Introduction to GT3

- Background
  - The Grid Problem
  - The Globus Approach
  - OGSA & OGSI
  - Globus Toolkit

- GT3 Architecture and Functionality:
  - The Latest Refinement of the Globus Toolkit
    - Core
    - Base Services
    - User-Defined Services
    - Future Directions

- Installation and Administration
  - Installation
  - Configuration
  - Debugging
  - Support

- Important Things to Remember

GT-OGSA Grid Service Infrastructure

GT3 Core

GT3 Core: OGSI Specification

The Specification Defines how Entities can Create, Discover and Interact with a Grid Service
GT3 Core:
OGSI Implementation

- GT3 includes a set of primitives that implement the interfaces and behaviors defined in the latest version of the OGSI Specification
- The implementation supports a declarative programming model in which GT3 users can compose OGSI-Compliant grid services by plugging the desired primitives into their implementation

GT3 Core:
OGSI Specification (cont.)

GridService portType
- Defines the fundamental behavior of a GridService
  - Introspection
  - Discovery
  - Soft State Lifetime Management
- Mandated by the Spec

GT3 Core:
OGSI Specification (cont.)

Factory portType
- Factories create services
- Factories are typically persistent services
- Factory is an optional OGSI interface

(Notification portTypes can also be instantiated by other mechanisms)
**GT3 Core:**

**OGSI Specification (cont.)**

Service group portTypes
- A ServiceGroup is a grid service that maintains information about a group of other grid services
- The classic registry model can be implemented with the ServiceGroup portTypes
- A grid service can belong to more than one ServiceGroup
- Members of a ServiceGroup can be heterogenous or homogenous
- Each entry in a service group can be represented as its own service
- Service group portTypes are optional OGSI interfaces

**HandleResolver portType**
- Defines a means for resolving a GSH (Grid Service Handle) to a GSR (Grid Service Reference)
  - A GSH points to a Grid Service (GT3 uses a hostname-based GSH scheme)
  - A GSR specifies how to communicate with the Grid Service (GT3 currently supports SOAP over HTTP, so GSRs are in WSDL format)
- HandleResolver is an optional OGSI interface

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**A Service Creation Scenario***

1. From a known registry, the client discovers a factory by querying the Service data of the registry

* The scenarios in this presentation are offered as examples and are not prescriptive
A Service Creation Scenario

1. From a known registry, the client discovers a factory by querying the Service data of the registry

2. The client calls the createService operation on the factory

3. The factory creates a service

4. The factory returns a locator

5. The client and service interact

A Notification Scenario

1. NotificationSink calls the subscribe operation on NotificationSource

2. The client calls the createService operation on the factory

3. The factory creates a service

4. The factory returns a locator

5. The client and service interact
A Notification Scenario

1. NotificationSink calls the subscribe operation on NotificationSource
2. Notification Source creates a subscription service
3. Notification Source returns a locator to the subscription service
4.a The NotificationSink and Subscription service interact to perform lifetime management
4.b The NotificationSink and Subscription service interact to perform lifetime management

The sole mandated cardinality: 1 to 1
GT3 Core: Security Infrastructure

- Transport Layer Security/Secure Socket Layer (TLS/SSL)
  - To be deprecated
- SOAP Layer Security
  - Based on WS-Security, XML Encryption, XML Signature
- GT3 uses X.509 identity certificates for authentication
- It also uses X.509 Proxy certificates to support delegation and single sign-on, updated to conform to latest IETF/GGF draft

GT3 Core: System Level Services

- General-purpose services that facilitate the use of Grid Services in production environments
- The 3.0 distribution includes the following System-Level services:
  - An Administration Service
  - A Logging Service
  - A Management Service
GT3 Core: Grid Service Container

Includes the OGSI Implementation, security infrastructure and system-level services, plus:

- Service activation, deactivation, construction, destruction, etc.
- Service data element placeholders that allow you to dynamically fetch service data values at query time
- Evaluator framework (supporting ByXPath and ByName notifications and queries)
- Interceptor/callback framework (allows one to intercept certain service lifecycle events)

GT3 Core: Grid Service Container (cont.)

Layers in the Web Services Model

- Interface Layer
- Transport Layer
- Implementation Layer

OGSI Spec is here

Transport/Binding Layer (GT3 supports SOAP over HTTP)

Container is here
GT3 Core: Hosting Environment

GT3 currently offers support for four Java Hosting Environments:

- Embedded
- Standalone
- Servlet
- EJB

GT3 Core: Virtual Hosting Environment Framework

- Virtual Hosting allows grid services to be distributed across several remote containers
- Useful in implementing solutions for problems common to distributed computing
  - Load balancing
  - User account sandboxing

A Service Creation Scenario Illustrating Redirection in Virtual Hosting

1. From a known registry, the client retrieves a factory locator
2. The router intercepts the createService call on the factory
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2. The router intercepts the createService call on the factory
3. The router passes the createService request to the Host Env Starter
4. The HE Starter creates a new Host Env as well as the service
5. The router returns a service locator
6. Using the service locator, the router redirects subsequent client-service interactions
GT3 Base Services

- GRAM Architecture rendered in OGSA
- The MMJFS runs as an unprivileged user, with a small highly-constrained setuid executable behind it.

MMJFS: Master Managed Job Factory Service
MJFS: Managed Job Factory Service
MJS: Managed Job Service

GRAM Job Submission Scenario

1. From an index service, the client chooses an MMJFS
GRAM Job Submission Scenario

1. From an index service, the client chooses an MMJFS

Client

Index Service

2. The client calls the createService operation on the factory, supplying RSL

MMJFS

3. The factory creates a Managed Job Service

MJS

4. The factory returns a locator

5. The client subscribes to the MJS’ status SDE and retrieves output

Index Service

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Index Service

Client
GT3 Base: Information Services

- Index Service as Caching Aggregator
  - Caches service data from other grid services
- Index Service as Provider Framework
  - Serves as a host for service data providers that live outside of a grid service to publish data

GT3 Base: Reliable File Transfer

- Reliably performs a third party transfer between two GridFTP servers
- OGSI-compliant service exposing GridFTP control channel functionality
- Recoverable Grid Service
  - Automatically restarts interrupted transfers from the last checkpoint
- Progress and Restart Monitoring

GT-OGSA Grid Service Infrastructure

- Grid Service Container
- User-Defined Services
- Base Services
- System-Level Services

- OGSI Spec Implementation
- Security Infrastructure
- Web Service Engine
- Hosting Environment

GT3 User-Defined Services

- GT3 can be viewed as a Grid Service Development Kit that includes:
  - Primitives designed to ease the task of building OGSI-Compliant Services
  - Primitives for provisioning security
  - Base services that provide an infrastructure with which to build higher-level services
GT3 User-Defined Services (cont.)

- User source files
- ANT
- Grid Service executable files
- GT3 Build Files
- User Build File

(Diagram inspired by Borja Sotomayor’s excellent tutorial on GT3)

Future Directions of GT

- Standardization of container model
- Development of lightweight container/api
- Adding rich support for queries
- Further refinements of Base Service designs
- Pushing on standardizing at a higher level than OGSI