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ICENI: A Next Generation Grid Middleware

Delivering e-Science

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The problem: Thermohaline circulation

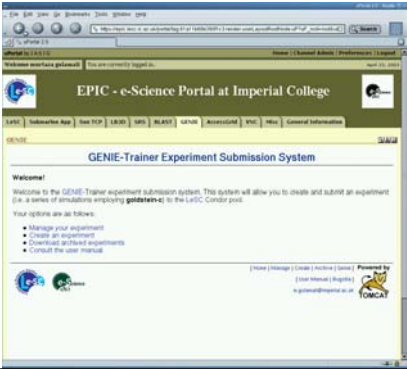
- Ocean transports heat through the "global conveyor belt."
- Heat transport controls global climate.
- Wish to investigate strength of model ocean circulation as a function of two external parameters.
- Use GENIE-Trainer.



- Wish to perform $31 \times 31 = 961$ individual simulations.
- Each simulation takes ~4 hours to execute on typical Intel P3/1GHz, 256MB RAM, machine \Rightarrow
time taken for 961 sequential runs ≈ 163 days!!!

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The GENIE channel within EPIC



EPIC - e-Science Portal at Imperial College

GENIE-Trainer Experiment Submission System

Welcome!

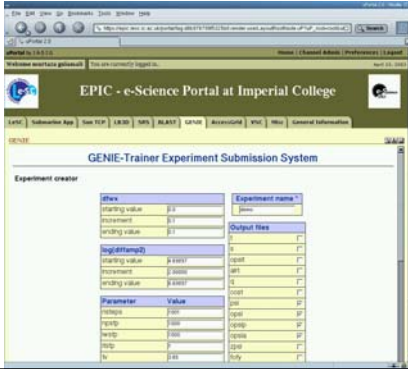
Welcome to the GENIE-Trainer experiment submission system. This system will allow you to create and submit an experiment (i.e. a series of simulations) using **geniescripts** to the LASC Condor pool.

Your options are as follows:

- Manage your experiment
- Create an experiment
- Download grid-based experiments
- Consult the user manual

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Create Parameter Search



EPIC - e-Science Portal at Imperial College

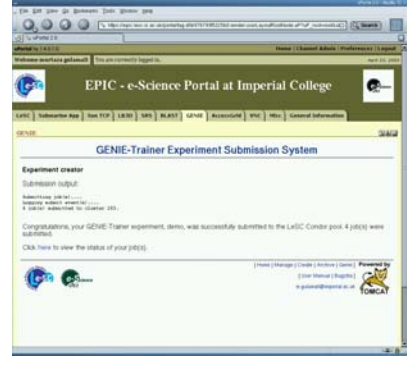
GENIE-Trainer Experiment Submission System

Experiment creator

Parameter	Value	Unit	Output files
Start	0	year	Start
End	100	year	End
Step	1	year	Step
Output	1	year	Output
...

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Submit into Condor pool



EPIC - e-Science Portal at Imperial College

GENIE-Trainer Experiment Submission System

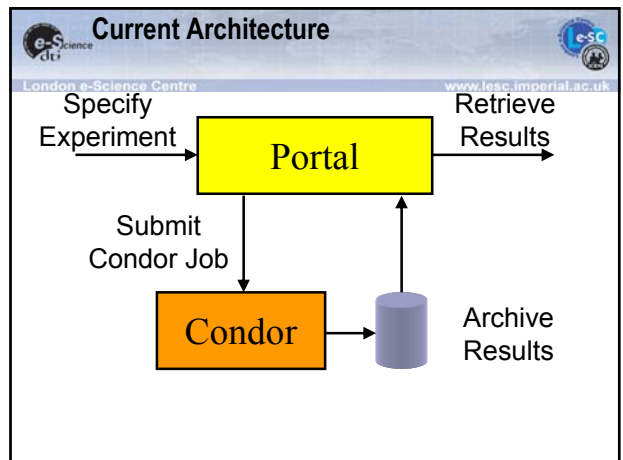
Experiment creator

Submission output:

Submission job id: ...
 Output files: ...
 A status message for cluster 203.

Congratulations, your GENIE-Trainer experiment, demo, was successfully submitted to the LASC Condor pool. 4 jobs were submitted.

Click here to view the status of your jobs.



The Solution: Delivering Grid Computing Resources

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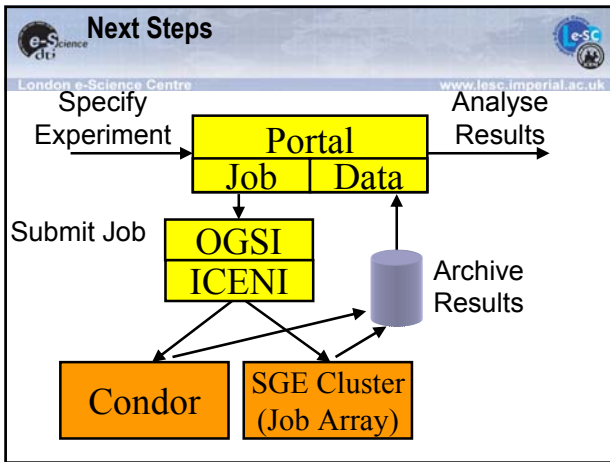
- Use flocked Condor pools between SReSC, DoC at Imperial College London, and LeSC (~200 Linux and Solaris nodes).
 - time taken for 961 Condor runs \approx 3 days!!!
- Advantages of Condor:
 - simulations are nearly parallel.
 - automatic check pointing and job migration.
 - Condor File Transfer Mechanism.
- Problems:
 - Firewalls! Overcame by designating and utilising port ranges specified by the Condor and firewall admin.

The Results: Scientific Achievements

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Intensity of the thermohaline circulation as a function of freshwater flux between Atlantic and Pacific oceans (DFWX), and mid-Atlantic and North Atlantic (DFWY).

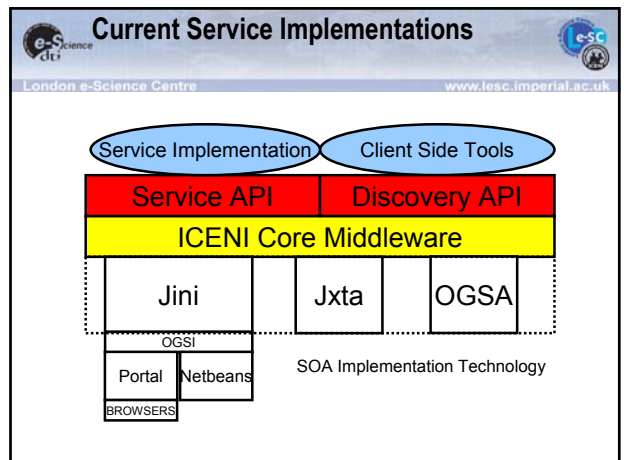
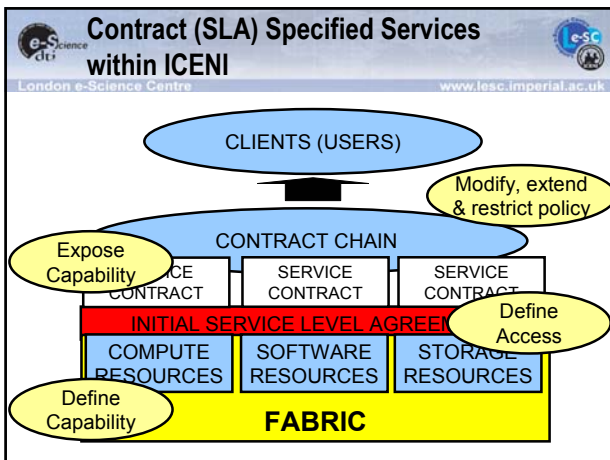
Surface air temperature difference between extreme states (off - on) of the thermohaline circulation. North Atlantic 2°C colder when the circulation is off.



ICENI: Imperial College e-Science Network Infrastructure

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- Interoperable and Integrated Grid Middleware
- Service Oriented Architecture (SOA) with rich Metadata Description
- Augmented Component Programming Model
- Service Federation govern by Usage Policy and Service Level Agreement
- Foundation for higher-level Services and Autonomous Composition



Netbeans ICENI Service Browser

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The screenshot shows the Netbeans IDE interface with the ICENI Service Browser plugin. The main window displays a circular network diagram where nodes represent service instances and lines represent dependencies or connections between them. The nodes are arranged in a ring, with some internal connections.

ICENI Portal

Specify location of service community

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The screenshot shows the ICENI Portal interface for specifying a service community. It includes a navigation menu on the left with options like Home, Logout, and Migrate. The main content area has a form with fields for Host (jps1.lesc.ac.uk) and Port (8082), and buttons for Reset and Submit. There are also sections for Resource Menu and Application Menu.

ICENI Portal

View available services

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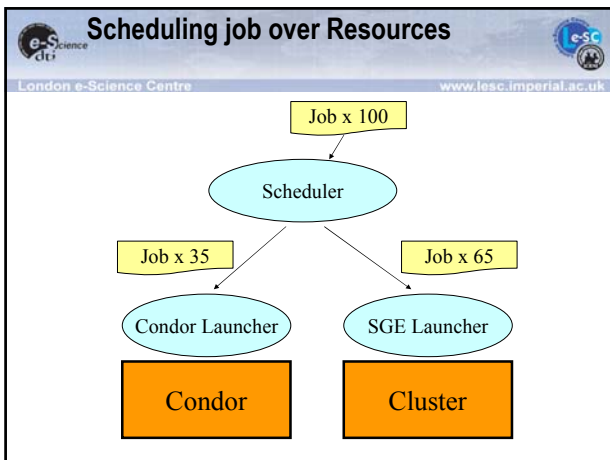
The screenshot shows the ICENI Portal interface for viewing available services. It displays a table of service instances with columns for Name and URL. The table lists 18 different service instances, including Public Software Resource instances and Deactivated core/notification services.

#	Name
1	Public Scheduling Framework Instance from jps1.lesc.ac.uk
2	Public Software Resource Instance from jps1.lesc.ac.uk
3	Public Software Resource Instance from jps1.lesc.ac.uk
4	Public Software Resource Instance from jps1.lesc.ac.uk
5	Public Software Resource Instance from jps1.lesc.ac.uk
6	Public Software Resource Instance from jps1.lesc.ac.uk
7	Deactivated core/notification/NotificationSubscriptionFactoryService
8	Public Software Resource Instance from jps1.lesc.ac.uk
9	Public Software Resource Instance from jps1.lesc.ac.uk
10	Deactivated core/notification/NotificationSubscriptionFactoryService
11	Public Software Resource Instance from jps1.lesc.ac.uk
12	Public Software Resource Instance from jps1.lesc.ac.uk
13	Public Software Resource Instance from jps1.lesc.ac.uk
14	Deactivated core/notification/NotificationSubscriptionFactoryService
15	Public Software Resource Instance from jps1.lesc.ac.uk
16	Handle Resolver
17	Public Scheduling Framework Instance from jps1.lesc.ac.uk
18	Container Registry Service

Composing and Submitting an ICENI Application

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The screenshot shows the ICENI Portal interface for composing and submitting an application. It displays a complex dependency graph with multiple nodes and arrows indicating dependencies between different service components. The interface includes a navigation menu and a main content area for the graph.



ICENI Semantic Service Adaptation Framework

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- Semantic Matching Service** performs service discovery based on Requirement of the Client and Capability of Available Services
- Adaptation Service** adapts requirement interface to service implementations.

The diagram shows the semantic adaptation process. On the left, a client requirement is expressed as `add3(int a, int b, int c)`. On the right, a service implementation is expressed as `sum(int[] a)`. A mapping is shown between the two, with the client requirement being adapted to the service implementation. The adapted requirement is shown as `AddService.add(1,2)`.

Prototype Implementation

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- Semantically annotate Services with RDF and OWL (ontology)
- Semantically matching Services using the Euler inference engine
- Service Adaptation using graph transformation rules

Demonstration


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- The movie of the demonstration is available at:

<http://www.lesc.ic.ac.uk/iceni/demos.html>
Item "Semantic Matching Service"

ICENI: An integrated Grid Middleware

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<http://www.lesc.ic.ac.uk/iceni/>

**ICENI Release 1.0
available !!!**

- ICENI Open Source licence (extended SISSL)
- Project website & mailing lists
- Daily builds, regression & automated deployment tests
- Documentation, manuals & user guide

Acknowledgements

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