

# Discovery of resources in a distributed GRID environment based on specific Service Level Agreements (SLAs)

D.Kollia, S.Kafetzoglou,  
M.Grammatikou, S.Papavassiliou

# Outline of the presentation

- What is GRID
- GRID and Quality of Service
- SLAs in GRID Environments
- Background information and Objectives
- The GRIA Grid middleware
- Contextualized discovery implementation

# Grid and Quality of Service (QoS)

- Guarantees on the reservation and availability of resources are required.
  - Grid technology is moving towards Web Services Technology.
- Quality of service attributes should be provided in terms of Service Level Agreements (SLAs).

# SLAs in Grid environments

- SLA is a contract between the service provider and the user.
- Charges for the resource usage and penalties in case of violation.
- Discovery of resources according to QoS criteria using SLAs.

# The GRIA Grid middleware

*Provides the appropriate web service interface through which service providers can offer their resources*

*The following software packages were used:*

- **Basic Application Services Package**
  - Data Service → data stager
  - Job Service → job
- **Service Provider Management Package**
  - SLA Management Service
    - Creation of the SLAs
    - Service management
  - Trade Account Service
    - Creation of Trade Accounts
- **Service Developer's Package**
  - Sample Service → sample resource (further specification)

# Contextualized discovery implementation

## ***Main Purpose:***

***Discovery of resources in the context of SLA templates in a distributed way.***

# Contextualized Discovery implementation

## ***Main Purpose:***

***Discovery of resources in the context of SLA templates in a distributed way.***

## ***Implementation environment:***

- Computer network consisting of three computer nodes.
- Each computer node has:
  - A GRIA site → SLA Management Service, Trade Account Service, Data Service, Job service, Sample Service
  - A contextualized registry (GRIA Registry Component)
  - XML representation of resources
  - Dynamic registration and discovery of resources using context information
  - Registry Domain Model (RDM) → concepts and relationships between concepts

# Steps of implementation- Discovery of resources

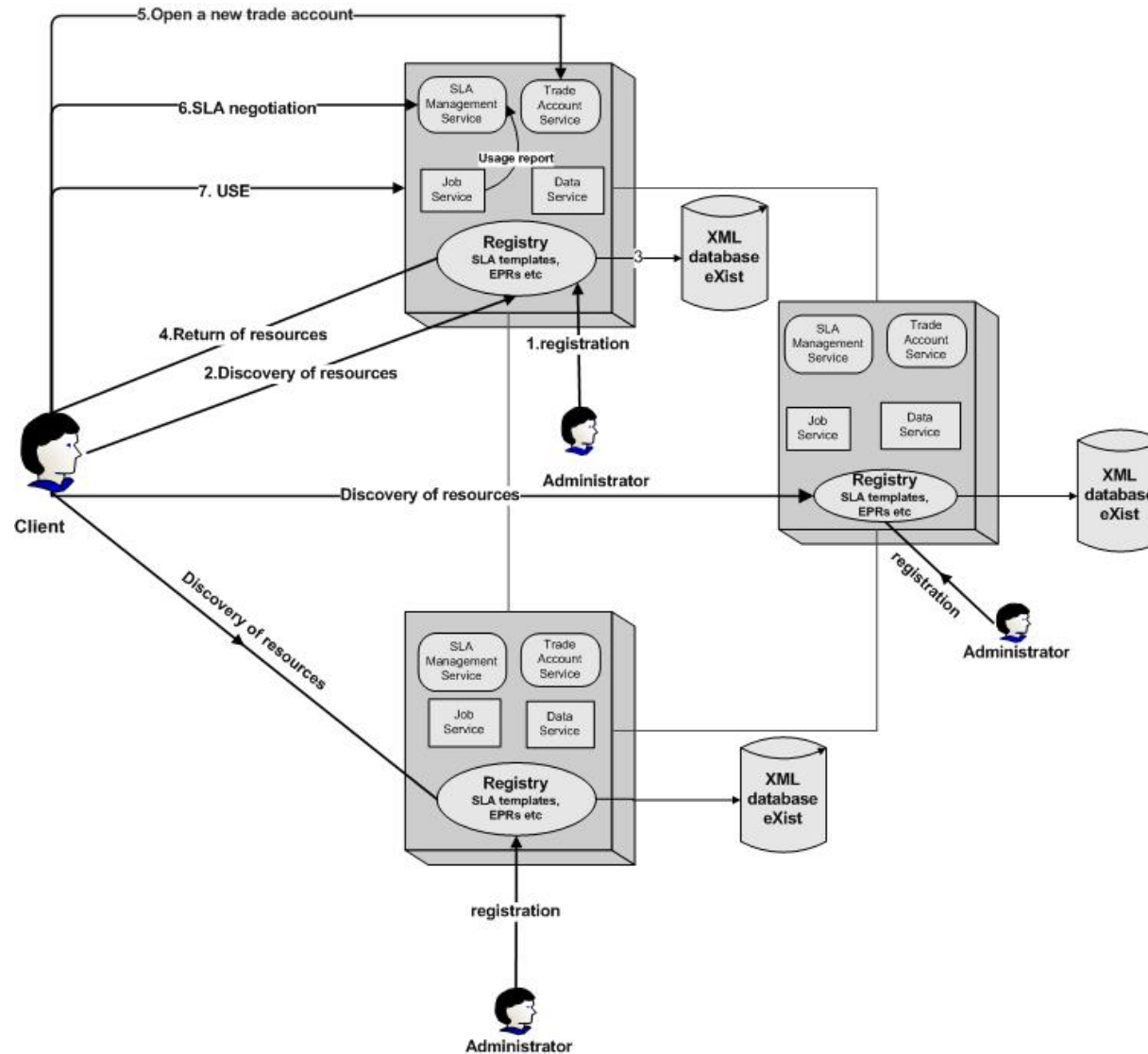
1. Registration of SLA templates, resources, services' EPRs into the registry under concepts.
2. Discovery of resources. The desired quality of service attributes are given in the form of a query in ooXmlQL.
3. Connection with the XML database eXist.
4. The database returns the requested resources which are:
  1. SLA Template in XML form
  2. Service EPR in XML form

# Steps of implementation -Agreement of the SLA

5. The user
  1. opens a Trade Account and
  2. proposes the SLA Template to the Service Provider.
6. The SLA is agreed if
  1. there is sufficient capacity of resources and
  2. the user has enough balance in his trade account.
7. The SLA is agreed, the service can be used.
8. Checks that guarantee that usage of the resources follows the SLA constraints.

Usage reports are sent to the SLA management service by the functional service.

# Steps of implementation



# Use Case 1 - Query

Discovery of the Image Service that provides satellite images of resolution of at least 10 Mpixels and at 0.01 EUR per pixel.

```
<query>
  <select>$template $epr</select>
  <declare name="ns1">http://it-innovation.soton.ac.uk/2005/grid</declare>
  <declare name="addressing">http://www.w3.org/2005/08/addressing</declare>
  <from as="$epr">
    <class name="Reference"/>
    <join on="holdBy" as="$refAble" class="SlaManagedService">
      <join on="canbemanaged" as="$template" class="SlaTemplate"/>
    </join>
  </from>
  <where>
    $template//constraints//constraint//metric//description="image-resolution" and
    $template//constraints//constraint//bound="LE" and
    $template//constraints//constraint//limit="10" and
    $template//pricingTerms//pricingTerm//price="0.01"
  </where>
</query>
```

# Results EPR

Searching in xmldb:exist://dimitra.netmode.ntua.gr:8080/exist/xmlrpc

Outputs:

0.ID: [7c333852.xml]

```
<EndpointReference xmlns="http://www.w3.org/2005/08/addressing">
```

```
<Address>https://dimitra.netmode.ntua.gr:8443/EO/services/SatelliteImageService</Address>
```

```
<Metadata>
```

...

```
<ns3:default xmlns:ns3="http://it-innovation.soton.ac.uk/2005/grid">
```

```
https://dimitra.netmode.ntua.gr:8443/EO/services/SatelliteImageService#14d65db2-171b9df5-0118-1cb0023g-0004</ns3:default>
```

```
</Metadata>
```

```
</EndpointReference>
```

# Results SLA Template

```
1.ID: [c88a1b14.xml]
<slaTemplate>
  <label>SLA Template for image service</label>
  ...
<constraints>
  <!-- This constraint limits the user to using up to 10 Mpixels any one time -->
  <constraint type="CUMULATIVE">
    <metric type="RESOURCE">
      <uri>http://www.EO.com/sla/metric/resource/image/resolution</uri>
      <description>
        <description>image-resolution</description>
        <instantaneous>image-resolution</instantaneous>
      </description>
      <units type="DECIMAL">
        <instantaneous>pixels</instantaneous>
      </units>
    </metric>
    <bound>LE</bound>
    <private>>false</private>
    <limit>10</limit>
    ...
  </constraints>
<pricingTerms>
  ...
  <price>0.01</price>
  <metric type="ACTIVITY">
    <uri>http://www.EO.com/sla/metric/resource/image/resolution</uri>
    ...
  </metric>
  ...
</slaTemplate>
```

# Results SLA Template (continue)

Results Found

Number of results is: 2

Searching in xmldb:exist://niobe.netmode.ntua.gr:8080/exist/xmlrpc

Outputs:

No results found!

Number of results is: 0

Searching in xmldb:exist://argugrid-server.netmode.ntua.gr:8080/exist/xmlrpc

Outputs:

No results found!

Number of results is: 0

*Only the Image Service provided by the host [dimitra.netmode.ntua.gr](http://dimitra.netmode.ntua.gr) offers satellite images with 10MPixels resolution.*

# Future work

Implementation within the EU ARGUGRID scenario of Oil detection.

Discovery of the satellite service that provides images in the most profitable combination of image quality, response time and regional coverage of the sea region contaminated by oil