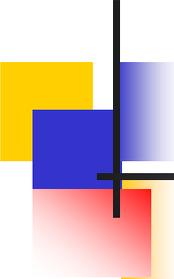


# Business Grid: Grid Computing Infrastructure for e-Business Solutions

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**Jen-Yao Chung, Liang-Jie Zhang**  
**IBM T. J. Watson Research Center**

April, 2003



# Agenda

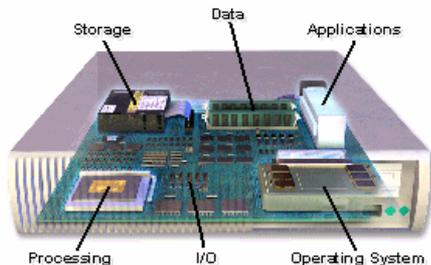
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- Introduction
- OGSA
- Grid Solution Architecture
- Business Grid
- Summary and Resources

# Grid Computing

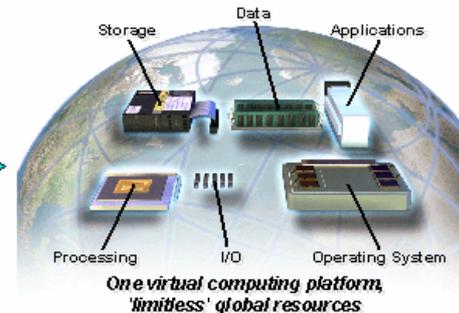
Grid computing provides a framework and deployment platform that enables resource sharing, accessing, aggregation, and management in a distributed computing environment

- Based on system performance, users' quality of services (QoS)
- Based on emerging open standards, such as Web services.



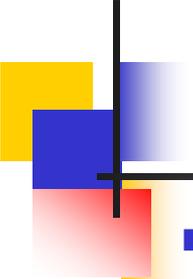
The Grid on Steroids

is happening fast



Computer

Grid



# Grid Powered by Technology Suite

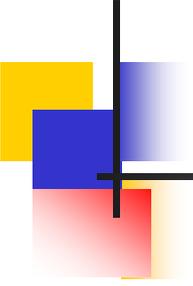
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- Timely, Reliable, Sophisticated, Technologies
- Huge Talent Pool
- Developing Standards
- Driving Innovation
  - UDDI
  - XML
  - Globus
  - Linux
  - SOAP
  - HTTP
  - Java
  - TCP/IP
  - HTML
  - WSDL

# Web Services and Grid Computing

- Web Services is a generic solution for addressing interoperability in distributed environments (e.g. WSDL, SOAP, XML)
- Grid is the natural extension of Web services for solving REAL problems in the business and scientific computing domains
- Open Grid Services Architecture (OGSA) is a distributed interaction and computing architecture
  - It is based around the Grid service, assuring interoperability on heterogeneous systems.
  - It leverages the emerging Web services to define the Web Services Definition Language (WSDL) interfaces for Grid service.



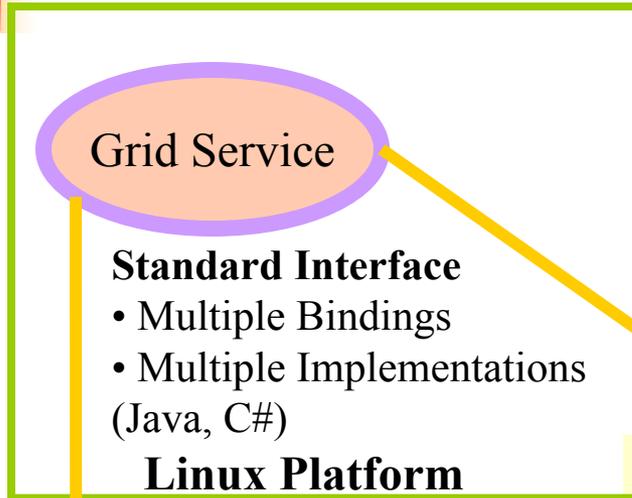


# Agenda

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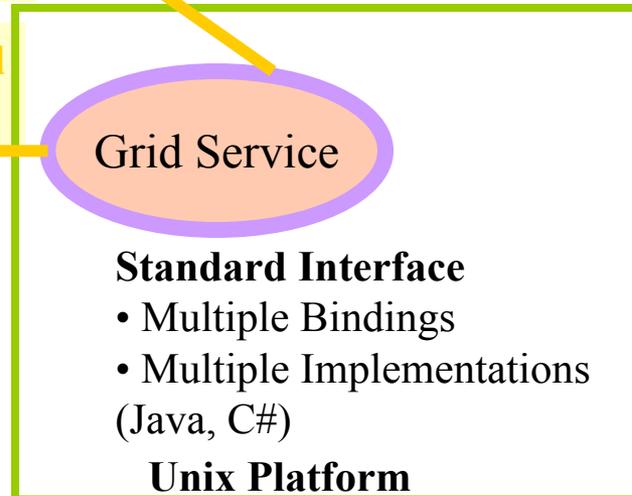
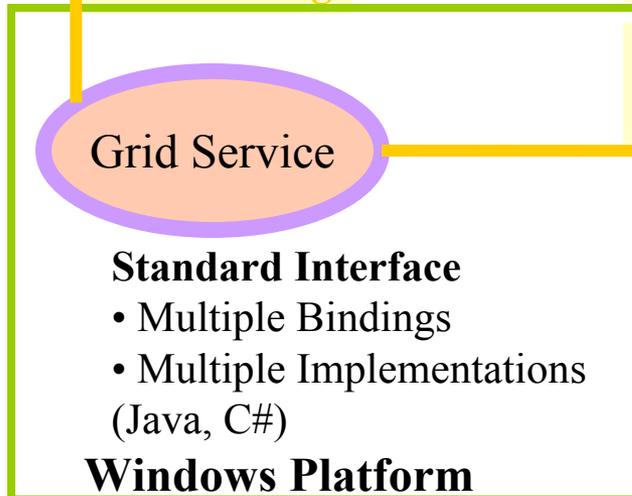
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# Open Grid Services Architecture (OGSA)



## Service Oriented Architecture (GRID+Web Services+Toolkit)

All the services (persistent or transient) are built on Globus Toolkit

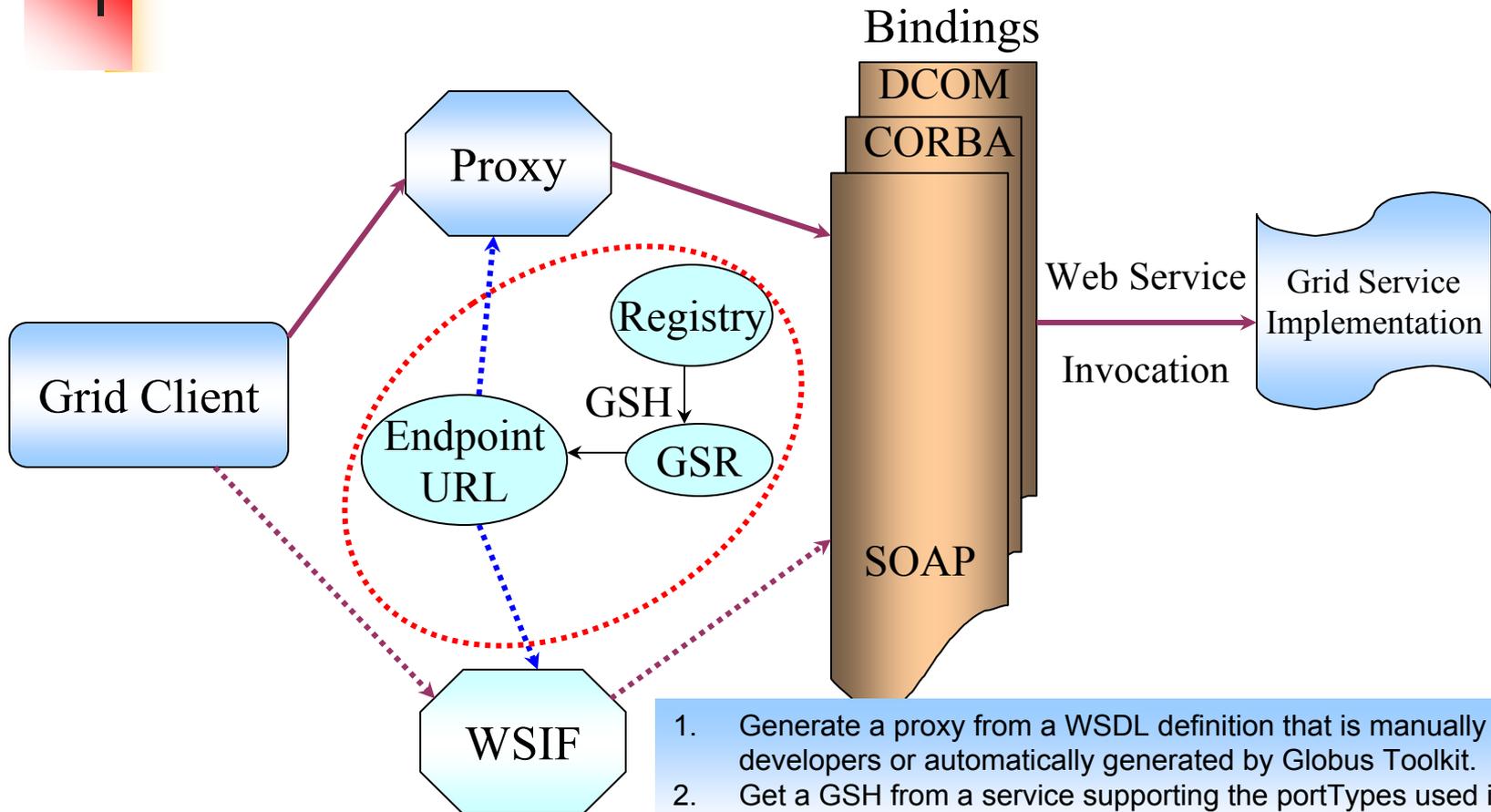


Secured Msg

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# Invocation of Grid Service

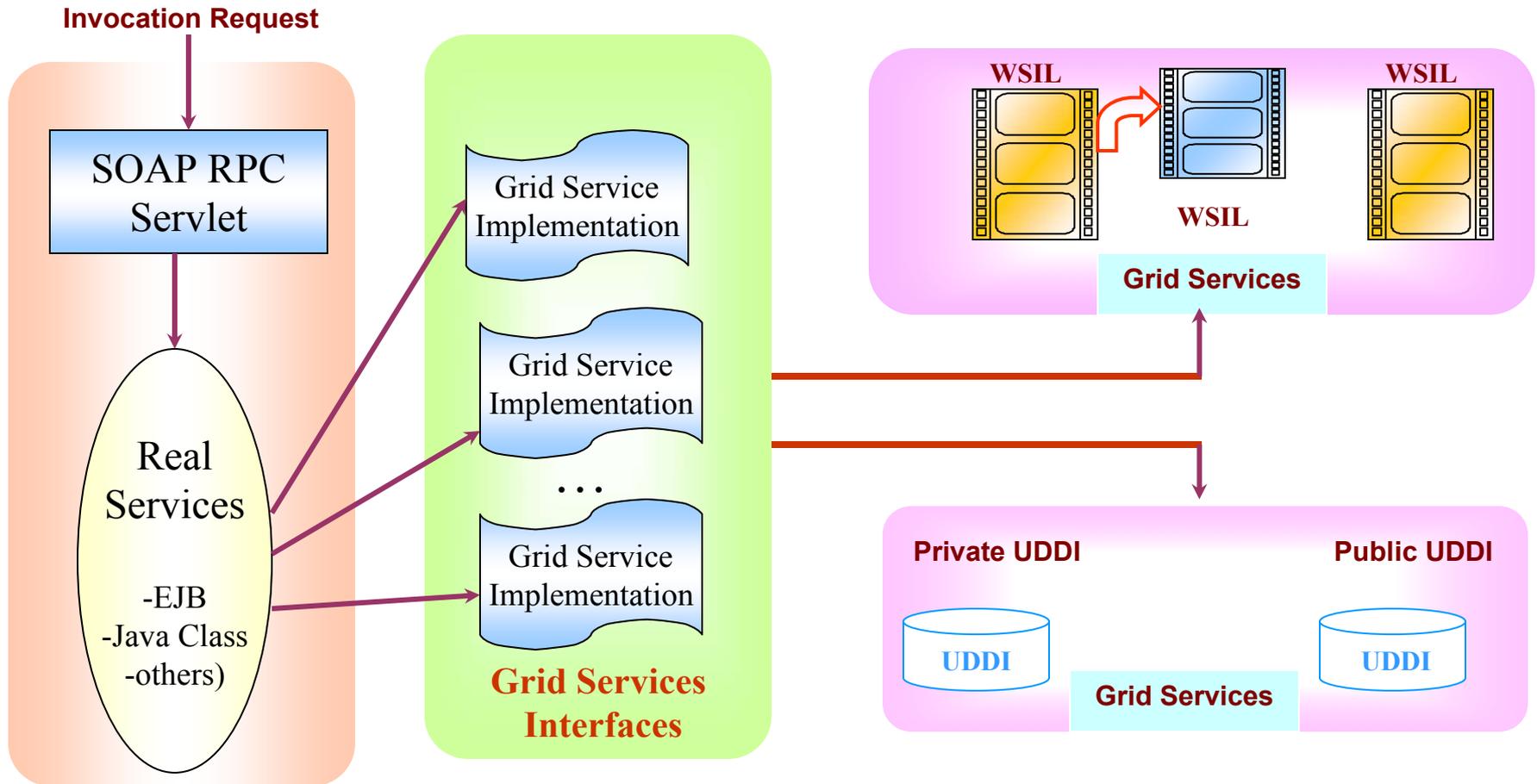


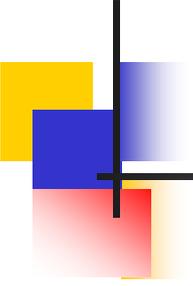
1. Generate a proxy from a WSDL definition that is manually created by developers or automatically generated by Globus Toolkit.
2. Get a GSH from a service supporting the portTypes used in Step 1 from a Grid service registry such as WSIL document or UDDI registry.
3. Invoke HTTP Get with the WSDL option on the GSH to get the GSR, and extract the endpoint URL.
4. Pass in the endpoint URL found in Step 3 to the proxy generated in Step 1, and start making invocations on the service.

# Deployment and Publishing

## Deployment

## Registry





# Agenda

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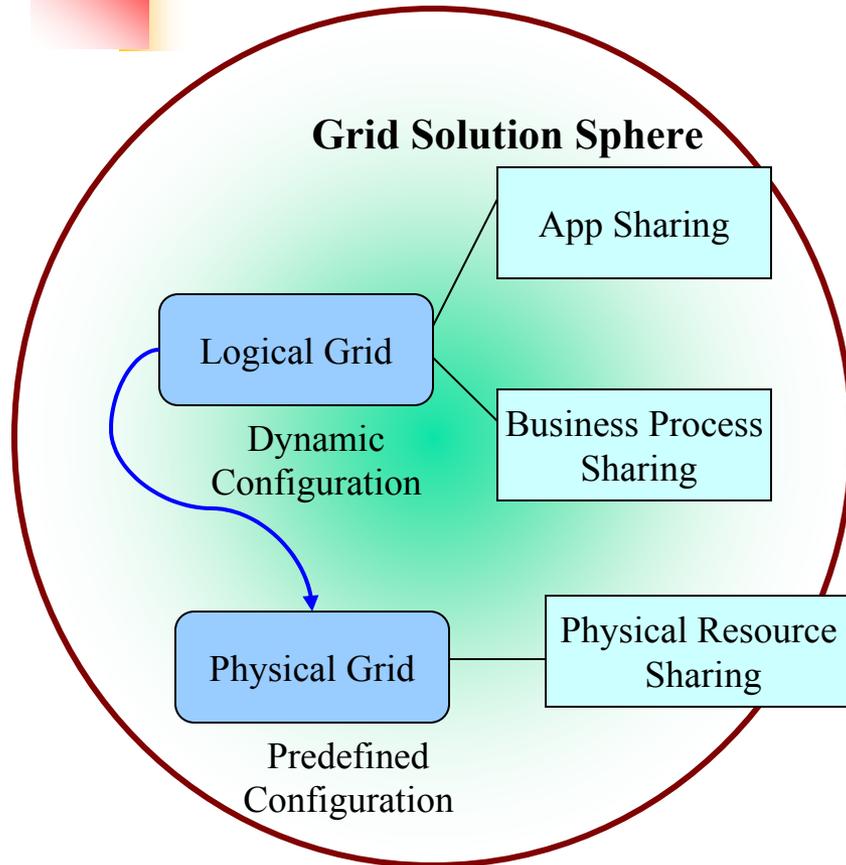
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# Challenging Issues of Building Grid Solutions

- Need comprehensive administration
- Need resource provisioning
- Need adaptive application integration
- Need flexible data sharing and access
- Need activity monitoring
- Need policy-based Grid management mechanisms

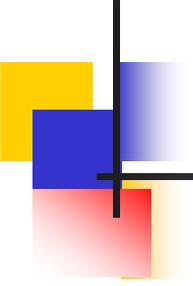


# Grid Solution Sphere



- Our proposed OGSA-based Grid solution architecture
- Grid Solution Sphere includes both logical Grids and physical Grids
  - The physical Grid refers to computer power and other hardware resources that can be shared over a distributed network. This is a predefined configuration for a specific task.
  - The logical Grid refers to software and application sharing, as well as higher level business process sharing. A logical Grid can be dynamically configured based on customer requirements.

Next: **Business Grid** is a typical collaborative logical Grid solution for business process integration.



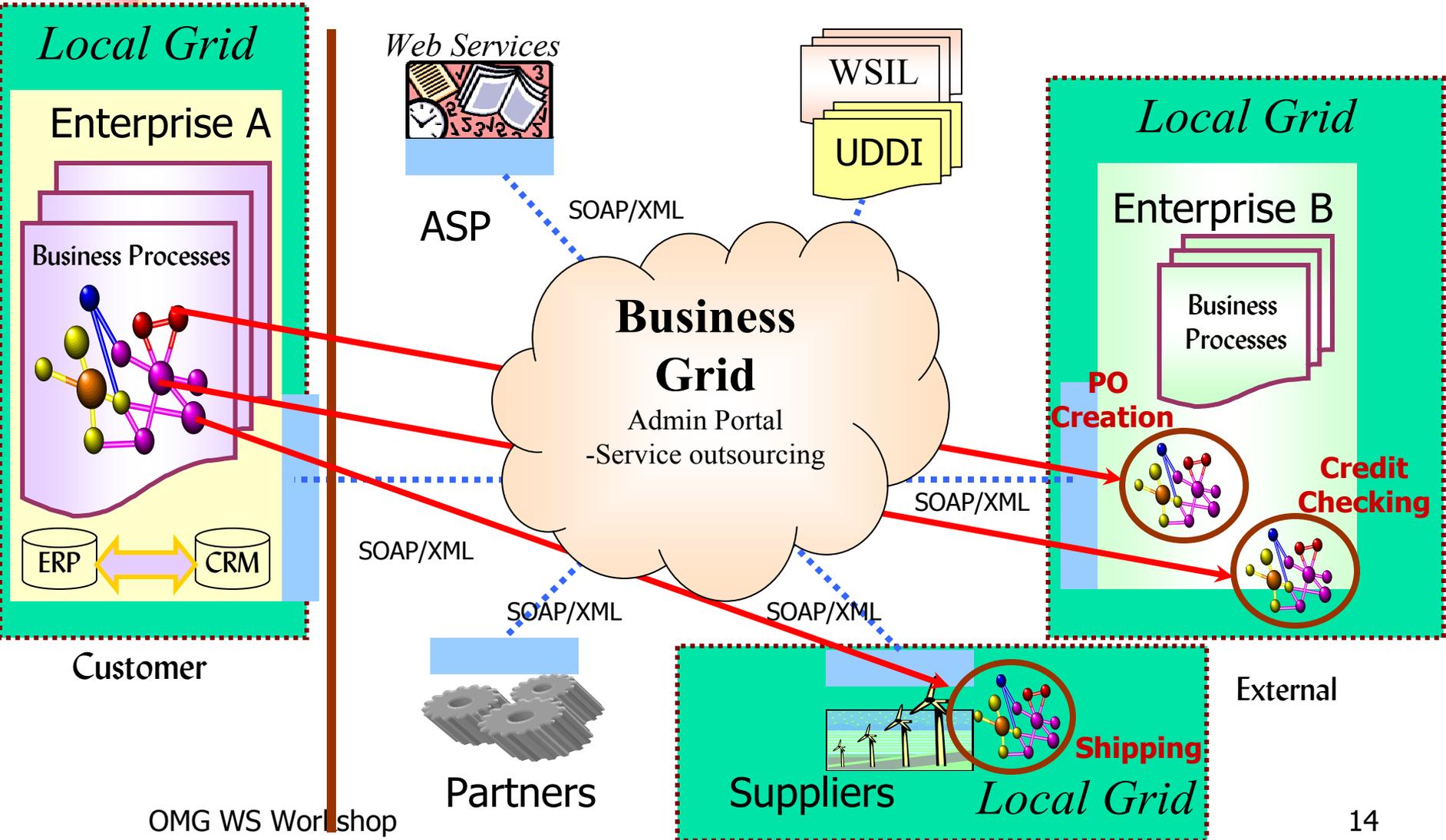
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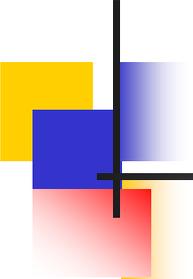
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# Business Grid example

Enable Grid computing for business process outsourcing





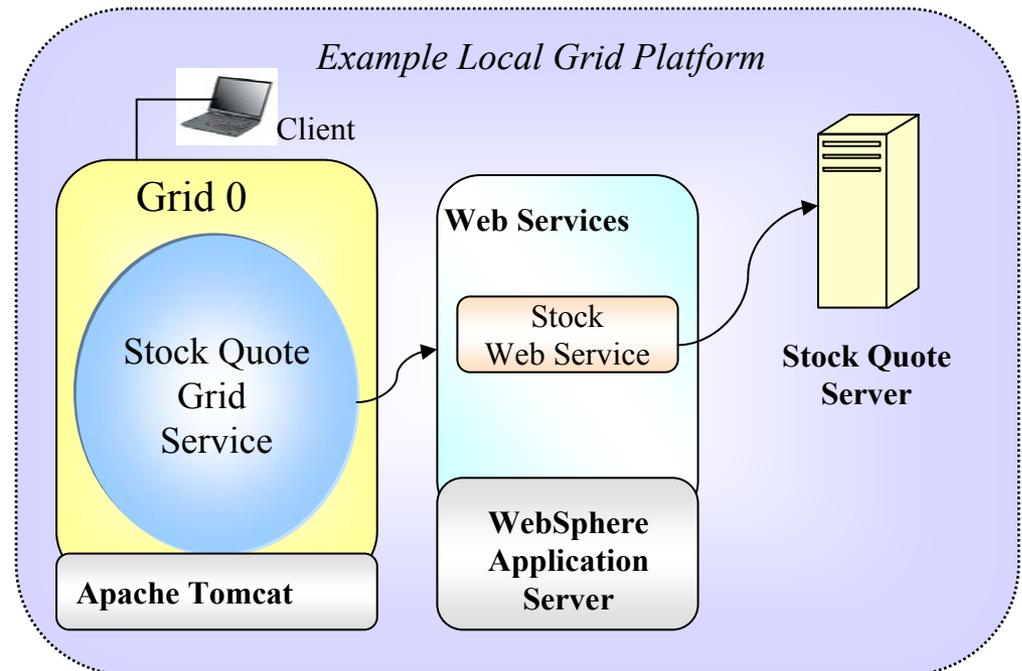
# Business Grid components

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- Comprehensive administration for business entities and users on-boarding
- Grid service provisioning for external
- Dynamic Grid services composition based on business requirements
- Utilities like Grid services discovery and capability matching
- Adaptive business process driven application integration
- Flexible and secure data sharing and access
- Business activity monitoring and policy-based management mechanisms

# Integration of Grid Services and Web Services

- One Grid service interface for integrating one or more Web services
- The implementation of Grid service invokes one or more Web services
- Web services get the real job done



# OGSA Grid service browser

Part of Globus Toolkit

The screenshot shows the OGSA Service Browser interface. The address bar displays the URL: `http://127.0.0.1:8080/ogsa/services/base/registry/ContainerRegistryService`. The interface includes a search section with a "Service Data Name" input field, a "Query By Name" button, and a "Type Namespace" input field. Below this is a "Registry Inspection" section with a "Table" tab selected, showing a list of services. The "Sample Stock Service (Gateway to Live Service)" is highlighted in blue. At the bottom right, there is an "Auto update" checkbox.

Description	
Sample Basic Counter Factory Service	http://1
Sample Delegation Counter Factory Service	http://1
Sample Logging Counter Factory Service	http://1
Sample Secure Counter Factory Service	http://1
Sample Notification Counter Factory Service	http://1
Sample Sink Listener Factory Service	http://1
Sample Weather Service (Gateway to Live Service)	http://1
<b>Sample Stock Service (Gateway to Live Service)</b>	<b>http://1</b>

Stock  
Grid  
Service

# Grid service instance creation

The screenshot shows the OGSA Service Browser window for the service `http://192.168.0.21:8080/ogsa/services/samples/stock/StockFactoryService`. The interface includes a 'Services' tab and a 'WSDL' tab. A 'Timeout(seconds):' input field is visible. Below this is a table with the following content:

Description	
Gateway to Live Service)	<code>http://192.168.0.21:8080/ogsa/s</code>
	<code>http://192.168.0.21:8080/ogsa/s</code>

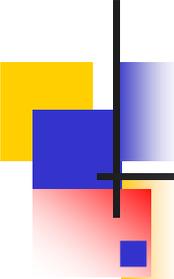
At the bottom of the window, there is an 'Auto update' checkbox and a 'Refresh' button. A red dotted oval highlights the 'Instance name: MyStockGridService' text and the 'Create Instance' button.

MyStockGridService

# Stock Grid service invocation

The screenshot shows a web browser window titled "[http://192.168.0.21:8080/ogsa/services/samples/stock/StockFactoryService/MyStockGridService] - OGSA Service Browser". The address bar contains the URL "http://192.168.0.21:8080/ogsa/services/samples/stock/StockFactoryService/MyStockGridService" and a "Go" button. Below the address bar are two tabs: "Services" and "WSDL". The "Services" tab is active, showing a "Grid Service" section with a "Service Data Name:" input field, a "Query By Name" button, and a "Type Namespace:" input field. Below this is a large empty white area. Further down is a "Timeout(seconds):" input field. The "Stock Example" section contains a "Symbol:" input field with "IBM" entered, a "Set" button, a "Quote:" label with "79.35" displayed, and an "Update" button. A dashed orange oval highlights the "Symbol:" input field, "Set" button, "Quote:" label, and "Update" button.

(10:00AM on August 17, 2002).



# Towards Autonomic Computing

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## ■ Self-protecting

- System designed to protect itself from any unauthorized access anywhere

## ■ Self-optimizing

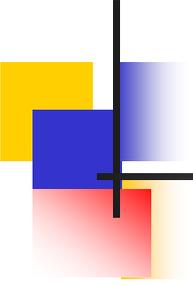
- System designed to automatically manage resources to allow the servers to meet the enterprise needs in the most efficient fashion

## ■ Self-configuring

- systems designed to define itself "on the fly"

## ■ Self-healing

- Autonomic problem determination and resolution



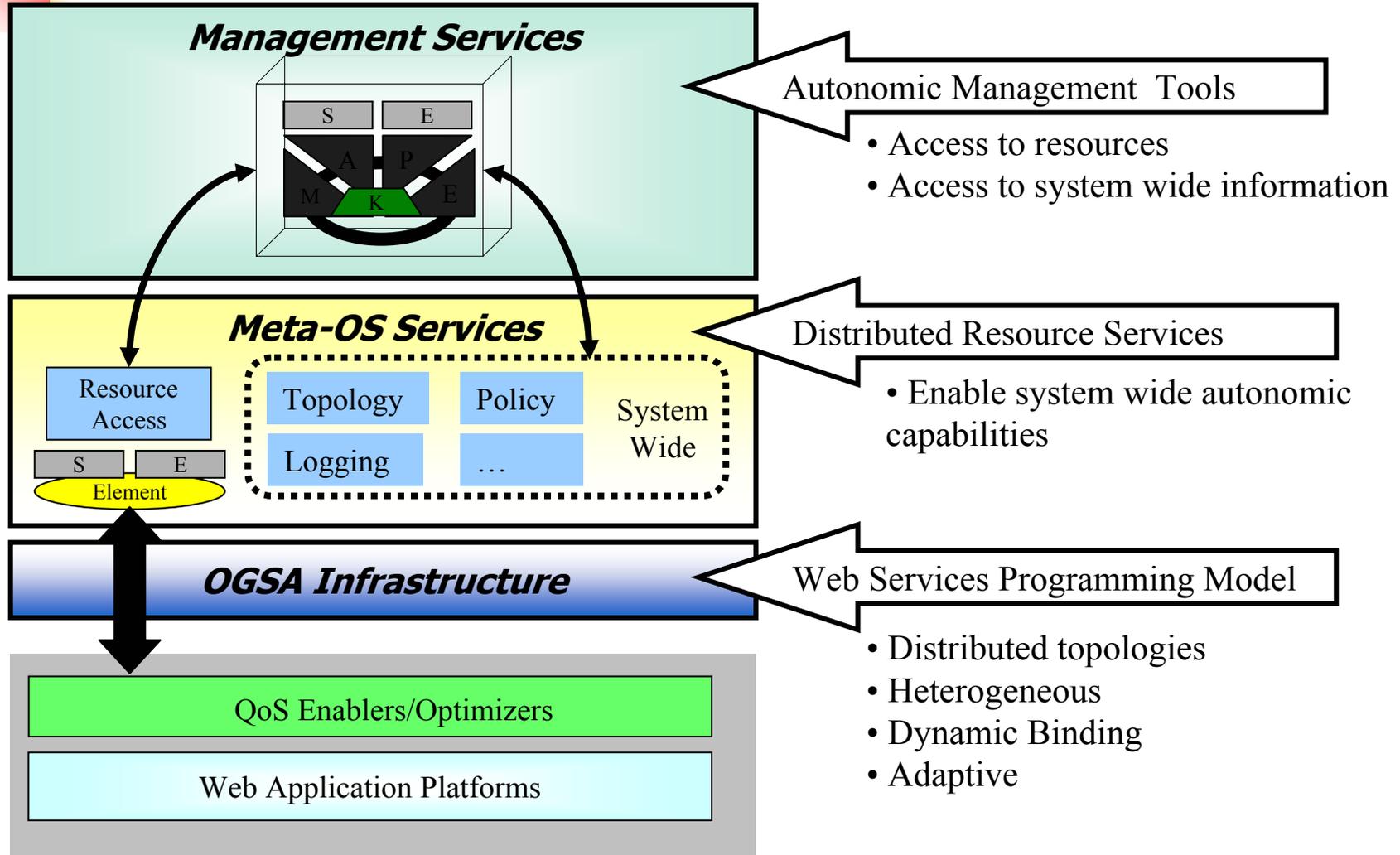
# Autonomic Computing

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- **Manage the infrastructure**

- Autonomic elements are functions in a system that monitor activities and adjust the system to accomplish system wide policy.
- Provisioning is a task that needs to be instrumented in all applicable autonomic elements. The element provides appropriate sensors for sending resource utilization status, and effectors for re-allocation of the resource.

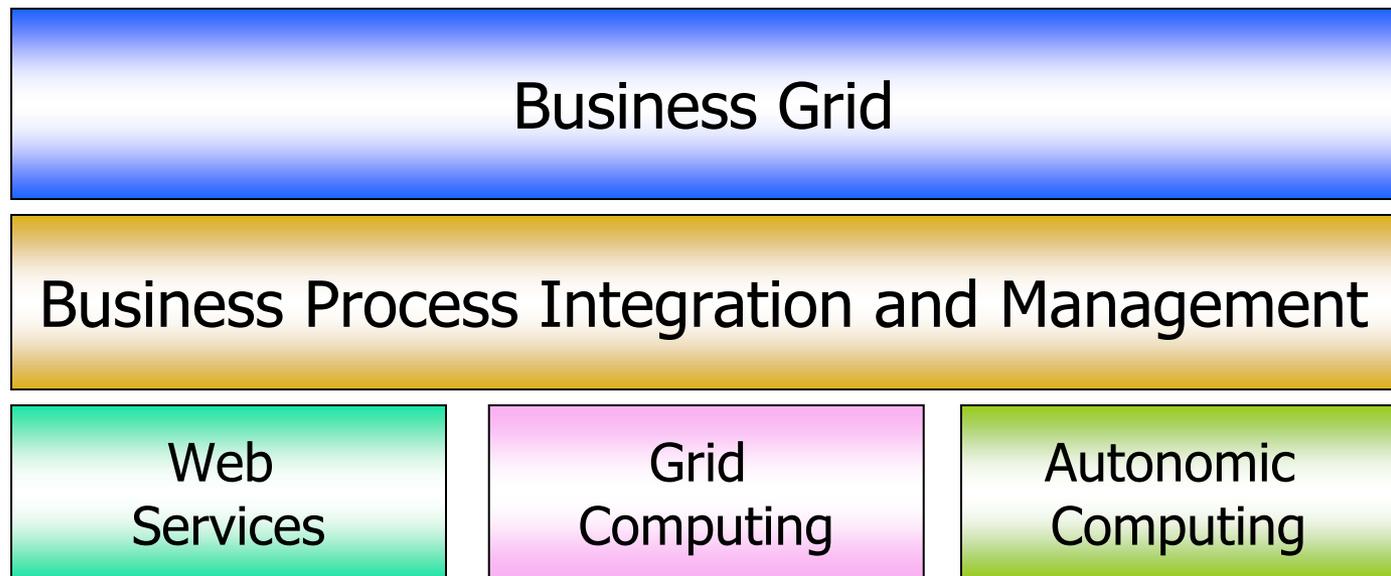
# Open Grid Services Architecture & Autonomic Computing

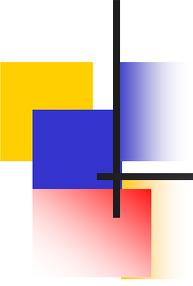


# Next Generation E-Business Integration

## ■ Dynamic e-Business

- Build Infrastructure Using Web Services and OGSA
- Share and Access business services using Grid Computing
- Manage Infrastructure using autonomic computing

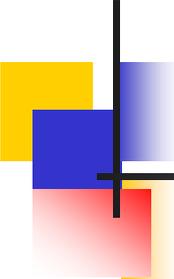




# Agenda

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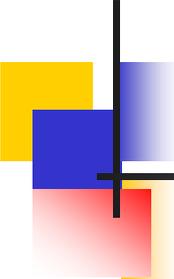
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# Research Topics

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- Business Process Execution Specification for Grid Services
- Dynamic Grid Services Flow Composition
- Federated Grid Services Discovery
- And others ...



# Resources

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- [The Open Grid Service Infrastructure Working Group](#) of the Global Grid Forum (**GGF**) is defining the OGSA.
- [The Globus Project](#)
- Grid Computing, IBM, <http://www-1.ibm.com/grid/>
- **Developing Grid computing applications, IBM developerWorks ([Part 1](#) and [Part 2](#))**
- **Autonomic Computing, <http://www.research.ibm.com/autonomic/>**
- **Service Domain (part of WSTK)**
- **Conference Invitation**
  - **2003 International Conference on Web Services (ICWS'03)**
    - <http://tab.computer.org/tfec/icws03>
    - June 23 - 26, 2003, Las Vegas, Nevada, USA