

ICENI: A Jini based Grid Middleware for Exploiting federated resources

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Building Computational Communities

- Need to federate resources from real organisations
 - Express ownership and retain control
 - Grid resources are 'not' free – accountability/payment!
 - Manage the resources as a single unit
- Computational Communities (a.k.a. Virtual Organisations)
 - Share and combine heterogeneous resources
 - Ensure transparency by hiding complexity from the user
 - Optimise resource utilisation for all jobs and users
 - Easy to contribute (and withdraw) resources

Need Higher Level Knowledge

- Resources
 - Availability, capability, environment, access
- Application
 - Composition, behaviour, performance
- User
 - Who, what, when, where

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ICENI

The Iceni, under Queen Boudicca, united the tribes of South-East England in a revolt against the occupying Roman forces in AD 60.



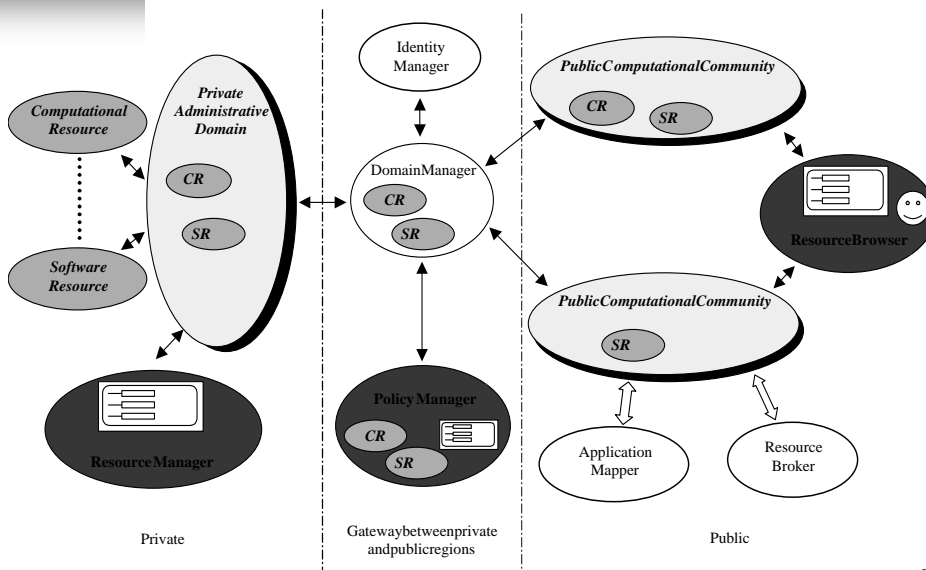
- IC E-Science Networked Infrastructure
- Developed by Grid Middleware Group
- Collect and provide relevant Grid meta-data
- Use to define and develop higher-level services

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Open Extensible Technologies

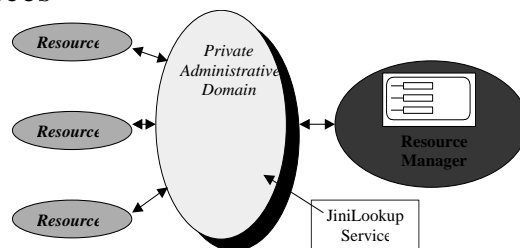
- XML used to define:
 - Resource, application, user meta -data
 - Protocol between different services in the system
- Java used to construct the framework, run -
time representation and interface to the
assembled components
- Jini used to provide a wide -area transport
layer that supports dynamic discovery and join
- Examining SOAP, WSDL, UDDI, .NET etc.

ICENI Architecture



Managing Internal Resources

- The resources advertise their capabilities to a private domain
- Three types of resources:
 - Computational resources
 - Storage resources
 - Software resources
- Annotate using XML



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What is a resource?

- Provides a service (i.e. interface) towards the users in the computational community
 - Allow them to connect to it
 - Executes their applications (for the computational resources)
- Set of static and dynamic attributes

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ResourceService:basicservice

```
//Definestheinterfaceforabasicresource
publicinterface ResourceService extendsjava. rmi.Remote,
IpcTraceableService {

    // Getstherepresentationoftheresource.
    public ResourceInfo getInfo();

    // Modifiestheresource.
    publicvoidmodify( ResourceElement oldValue,
ResourceElement newValue);

} //endinterface ResourceService
```

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ComputationalResourceService

```
//Definestheinterfaceforacomputationalresource
publicinterface ComputationalResourceService
extends ResourceService {

    //Executesajobonthisresource
    public boolean execute(String plan)
throws RemoteException;

} //endinterface ComputationalResourceService
```

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The service ResourceAP3000

```
//Implementation of the resource AP3000
public class ResourceAP3000 extends Resource implements
    ComputationalResourceService {

    public ResourceAP3000() throws RemoteException {
        super();
    } //end ResourceAP3000

    public boolean execute(String plan) throws RemoteException {
        return true;
    } //end execute

} //end class ResourceAP3000
```

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Definition of the resource

```
<resource name="ap3000"
  type="icpc.grid.resources.computational.ResourceAP3000"
  publish="jini://ariane.doc.ic.ac.uk/">
  <staticAttribute name="OS" value="Solaris" public="TRUE"
    classURL="..." />
  <staticAttribute ... />
  <dynamicAttribute name="queueStatus" public="TRUE"
    serviceURL="rmi://cnet0076.doc.ic.ac.uk/getAP3000NQSStatus"
    classURL="..." interval="5" property="data/xml/grid/private/queueStatus.prp"
  />
  <dynamicAttribute ... />
  <connection
    login="data/xml/grid/private/resourceAP3000_login.xml.enc"
  />
</resource>
```

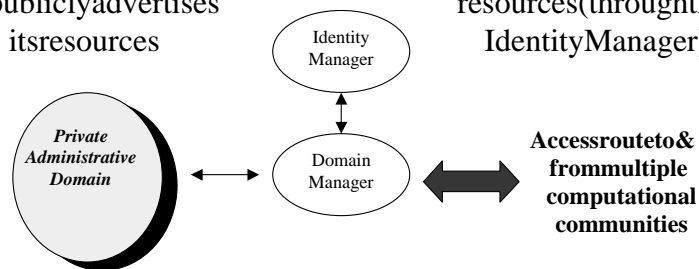
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The Domain Manager

Sole route between the private and the public areas of the infrastructure

Private → Public
Imposes local usage requirements and access and publicly advertises its resources

Public → Private
Authenticates requests to use the local resources (through the Identity Manager)



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Access to resources

- Recognise three entities: individuals, groups and organisations (or domains)
- Entities verified through public key architecture (Identity Manager)
- Locally managed access control list determine which entities have access to local resources

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Whocanaccesstheresources andwhen?

```
<domainManager manage="jini://jini.doc.ic.ac.uk/" name=" icpc">
  <promotedomain=" jini://trident.doc.ic.ac.uk/">
    <deny startDay="friday"><entitytype="group" name=" ra"/></deny>
    <allow><entitytype=" organisation" name="ICPC"/> </allow>
    <resource name="a p3000">
      <allow> <entitytype="person" name="nforSigned"/> </allow>
    </resource>
    <resource name=" atlas">
    </promote>
    <!-- DomainManager promotesresourcesinasecondJINI -->
    <promotedomain=" jini://ariane.doc.ic.ac.uk"> ...</promote>
  </domainManager>
```

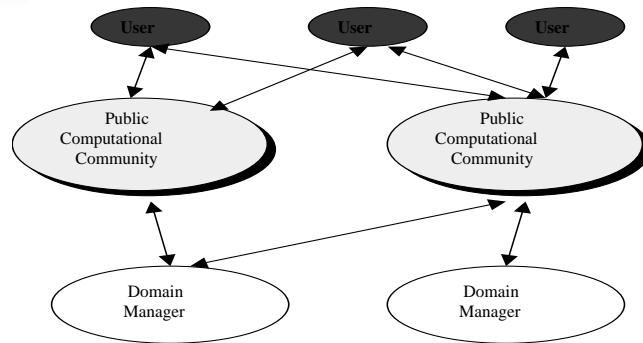
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Individuals, Groups & Organisations

```
<identificationOrganisation publish="jini://jini.doc.ic.ac.uk"
  name="ICPC" keystore="./data/security/keystore/keystore.ICPC">
  <group name="ala">
    <username="aem3Signed"/>
    <username="asm100Signed"/>
    <username=" nforSigned"/>
  </group>
  <group name=" ra">
    <username="asm100Signed"/>
    <username=" nforSigned"/>
  </group>
  <knownOrganisation name="inria" />
</identificationOrganisation>
```

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Interaction with the Computational Community



The Computational Community allows Users
& Domain Managers to advertise
their capabilities and requirements.

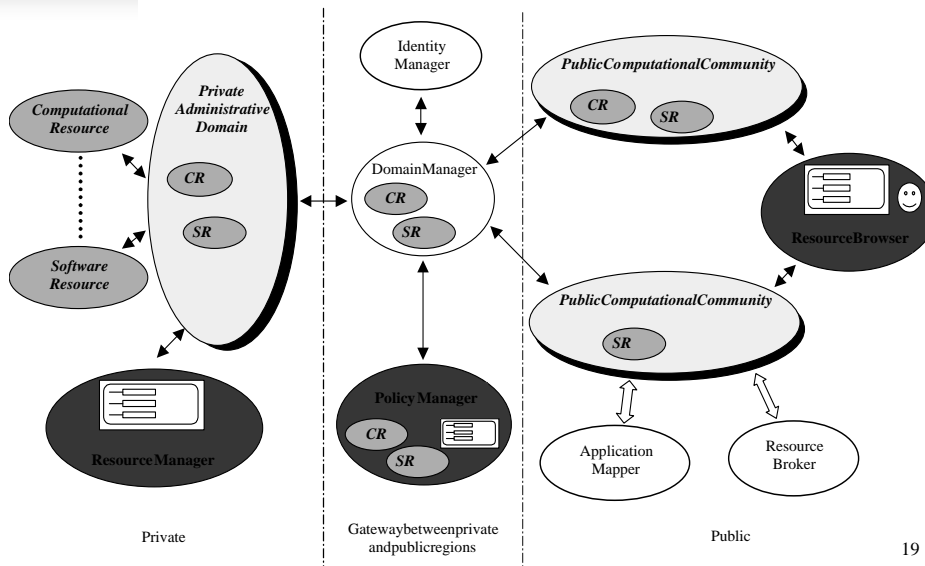
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Resources in a Computational Community

- When a resource is available, it is shown with all its public attributes and access policies.
 - It's possible to get the values of the dynamic attribute(s)
 - It's possible to connect to the resource (if there is an available connection)
 - The resource can be selected for the execution of an application.

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ICENI Architecture



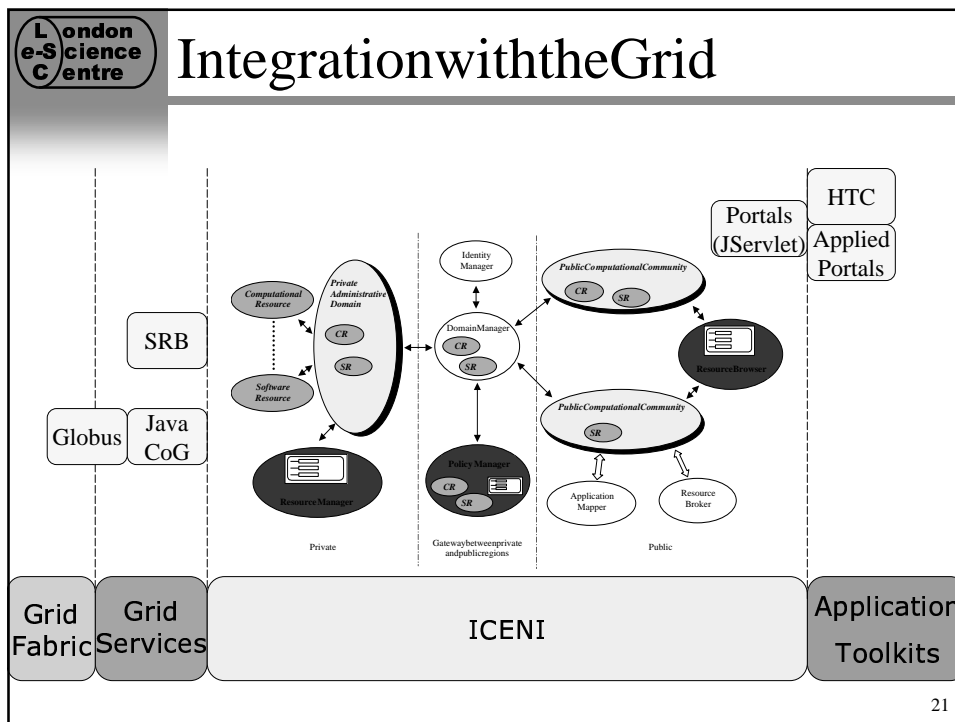
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Higher-level Grid Services

- **Application Mapper**
 - Uses resource and application information to optimise resource selection for an application (e.g. are 16 PC processors better than 8 Alpha processors?)
- **Resource Broker**
 - Uses computational economic to balance priorities (e.g. 16 underused PC processors may cost less for longer than 8 oversubscribed Alpha processors)
 - Factor queue length into resource selection (e.g. Will a slow unloaded resource provides shorter job turnaround time than a faster but heavily loaded resource?)

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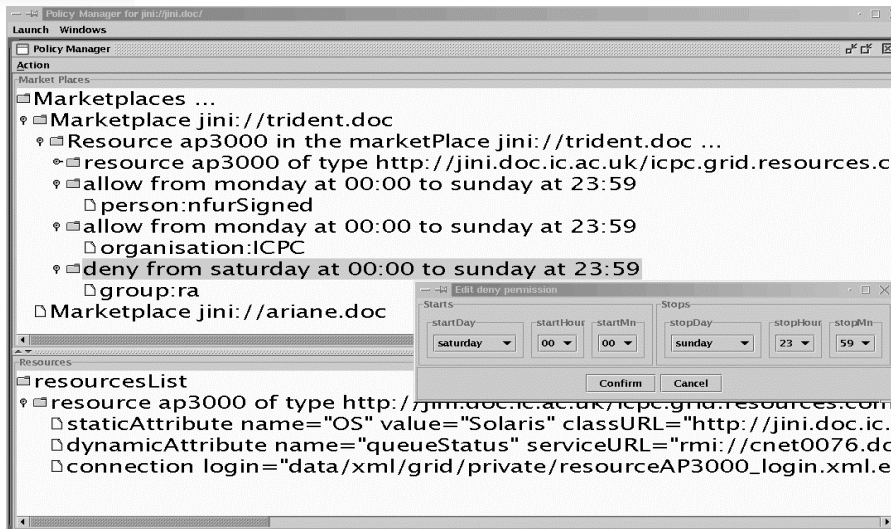
Integration with the Grid



Acknowledgements

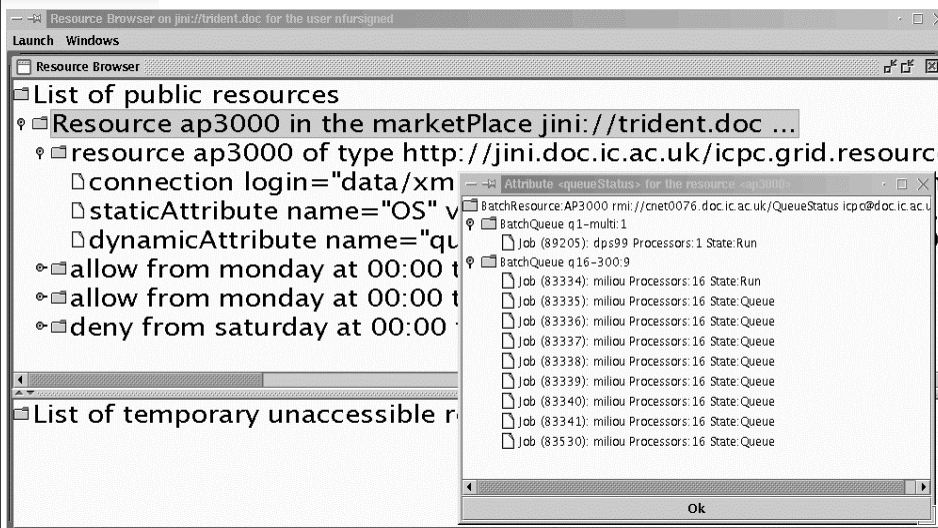
- Londone -ScienceCentre, GridMiddlewareGroup:
 - JohnDarlington, Steven Newhouse, TonyField
 - AnthonyMayer, Nathalie Furmento, Stephen McGough, JamesStanton, etc...
- Further information: <http://www.lesc.ic.ac.uk/iceni/>
- Contact: lesc@ic.ac.uk
- Slides available at http://www.doc.ic.ac.uk/~nfur/GGF4_Iceni.ppt

The PolicyManager GUI



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The ResourceBrowser GUI



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