

Grid Services and Microsoft .NET

# The MS.NETGrid Project

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# Overview

- **MS.NETGrid Project:**
  - Goals
  - Partners
  - Related Projects
  - Activities
- **MS.NETGrid-OGSI:**
  - High-level Design
  - Programming Model
- **MS.NETGrid Demonstrators**
- **Training Courses**

# Project Goals

- **Goals:**
  - Engaging and training the e-Science community in OGSI and .NET
  - Facilitate uptake of .NET for developing Grid services
- **Achieve via delivery of:**
  - Free-source OGSI implementation on .NET
  - Free-source Grid service demonstrators
  - Training materials
  - Training courses

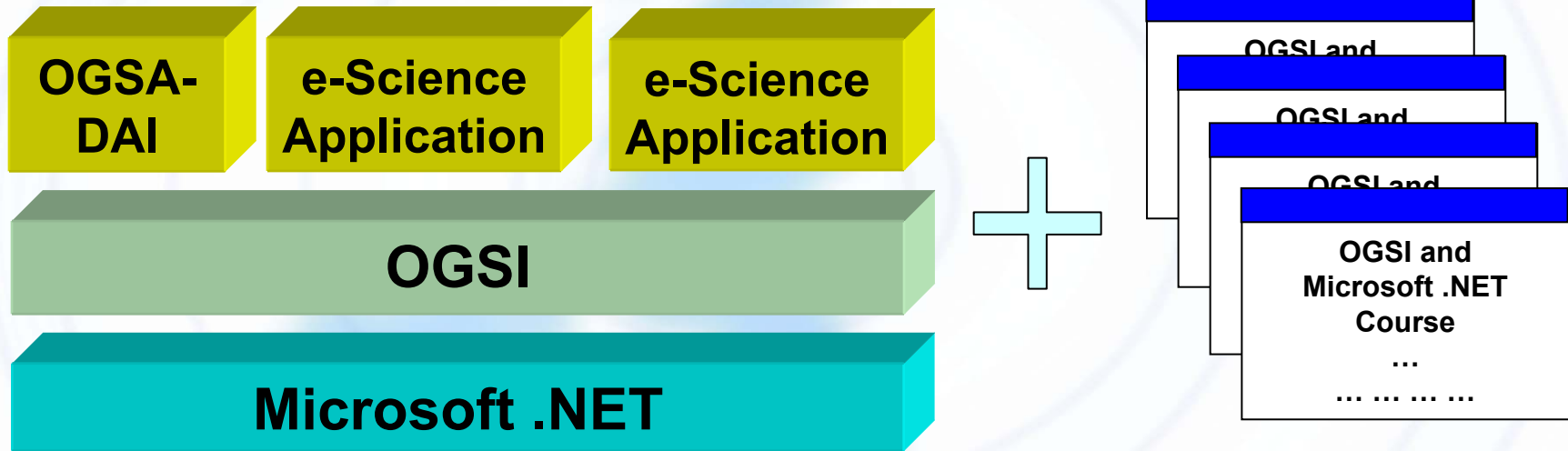
# Project Partners

- **EPCC:**
  - Project management
  - Design, development and implementation
  - Authoring training materials
  - Delivering training courses
- **Microsoft Research Limited (Cambridge):**
  - Technical consultancy and expertise
  - Provision of training materials
- **NeSC - UK National e-Science Centre:**
  - Production and negotiation of collaboration agreement
  - Hosting training courses
  - Technical consultancy and expertise

# Related Projects

- **Globus:**
  - Design and implementation of product-quality version of OGSI in Java
  - <http://www.globus.org>
- **University of Virginia:**
  - Design and implementation of OGSI on .NET
  - <http://www.cs.virginia.edu/~humphrey/GCG/ogsi.net.html>
- **GRASP Project / University of Salerno:**
  - Grid for Application Service Provision using commodity technologies
  - <http://eu-grasp.net>

# Project Activities



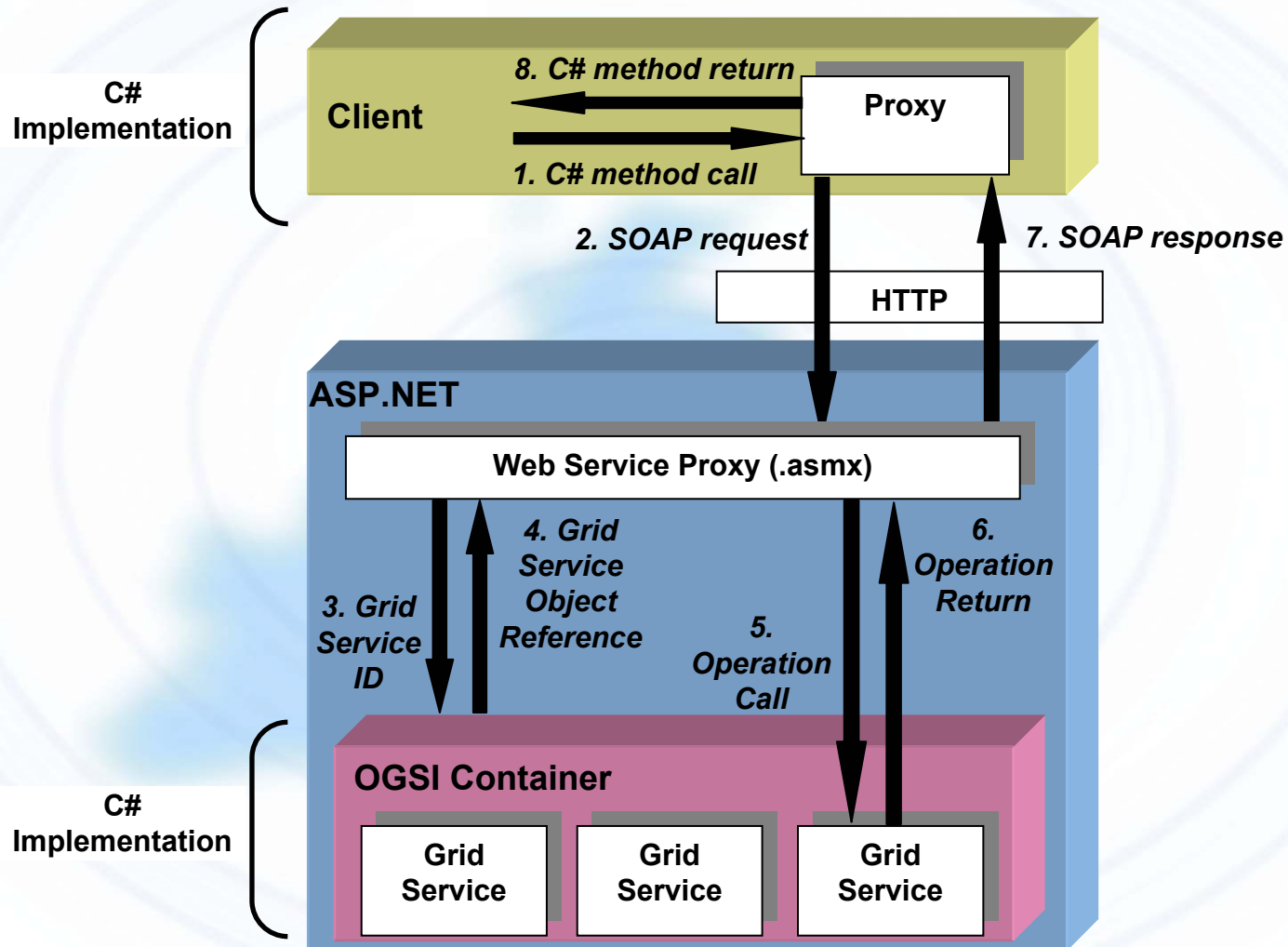
# Project Activities

- **Development of OGSI implementation - MS.NETGrid-OGSI:**
  - Design and implementation of OGSI on .NET
  - Leverage research from Globus and University of Virginia
  - Contribute experiences to development of OGSI .NET community
- **Development of Grid service demonstrators:**
  - Practical demonstration of the utility of OGSI on .NET
- **Production of training materials:**
  - Courses and supporting materials on OGSI and .NET
- **Delivery of training courses:**
  - Four training courses held at the e-Science Institute in Edinburgh

# MS.NETGrid-OGSI

- Implementation of OGSI on Microsoft .NET
- Leverages ASP.NET functionality
- Provides support for:
  - Grid service hosting in ASP.NET Web Services container
  - GridService portType-related functionality
  - Factory portType-related functionality
  - Service data management
  - Management of persistent and transient services

# High-level Design

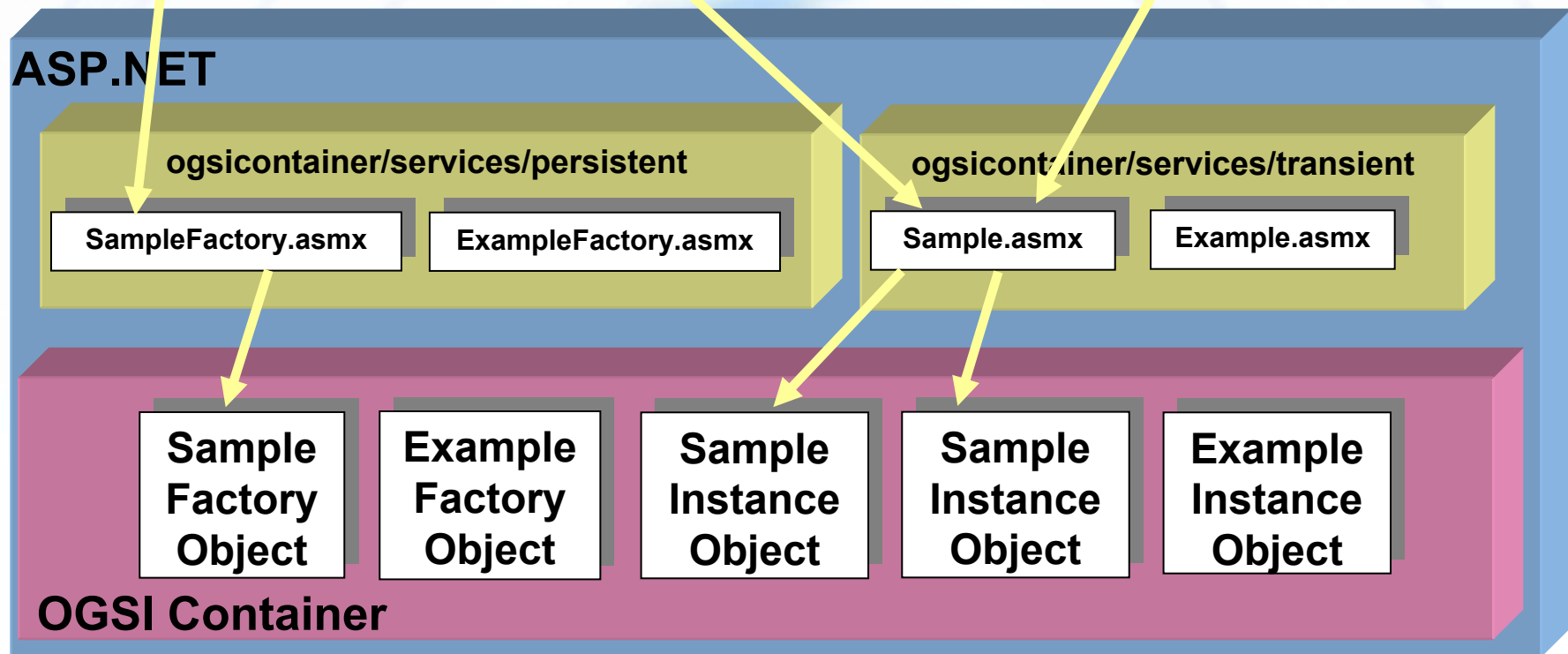


# Persistent and Transient Services

<http://host/Ogsi.Container/services/persistent/SampleFactory.asmx>

<http://host/Ogsi.Container/services/transient/Sample.asmx?instanceId=sampleInstance1>

<http://host/Ogsi.Container/services/transient/Sample.asmx?instanceId=sampleInstance2>



# Programming Model - Components

- **Service implementation class(es):**
  - `GridServiceSkeleton`-derived
- **Proxy class:**
  - Communications layer between outside-world and service implementation classes
  - Represents most-derived portType
  - Inherits from `GridServiceInstanceAspProxy` (which derives from ASP.NET class `WebService`)
- **ASP.NET Web service deployment descriptor:**
  - Location of classes, proxies
  - Service lifetime type
  - Application-specific information
  - `Web.config`

# Programming Model - Service Development

1. **Develop service implementation classes**
2. **Develop service proxy**
  - These could be generated from tooling - when tooling exists!
3. **Deploy service**

# Developing a Service Implementation

- **Inherit from GridServiceSkeleton:**
  - PersistentGridServiceSkeleton for persistent services
- **Add service methods (operation providers):**

```
public class MyHelloServiceImpl :  
    PersistentGridServiceSkeleton {  
    int i = 1;  
    public string SayHello(string name) {  
        return String.Format("Hello, {0} {1}", name, i);  
    }  
    ...  
}
```

# Developing a Service Proxy

- An ASP.NET Web Service with a twist:

```
// HelloService.cs
public class HelloService :
    PersistentGridServiceInstanceAspProxy {
    [WebMethod]
    // Any other ASP.NET attributes
    public string SayHello(string name) {
        object [] args = { name };
        return (string) CallMethod("SayHello", args);
    }
}
```

- Constructor gives reference to service instance object via container
- CallMethod invokes on service instance object
- Write .asmx file:

```
<%@ WebService Class="HelloService"%>
```

# Deploying the Grid Service

- **ASP.NET Web service configuration file: Web.config:**
  - `gridContainer.config/gridServiceDeployment` element
  - Add `gridServiceDeploymentDescriptor`:

```
<gridServiceDeploymentDescriptor  
  asmFileName="HelloService.asmx"  
  className="HelloServiceImpl"  
  assembly="HelloAssembly"  
  persistence="persistent" />
```

- **Copy assembly to bin/ directory of web-app**
- **Copy .asmx file to services/persistent directory**
- **Proxy generation and deployment could be automated:**
  - Use reflection on service class

# Operation Providers

- **IOperationProvider interface and OperationProviderBase class**

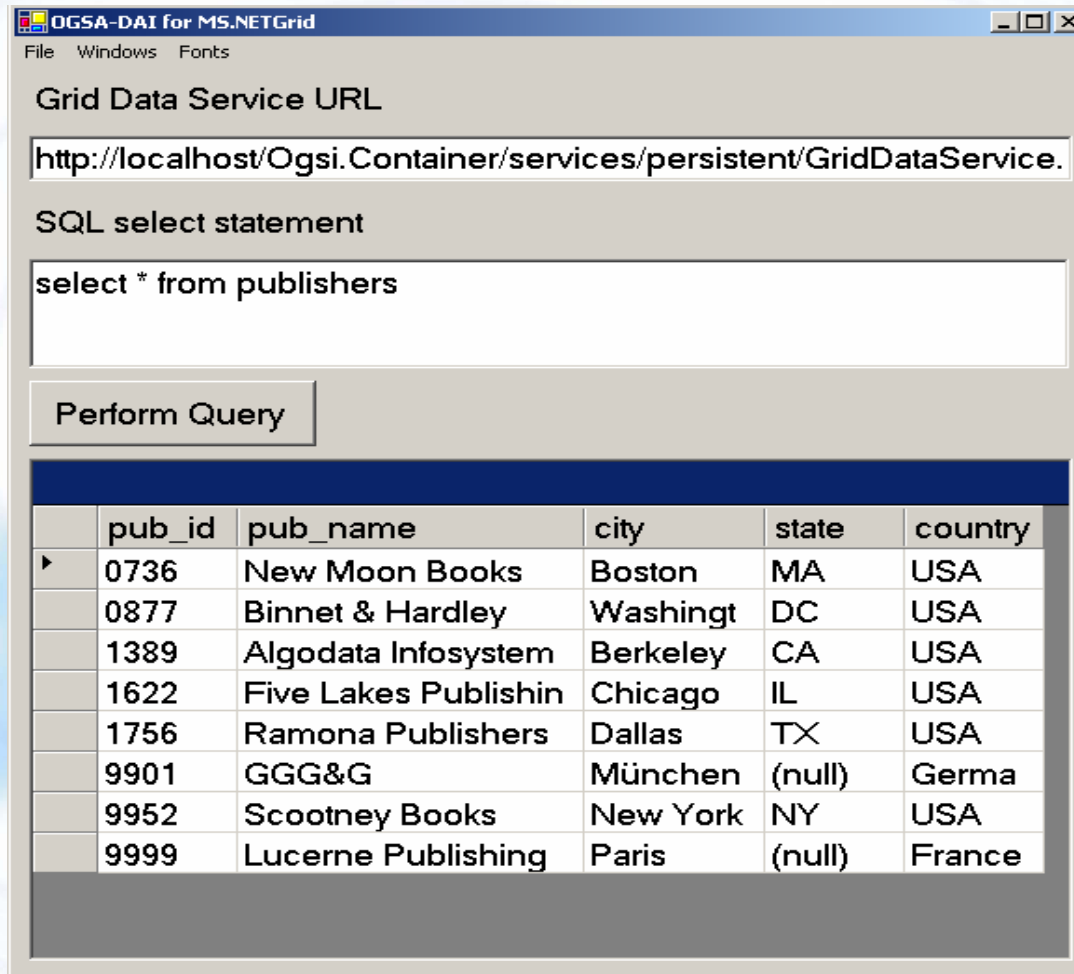
```
public class HelloPortType :
    OperationProviderBase {
    int i = 0;
    public string sayHello(string name) {
        return "Hello, " + name + " " + (++i);
    }
}

[OgsiPortType(typeof(HelloPortType),
    "someNamespaceUri", "HelloPortType")]
public class HelloServiceImpl :
    GridServiceSkeleton {
}
```

# MS.NETGrid Demonstrators

- Simple counter service
- Prime factors service
- Mock-up of a load monitoring service factory
- OGSA-DAI Grid Data Service:
  - Stripped down from full OGSA-DAI functionality
  - Execute queries on a back-end SQL Server database
  - Service-database communication over ADO.NET

# OGSA-DAI Grid Data Service



The screenshot shows a web application window titled "OGSA-DAI for MS.NETGrid". It has a menu bar with "File", "Windows", and "Fonts". The main content area is divided into sections:

- Grid Data Service URL:** A text input field containing the URL `http://localhost/Ogsi.Container/services/persistent/GridDataService.`
- SQL select statement:** A text input field containing the SQL query `select * from publishers`.
- Perform Query:** A button to execute the query.
- Results Table:** A table displaying the results of the query. The table has six columns: `pub_id`, `pub_name`, `city`, `state`, and `country`. The first row is expanded, showing a dropdown arrow on the left.

|   | pub_id | pub_name             | city     | state  | country |
|---|--------|----------------------|----------|--------|---------|
| ▶ | 0736   | New Moon Books       | Boston   | MA     | USA     |
|   | 0877   | Binnet & Hardley     | Washingt | DC     | USA     |
|   | 1389   | Algodata Infosystem  | Berkeley | CA     | USA     |
|   | 1622   | Five Lakes Publishin | Chicago  | IL     | USA     |
|   | 1756   | Ramona Publishers    | Dallas   | TX     | USA     |
|   | 9901   | GGG&G                | München  | (null) | Germa   |
|   | 9952   | Scotney Books        | New York | NY     | USA     |
|   | 9999   | Lucerne Publishing   | Paris    | (null) | France  |

# Training Courses

- “OGSI on Microsoft .NET”
- Designed for UK e-Scientists
- Four courses each for 25 attendees:
  - September 9<sup>th</sup>-10<sup>th</sup> 2003
  - November 4<sup>th</sup>-5<sup>th</sup> 2003
  - January 2004
  - February 2004
- e-Science Institute in Edinburgh
  - <http://www.nesc.ac.uk>

# Course Goals

- **Introduce / review:**
  - Grid Services
  - Microsoft .NET
- **Introduce OGSI on Microsoft .NET**
  - MS.NETGrid-OGSI
- **Use MS.NETGrid-OGSI:**
  - Develop a Grid Service
  - Develop a client
- **Introduce related OGSI on Microsoft.NET work**

# Course Outline - Day 1

- 09:30 - Welcome and Workshop Overview
- 09:45 - Grid Services
  - Web Services and XML
  - Grids, OGSA and OGSI
- 10:30 - BREAK
- 11:00 - Essential Microsoft .NET Concepts
  - .NET Framework Overview
  - C# Recap, Assemblies and Using Metadata
  - ASP.NET
- 12:45 - LUNCH
- 13:45 - OGSI and .NET
  - Why OGSI on .NET?
  - EPCC's MS.NETGrid-OGSI
  - Virginia's OGSI.NET
- 15:30 - BREAK
- 16:00 - Obtaining, installing and testing MS.NETGrid-OGSI
  - Practical
- 17:00 - END OF DAY 1

# Course Outline - Day 2

- 09:30 - Recap
- 10:00 - Developing a Grid Service 1
  - Practical
- 11:30 - BREAK
- 12:00 - Developing a Grid Service 2
  - Practical
- 13:00 - LUNCH
- 14:00 - Developing a Grid Service 3
  - Practical
- 15:00 - BREAK
- 15:30 - Miscellaneous:
  - MS.NETGrid-OGSI Demonstrators
  - Course Feedback
  - Discussion
- 16:30 - END OF DAY 2 - CLOSE

# Near Future

- **Revision of OGSI on .NET container**
  - Facilitating scalability and service persistence
- **Development of additional Grid service demonstrators:**
  - Practical demonstration of the utility of OGSI on .NET
- **Revision of training materials:**
  - Courses and supporting materials on OGSI and .NET
- **Delivery of additional courses**