A Brief Introduction to Grid Services

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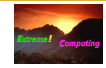
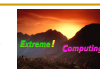
What are Grid Services?

- Grid Computing
  - Share information and processing capacities on Grid Resources
- Network-enabled entity that provides specific capability
- Interact with it using Messages
- Response behavior based on Service State
- Simple Internet Based Standards (XML, HTTP) for Interoperability
- Web Services with additional features
  - HTTP, SOAP, XML, (G)WSDL



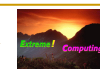
Grid Services Vs. Web Service

- Transient in Nature (Lifetime, Migration)
- Stateful Service
  - Service Data Elements (SDE)
  - Introspection
- GWSDL Vs. WSDL
  - Service Data Definitions
  - PortType (=Interface) Inheritance
- Standard Required Interfaces for all Services
  - Lifetime Management
  - Service Data Interaction
- Interfaces Predefined for Common Services

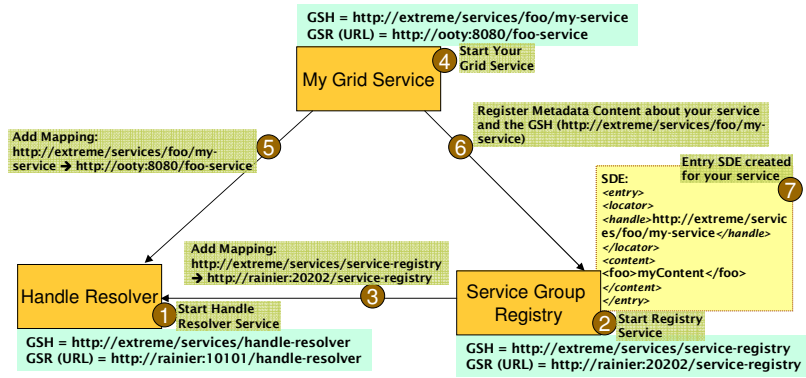


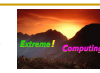
The OGSI Specification

- Open Grid Services Infrastructure (v1.0)
  - Global Grid Forum
- Standard Grid Service PortType
- Factory PortType – Service Creation
- Handle Resolver – Dynamic Location Lookup
  - Grid Service Handle (http://extreme/gannon/foo-service)
  - Grid Service Reference (http://rainier:8080/foo-service)
- Service Group – Register Service Metadata
  - Entry = Metadata Content + Service Location
- Notification PortType – Messaging service
- Web-Services Resource Framework (WSRF)

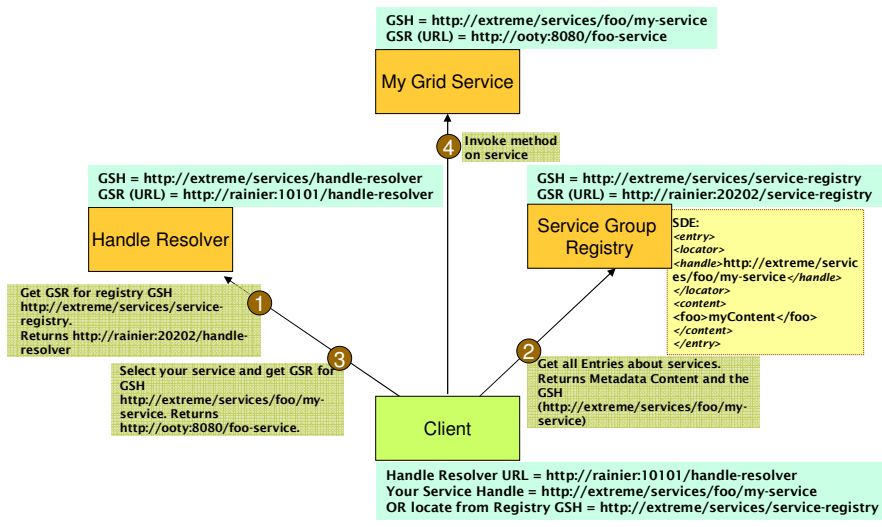


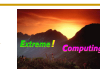
Grid Service Pattern





Grid Service Client Pattern

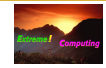




Introduction to Grid Services eXtensions (GSX)

What is GSX?

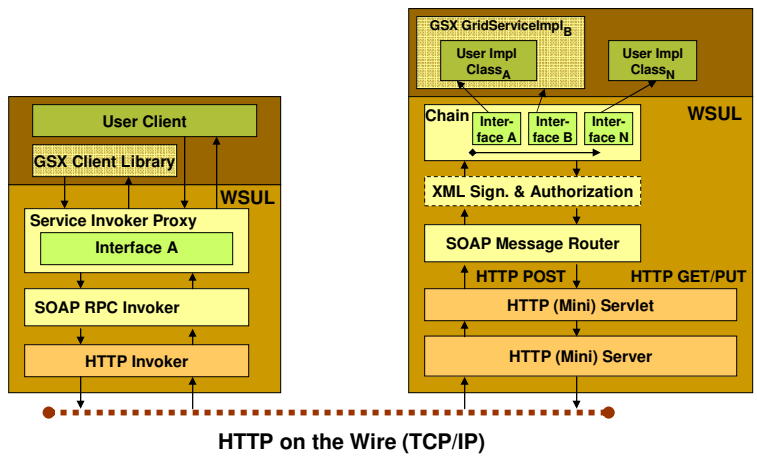
- Implementation of OGSI v1.0 Specification
- Lightweight Grid Services
  - Document as a Service?
- Experiment on Scalable Services
- Make it Simpler to write Grid Services
  - Predefined Interfaces and Implementations of Standard Grid Services (Resolver, Registry)
- Make it easier to run Grid Services
  - No starting Apache Tomcat HTTP Servers and deploying each service



Web Services Utility Library (WSUL)

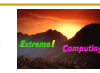
- A.k.a. XSUL ☺ [Alek Slominski]
- Mini HTTP Server
- Extensible – Add a stack of Message Processors
- SOAP Message Processing
- Message Routing
- XML Signature Processing
- Client side – SOAP Message Invocation
- Gives RPC view of XML document exchange

GSX/WSUL Communication Stack



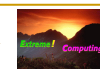
PortTypes implemented in GSX

- Grid Service PortType `GridServiceImpl.java`
  - Manage SDEs
  - Manage Service Lifetime
- Handle Resolver PortType `HandleResolverImpl.java`
  - Adding and Querying GSR-GSH Mappings
  - In-memory and Persistent (MySQL) versions
- Service Group Registry `ServiceGroup*Impl.java`
  - Adding and Querying Service Metadata Entries
  - In-memory and Persistent (Xindice XML DB) versions
- Extend `GridServiceImpl` and you have a Grid Service!
- Samples for starting Handle Resolver and Service Group are available



Managing Service Data Elements

- XML Metadata that describes the service's properties and state
  `<ogsi:interface>GridService</ogsi:interface>`
- Predefined Service Data Elements
  - Interface, ServiceDataName, GridServiceHandle, GridService Reference
- User Defined Service Data Elements
  - Any XML Document can be added
- Service Data Manager available to manage SDEs
  - In-memory and Persistent (Xindice XML DB) versions
  - Use SDM from within your code and SDEs are automatically available through `GridServiceImpl`



Document and RPC Styles

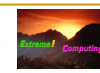
- Service's methods can have RPC or Document style

```
int sum(int j, int k) { return j + k; }
SumResponseDoc sum(SumRequestDoc) { ... }
```

- Invoke Services using RPC or Documents

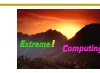
```
int j=5, k=6;
int i = sumServiceInvoker.sum(j, k);
(i == 11)
SumRequestDoc = <sum> <j>5</j> <k>6</k> </sum>
SumResponseDoc = DocInvoker.invoke(SumRequestDoc)
(SumResponseDoc == <sumResponse>11</sumResponse>)
```

- Even RPC style converts request to XML, but transparent to user (`sumServiceInvoker`)
- Document style useful when methods have to follow an XML Schema (e.g. OGSI Schema)
- RPC style useful for user defined methods



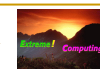
Grid Client Utility

- Grid Service PortTypes use document style
- Expect and return XML Documents
- Grid Client Utility gives RPC view of common Grid Service methods
- Wrap parameters into XML and unwrap responses
- Can override and call Grid Service methods directly using a document invoker



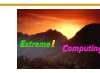
XML Beans

- All OGSI methods, parameters, service data elements have XML schema
  - GSH looks like `<handle>someURI</handle>`
- XML Beans gives Java Object view of XML Documents
  - `String gsh = gridServiceHandle.getHandle();`
- Get and set methods for all elements and attributes in XML Document
- Can compile any XML Schema into XML Beans Object classes
- ***You can pass complex types in GSX only as XML Bean Objects!!!***



Security – XML Signature and SAML

- WSUL provides an XML Signature module
- Client canonicalizes the SOAP Body and puts its Digital Signature in the header
- Verify signature at Service end and authenticate message
- Security Assertion Markup Language (SAML) used for Authorization
- Self contained signed tokens in header used to authorize the message request



Downloading and Using GSX

http://www.extreme.indiana.edu/xgws/GSX

Download ->

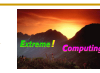
Distribution ->

GSX_1.0_RC_1_all.zip

$GSX_HOME/docs/index.html

faq.html

service_model.html



Questions?