directory Information tree). Moreover, the dictionary effort would likely benefit from the use of OIDs as well.

3 OID Namespace and Definition

The OID space is organized as a hierarchy. Each node within the tree can be both a definition and a delegation of authority over a subset of the OID space. The delegated party may then assign OIDs that fall within its subset of the OID space. OIDs are used in a variety of network protocols, most notably SNMP[1] and LDAP [6]. SNMP uses OIDs both to name object type specifiers and to describe the syntax of that object as specified in the Structure of Managed Information (SMI) [5].

The ITU/ISO definition of OIDs is of a slightly different form from which members of the Internet community are accustomed to seeing. In this definition, elements are space separated and the textual version is separated by braces. We adopt the IETF convention for OID representation that is specified in RFC 1778[3]. This format is represented by the regular definition in Figure 1.

The Grid Forum has obtained an OID under the Enterprise branch of the OID tree. The OID for the "Grid" in both ASCII and numeric form is:

```
iso.org.dod.internet.private.enterprise.Grid     1.3.6.1.4.1.6757
```

[1] The network encoding of these objects is specified in X.209 and ISO 8825 and may prove useful as a message encoding standard for the Grid Forum. This is an open question and is beyond the scope of this document.

```
<oid> ::= <descr> ( '.' <numericoid> )?
        | <numericoid>

<descr> ::= <keystring>

<keystring> ::= [a-zA-Z][-a-zA-Z]*

<numericoid> ::= <numericstring> ( '.' numericstring )*

<numericstring> ::= [0-9][0-9]+
```

Figure 1: Grammar for Object Identifiers

Since the namespace is (potentially) infinite, there can be OID prefixes for the above mentioned objects as well as institutions, packages, and some reserved for local, *ad hoc* use. Certain OIDs, however, may be identified and agreed upon by the community, and assigned into a general namespace.

For example, we could assign the OID number 1.3.6.4.1.6757.1 to the security working group and the OID number 1.3.6.4.1.6757.2 to the information working group. For brevity, we could represent these OIDs in ASCII as grid.security and grid.informationServices. We can even extend the assignment to individual subgroups within each working group, etc. Some examples might include.

- **grid.performance.network.tcp (grid.3.1.1)**
- **grid.performance.network.udp (grid.3.1.2)**
- **grid.performance.pkg.netlogger.myapp (grid.3.2.1.1)**
- **grid.performance.org.utenn.arbitrary (grid.3.3.1.1)**
- **grid.performance.site-local.reserved (grid.3.4.1)**
- **grid.performance.nws.network.tcp.forecast.version1-2 (grid.3.4.1.1.1.1**

4 Suggested OID Practices for Grid Forum

We propose that the Grid Forum create an Object Identifier Registry and Query service (called "the OID service") on an experimental basis. The OID service is offered as an aid for Grid developers who need to create LDAP schema objects for their applications. This service is also a component of a schema registry service, which the Grid will probably need in the near future. The OID service will be permissive in what can be registered, but a template or organization plan will be suggested. Access control will be offered.

The Globus project has also been assigned an OID number, which is "1.3.6.4.1.3536". Their intent is to utilize OID to define a precise and unambiguous definition of object classes, attributes, and DIT positions within the Metacomputing Directory Service (MDS). They have adopted a numbering convention based upon a service provider approach. The convention used by the Globus project is depicted in Figure 2. This convention has been presented only to initiate discussion within the Grid Forum as to the type of numbering convention that should be adopted. Such a naming convention needs to be adopted by the Grid Forum, and a mechanism defined to assign OIDs should be put it place.

4.1 Experimental Status

It is desirable to have a production quality registry run by a trusted and reliable party. A registry for OIDs is required but the requirements and configuration of such a service are not complete. Creating a registry service and recording OID usage in the GRId is useful now, and will aid development; this data can be transferred to a different service later should that be required. Establishing the idea of registering OIDs in the Grid now will reduce the need to backfill this information later.

```
Globus.1                Security Infrastruture
Globus.2                Information Services
    Globus.2.1              Common
        Globus.2.1.1            Attribute Types
        Globus.2.1.2            Syntaxes
        Globus.2.1.3            Object Classes
        Globus.2.1.4            Matching Rules
        Globus.2.1.5            Controls
        Globus.2.1.6            Extended Operations
        Globus.2.1.7            Access Control Information
        Globus.2.1.8            DIT Naming
    Globus.2.2              Compute Resource Information Provider
        Globus.2.2.1            Attribute Types
        ...
        Globus.2.2.8            DIT Naming
    Globus.2.3              Storage Resource Information Provider
        Globus.2.3.1            Attribute Types
        ...
        Globus.2.3.8            DIT Naming
    Globus.2.4              Software Resource Information Provider
        Globus.2.4.1            Attribute Types
        ...
        Globus.2.4.8            DIT Naming
    Globus.2.5              Network Resource Information Provider
        Globus.2.5.1            Attribute Types
        ...
        Globus.2.5.8            DIT Naming
    Globus.2.6              Replica Catalog
        Globus.2.6.1            Attribute Types
        ...
        Globus.2.6.8            DIT Naming
```

Figure 2: OID numbering convention within the Globus project

We suggest a period of 18 months (3-5 Global Grid Forum meetings) for this experimental service. This will give sufficient time to establish the service and revise as needed, evaluate its usefulness, and identify the appropriate service provider. At the end of this period, this service will be approved as a standard, revised, or discarded.

4.2 Developer Support

Developers and managers of Grid services need to acquire unique OIDs for their LDAP object classes and attribute types. They may also need OIDs for other purposes (not limited to LDAP). Organizations can easily acquire an OID from a variety of sources, but this may not be convenient, and the developer may have no interest in maintaining his own small registry. OIDs must not be used to describe multiple objects. In LDAP schemas, the namespace for object classes and attributes is flat; LDAP developers must be able to keep their schema entities' names unique to prevent conflict. Developers may need OIDs that have a short lifetime (experimental services, services with lifetimes), so there should be a procedure to clean up the OID space and mark OIDs as obsolete.

In order to meet these requirements, the OID service will offer a registration method, which will offer (or return) a unique OID to the user. The OID service will associate an OID with requestor information, a name for the object, and some time to live information. It may associate the OID with an approver name, a URL to a standards document, and access control information. New OIDs SHOULD be assigned a time to live of one year; the service (not the requestor) can change this time to live to some other period, none, or permanent. OID assignments MUST NOT be recycled. OID name assignments SHOULD BE unique in the service to accommodate LDAP's schema requirements. The OID service will offer a search capability for OID assignments by number and by name.

4.3 Schema Registry

This service is primarily for the support of developers of LDAP schema objects, but it MAY be used for other purposes. LDAP schema uses a flat namespace, and LDAP directory and schema management tools are heavily dependent on the names rather than the OIDs of schema entitities. To reduce conflict and confusion, these names SHOULD be unique. The service should identify name collisions to the service management and to users (those registering OIDs and those querying the OID service).

An LDAP schema registry would require more strict conformance to the LDAP schema requirements, support for additional features related to LDAP schemas, and more sophisticated querying and tagging than the OID service offers.

4.4 Operations

We suggest delegating an OID to each Grid Forum working group or other major project, on demand. The responsibility and ownership of this OID and the assignment of OIDs underneath rests in the working group, through its chair people or administration. This OID is referred to as a "major branch". Access control is discussed in Section 4.5.

Grid Forum working groups may develop their own procedures for managing OIDs, managing registration, establish their own hierarchical trees and so forth. Organizations may also have their own registered identities (eg "Globus" or "ESnet") and may be developing their own hierarchies outside of the Grid branch.

We suggest that these organizations SHOULD share their registration with this OID service. The OID service should also share its registry information (or a subset of it), with existing registries such as IANA or Harald Alvestrand's service (http://www.alvestrand.no/objectid/). THis may be addressed in a future revision of this service as required.

Grid Forum groups may need to develop a registry service on this model, or one of their choosing. This development is not recommended, but should this occur, these registries MUST share their registration data (the subset of OID number and name) with the OID service, and the OID service MUST make its registry database accessible to other Grid registries. The details are left for a future revision.

Grid Forum working groups may allocate numbers on any basis that suits them, but we suggest an organization similar to Figure 2, replacing the major branch "Globus" with "Grid.¡Working group name¿". The tag "Working group name" must conform to the limitations of the "¡keystring¿" production as described in Section 3. Groups may add additional categories, and leave uninteresting categories unpopulated (or even undefined).

4.5 Access Control

It may be necessary to provide and enforce access control, in order to prevent misunderstandings or denial-of-service (or vandalism) by outsiders. We suggest the following procedures:

4.5.1 Submission Mechanism

OID requestors fill out a submission form, which includes the fields described in Section 4.2, including a name, as well as a suggested branch (eg, grid.mds.pkg). This name will be appended to the suggested branch.

The submission will be translated by the OID service into:

- a tentative registration, with a one-year time to live and a previously unused number under grids.mds.pkg; a copy is sent to the submitter
- an e-mail message to the registered owner of the major branch: in this case, to the owner of grid.mds
- a message to the management of the OID service (a log file message)

4.5.2 Submission Management

The owner of the major branch may remove this registration if this is an erroneous submission. The assigned number MAY be reused. See section 4.5.3.

4.5.3 "Time To Live" Management

The owner of the major branch may change a registration from a one year time-to-live to some other value. It is not desireable to remove and reuse numbers that have been in active use; assignments made erroneously, and in the period immediately after registration, may be removed at the request of the major branch owner.

4.5.4 Delegation

Working groups owning major branches are free to delegate management to any party. They may do so by internal means (sharing access) or by requesting access for additional parties or by requesting assignment to another party.

5 Summary

Registrations immediately below the main Grid branch are reserved for working groups, organizations, or other projects. The owners of these top level prefixes are responsible for approving registrations of subordinate numbers, and for the organization of these numbers.

To oversee this process the working group should appoint a secretary to assigned numbers. This person would serve a term of one year and would be responsible for assigning OIDs, maintaining the (machine-readable) master list, and publishing the definitions of the Grid Forum OID tree to other OID registries. The document describing the current OID assignments should appear biannually as a Grid Forum standards document.

References

[1] CASE, J., FEDOR, M., SCHOFFSTALL, M., AND DAVIN, C. Simple Network Management Protocol (SNMP), May 1990.

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[3] HOWES, T., KILLE, S., YEONG, W., AND ROBBINS, C. The String Representation of Standard Attribute Syntaxes, March 1995.

[4] INTERNATIONAL ORGANIZATION FOR STANDARDIZATION, I. T. O. S. I. Specification of Abstract Syntax Notation One (ASN.1). ISO/IEC 8824, 1990.

[5] ROSE, M., AND MCCLOGHRIE, K. Structure and Identification of Management Information for TCP/IP-based Internet, May 1990.

[6] WAHL, M., COULBECK, A., HOWES, T., AND KILLE, S. Lightweight Directory Access Protocol (v3): Attribute Syntax Definitions, December 1997.

A Registries

There are various registries in place, but most provide only delegation and not registration. Other systems provide registration but without verification of correctness or authorization. Some examples are:

- **IANA** manages the "Private Enterprises" branch
- **ANSI** mamages the "US Organizations" branch
- **BSI** manages the "UK Organizations

B A Web-Based OID Registry

B.1 Reguirements

A simple registration and tracking mechanism that is correct without being fee-based. The data model is simple enough that either a RDBMS or LDAP server would be effective. Further, a simple system for browsing entries is needed (Basically a script that, given an OID can return its attributes in the registry; and in particular, return its children)

B.2 Presentation

Home page provides a tree-walking interface. For an example see http://www.alvestrand.no/objectid/1.3.6.1.4.1.html; there's no reason to provide anything more visually appealing. Initially tree-walking will done by OID number but it should support the descriptive keystrings as well.

It should also offer a "search" as in Alvestrand's registry, to search attributes like "descriptive name", "owner" without walking the tree.

It should offer the ability to link to any supporting document included in the OID's description (see below).

Each page returned by the tree-walking application will provide an Add Child / Modify Entry set of radio buttons. "Submit" will result in a login step (which will be cached with a short-lived cookie). Each node will have access control assigned to it and child nodes will inherit ownership from parents. Re-assignment of ownership and TTL changes can be done by the owner of that main branch; ordinary logins won't be able to do this (however, it's unlikely that any other logins than the main branch will exist at first).

The Modify screen will allow the same changes to be propagated to all subordinate nodes (where it makes sense to do this, TTL, ownership, group name etc.).

The Add screen will allow multiple new child OID's to be added. The next available consecutive number will be assigned to each new descriptive name. An optional field for each entry supports additional text (intended for a URL to a supporting document). These consecutive numbers will be marked as reserved in the DBMS.

On POST the changes are queued and also mailed to the owner of the branch. Changes may be made to the database immediately or delayed depending on the nature of this major branch.

B.3 Administration

For branches where an approval process is required, a major branch administrator's page can be provided. This is simply another version of the modify page, changing an internal attribute from reserved to approved and allowing the OID's to become visible in searches.

B.4 Security Model

In order to keep the experiment from getting out of hand and testing the wrong thing (our ability to manage a lot of web accounts, as opposed to evaluating the utility of an OID registry), we recommend that a minimum number of accounts be created: about one per Gridforum WG, on demand, and that the working groups adopt a policy of allowing anyone to register OID's but requiring the working group's account holder to approve these postings.

Only basic authentication will be provided at first (can be wrapped in SSL). An implementation based on certificates and/or GSI could be included as an additional experiment later.

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