



Grid Computing

IBM Grid Computing

Leadership in Standards and Technology

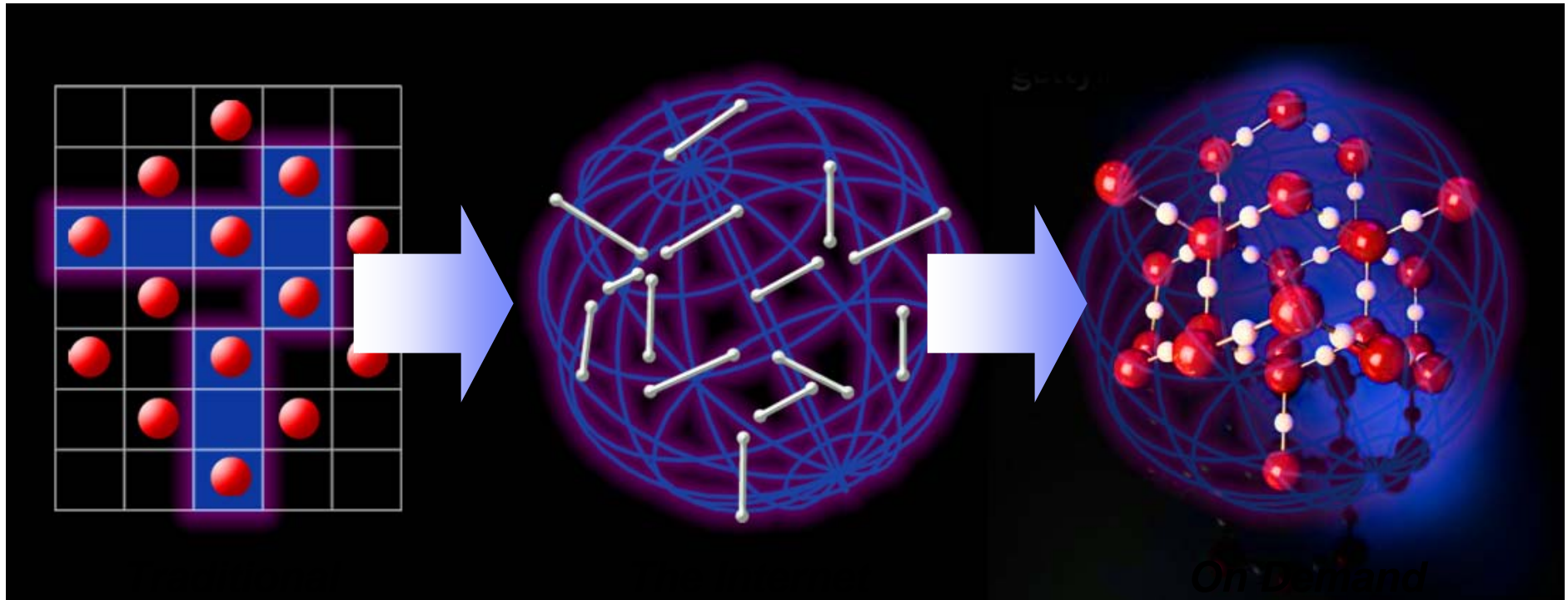
**Ground Systems Architecture
Workshop**

March 31, 2004



Deepening Integration of IT with Business

Emerging On Demand Computing Model



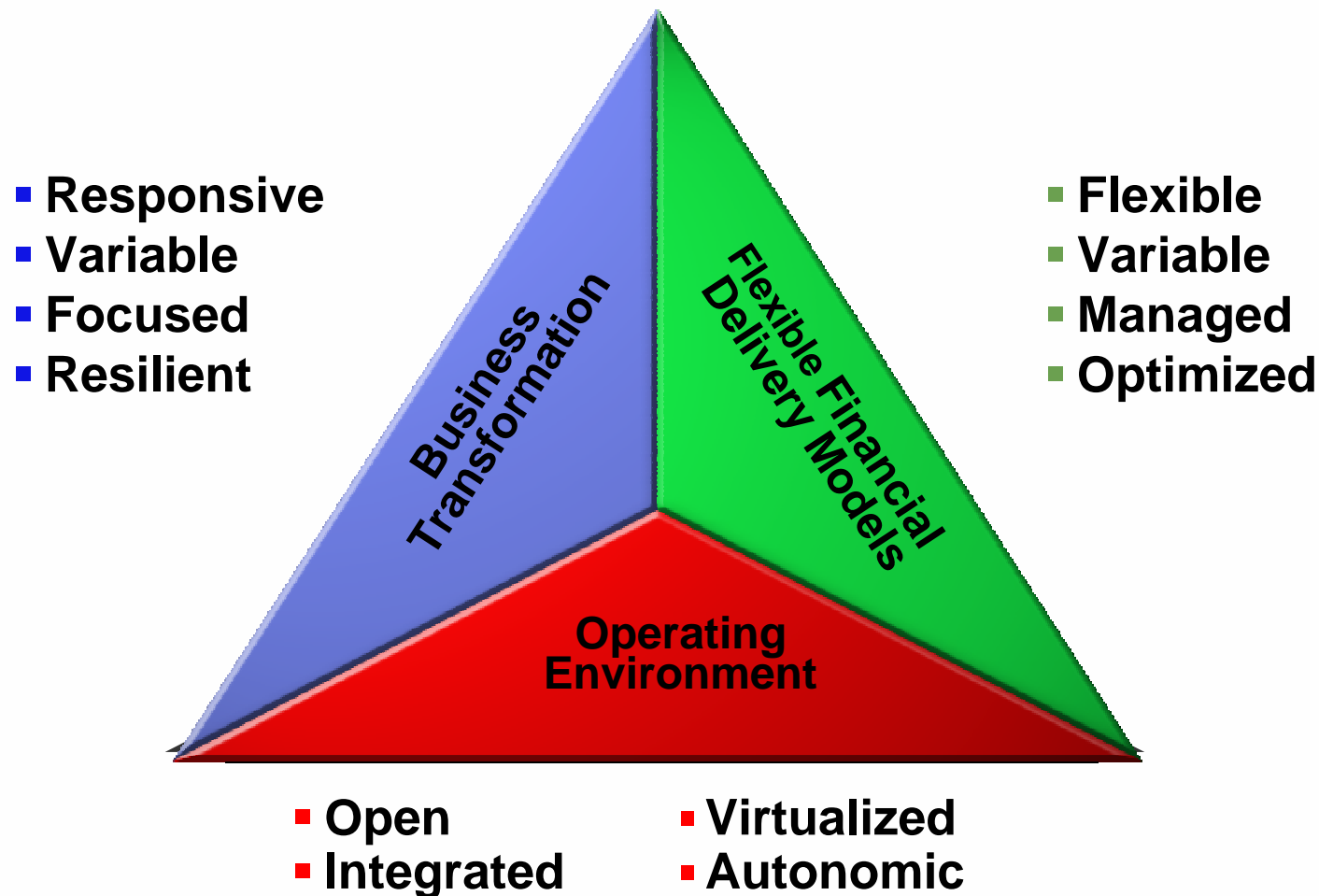
**Structured
Calculations
Data Processing
Transactions**

**Open Standards
Connectivity
Flexibility
Simplicity**

**Modular Components
easily defined and manipulated**

**Dynamic definition and
operations**

Grid is a First Step to On Demand

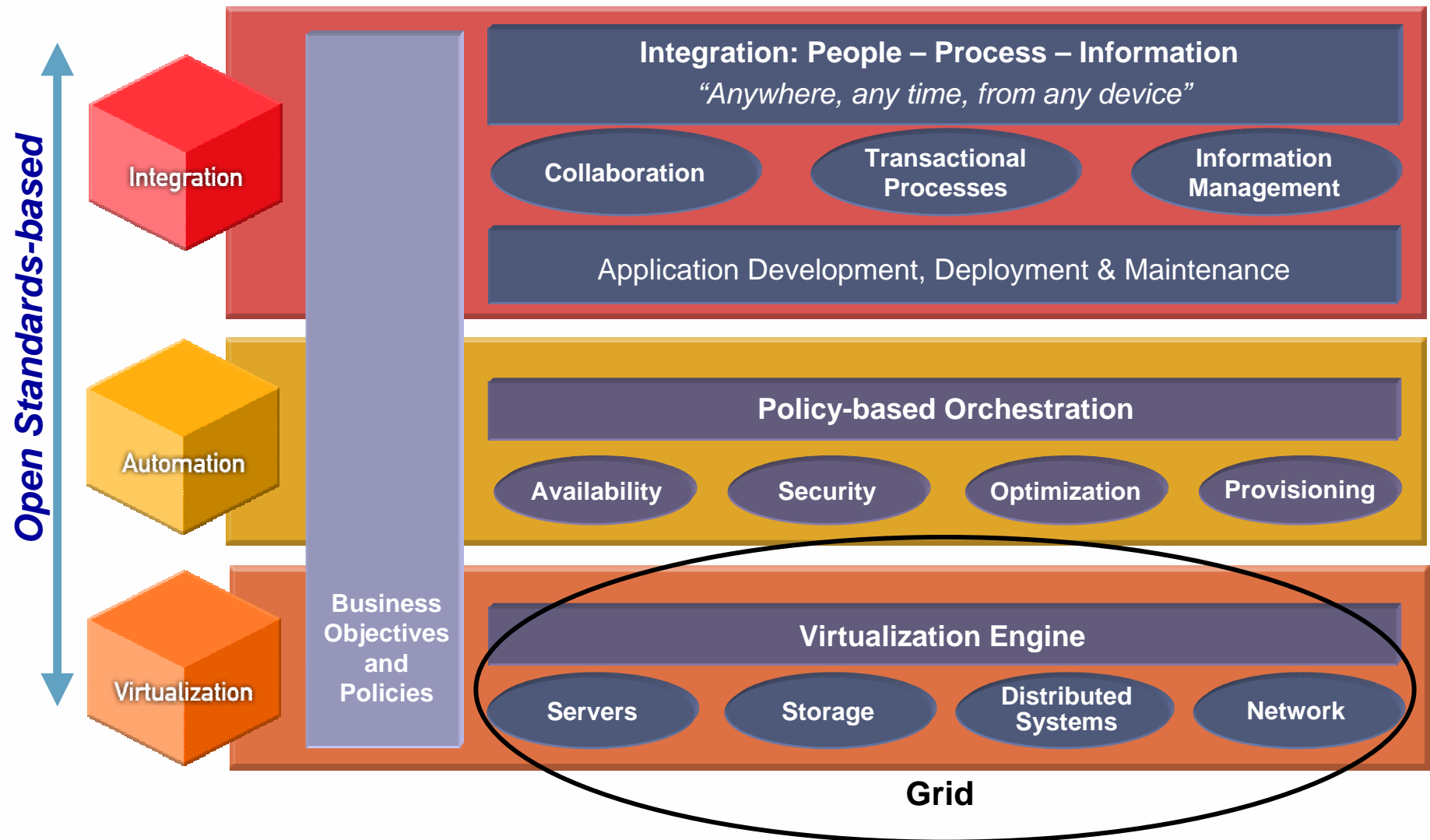


Grid is a First Step to On Demand

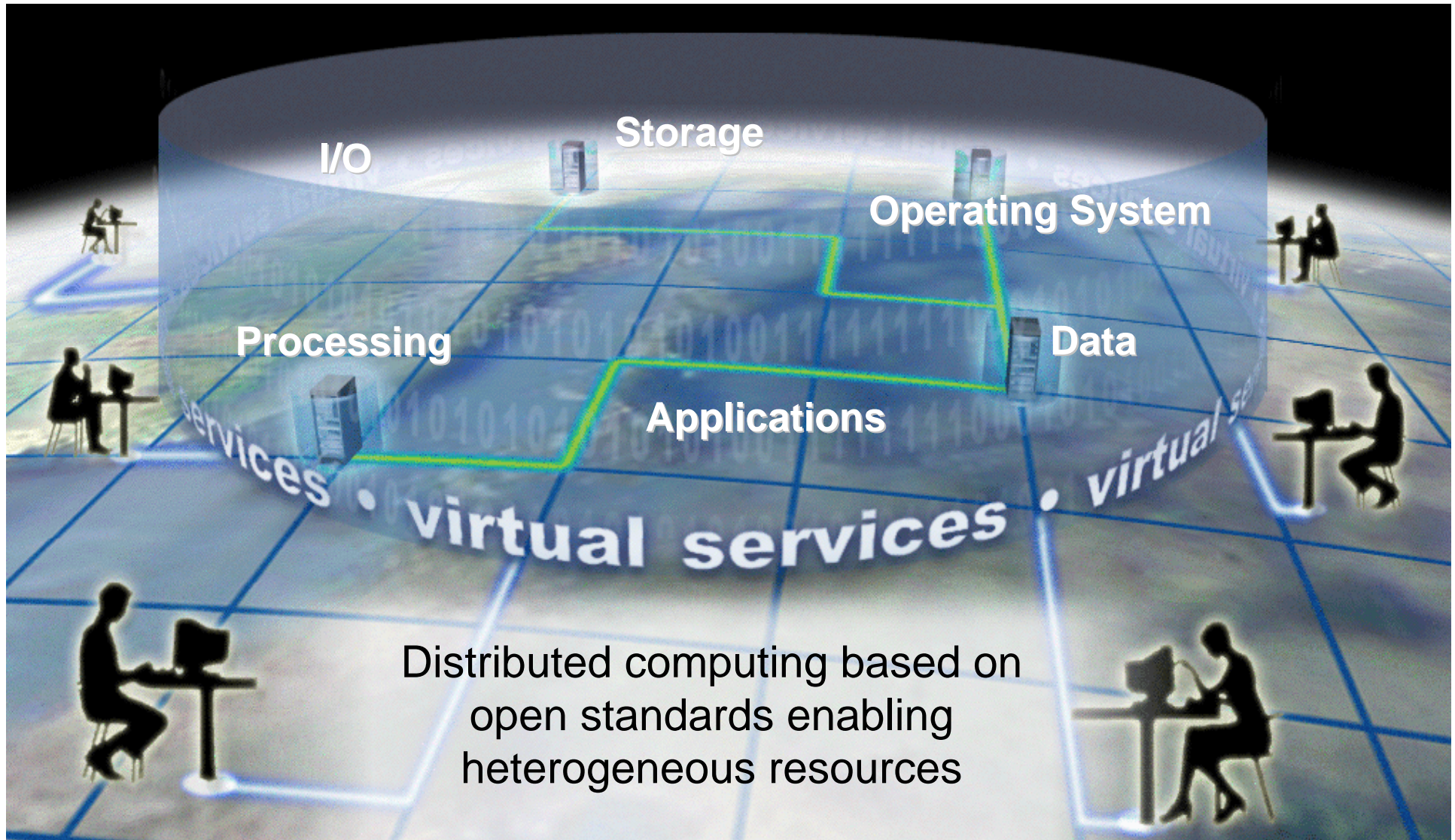
Grid Computing

On Demand Operating Environment Characteristics	Grid Alignment
Integrated	■ The OGSA Grid standard brings together other open standards such as XML, WSDL, UDDI and SOAP—all important to Web services.
Open	■ Grids are built on open standards (e.g. OGSA) and support multi-vendor operating environments. Linux offers an operating environment that runs on all platforms providing flexibility for choices of hardware
Virtualized	■ With Grid Computing, customers can virtualize entire data centers, sharing and managing distributed computing resources as if these resources were a single, unified computing instance.
Autonomic	■ Grid software and hardware contain autonomic elements (e.g. DB2, eServer, etc.) that reduce administrative time to manage the infrastructure.

The On Demand Operating Environment is based on open standards and integrated processes

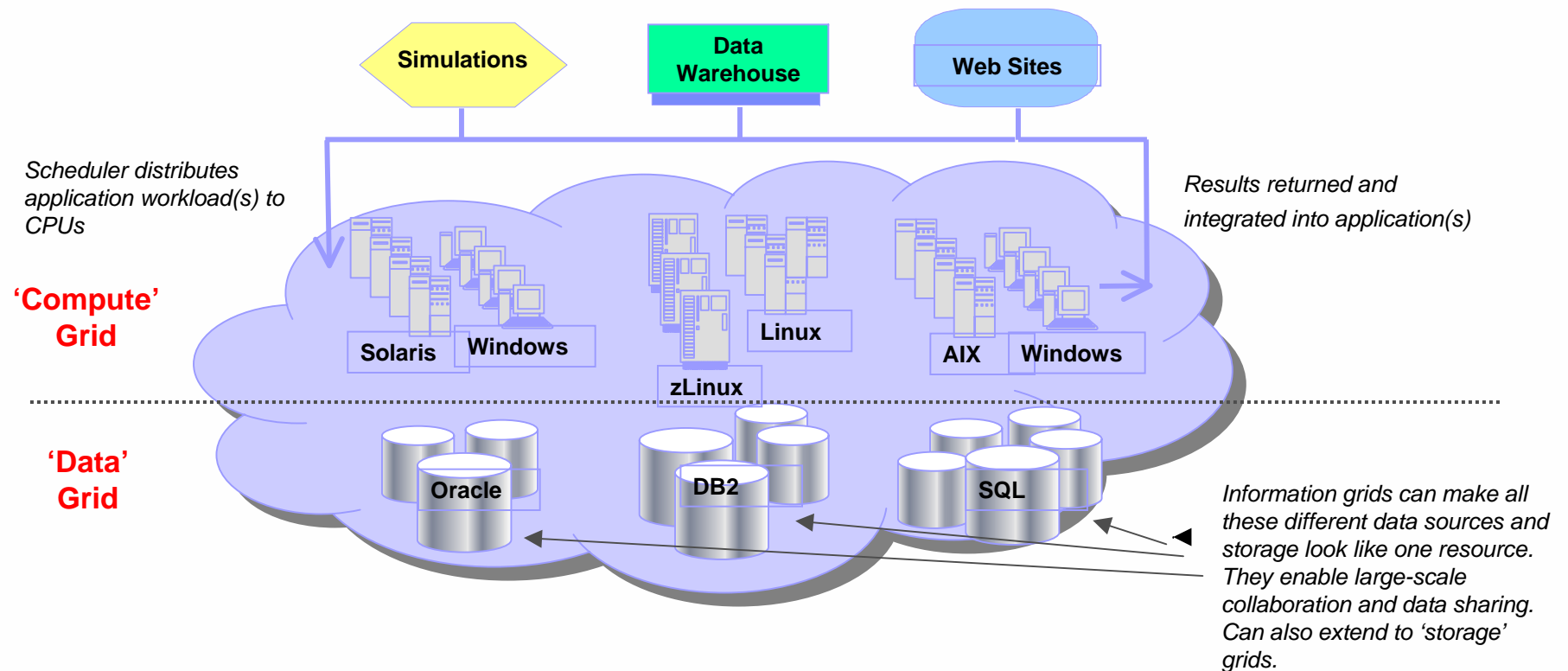


Grid Computing is built on virtualized shared compute, data, and network services



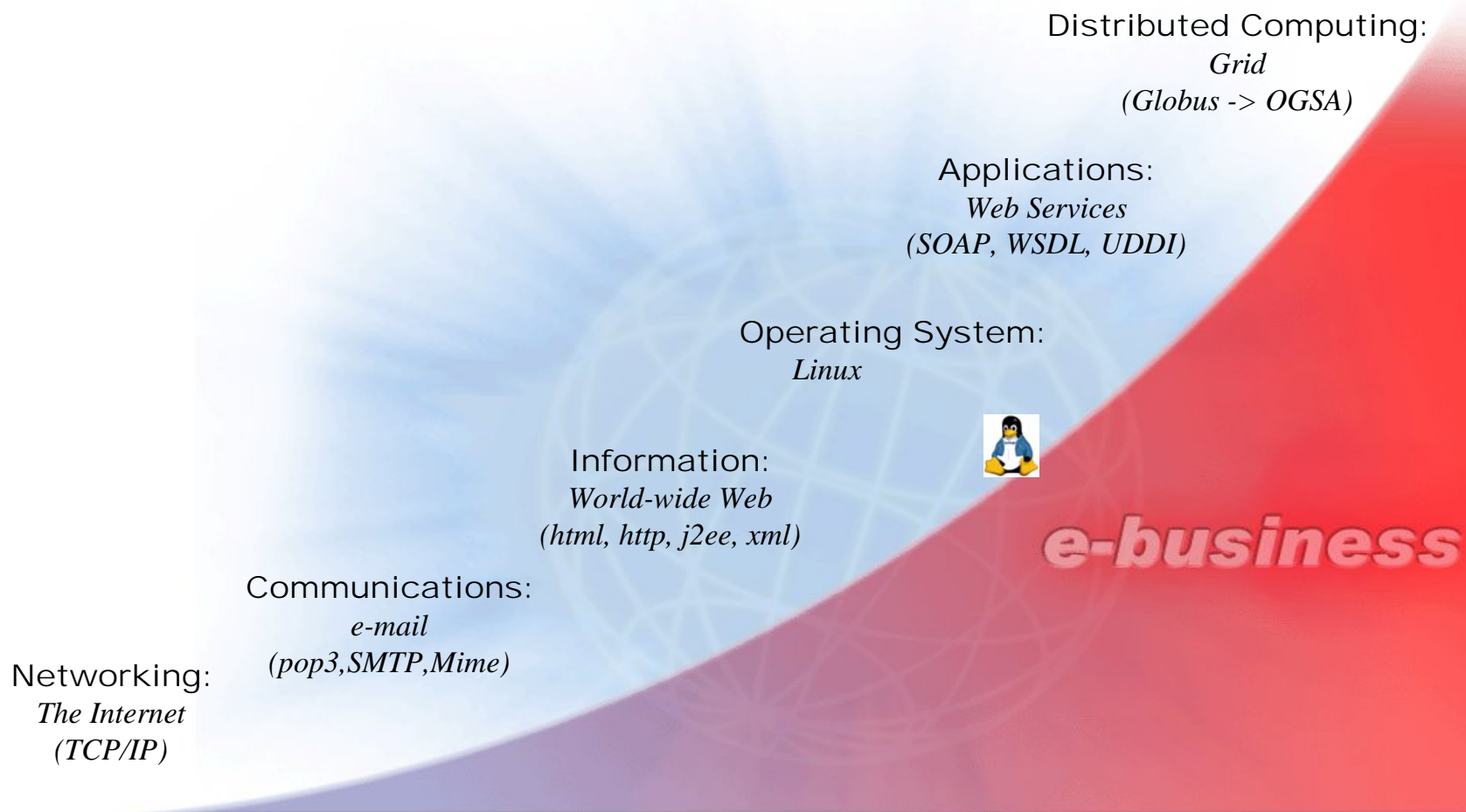
Grid = The Virtualization of Resources

Decoupling applications from infrastructure

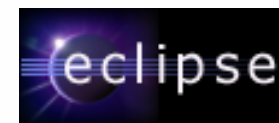
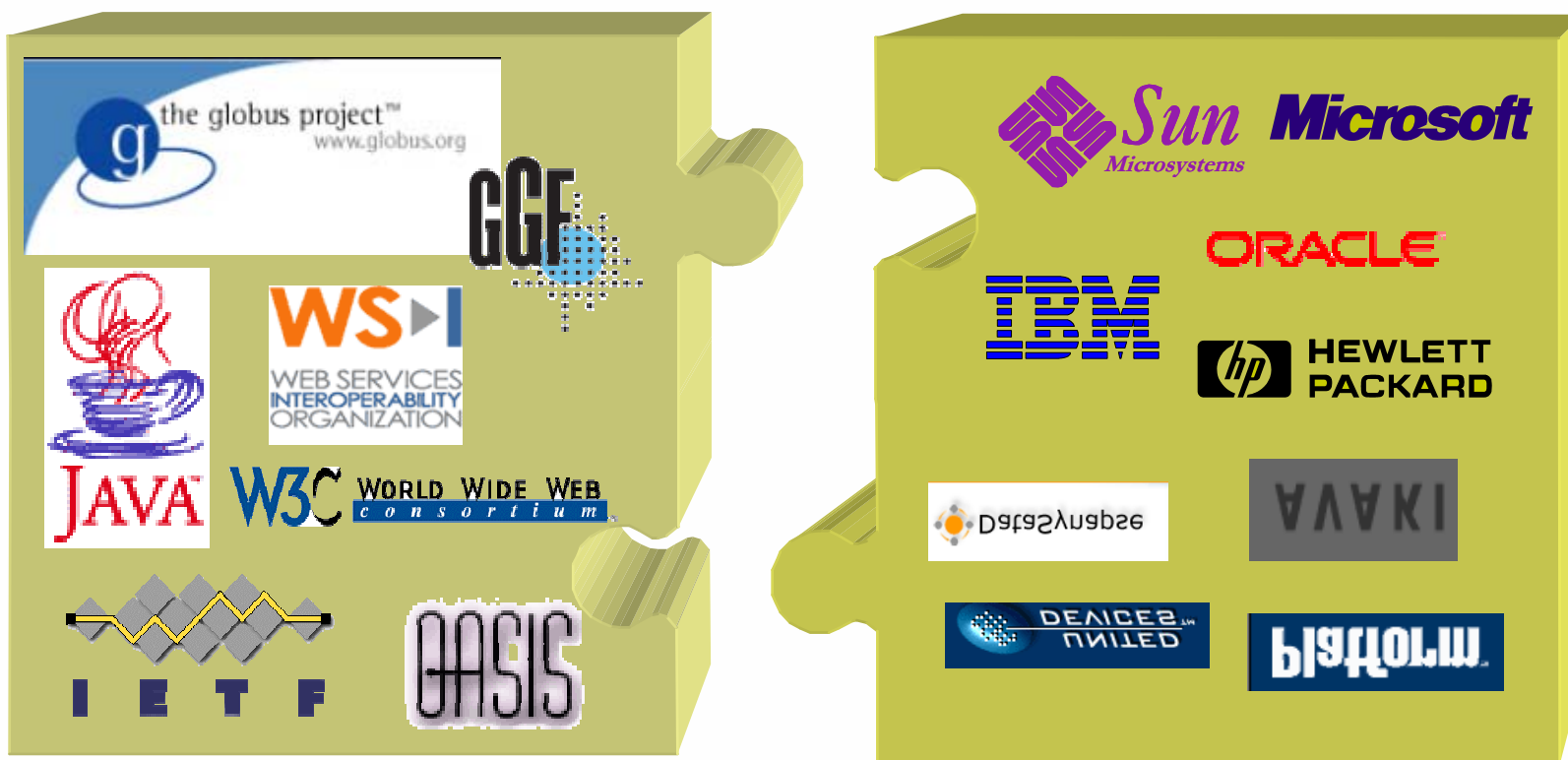


Distributed computing over a network, using open standards to enable heterogeneous operations, all in an environment that is autonomic, virtualized, and open.

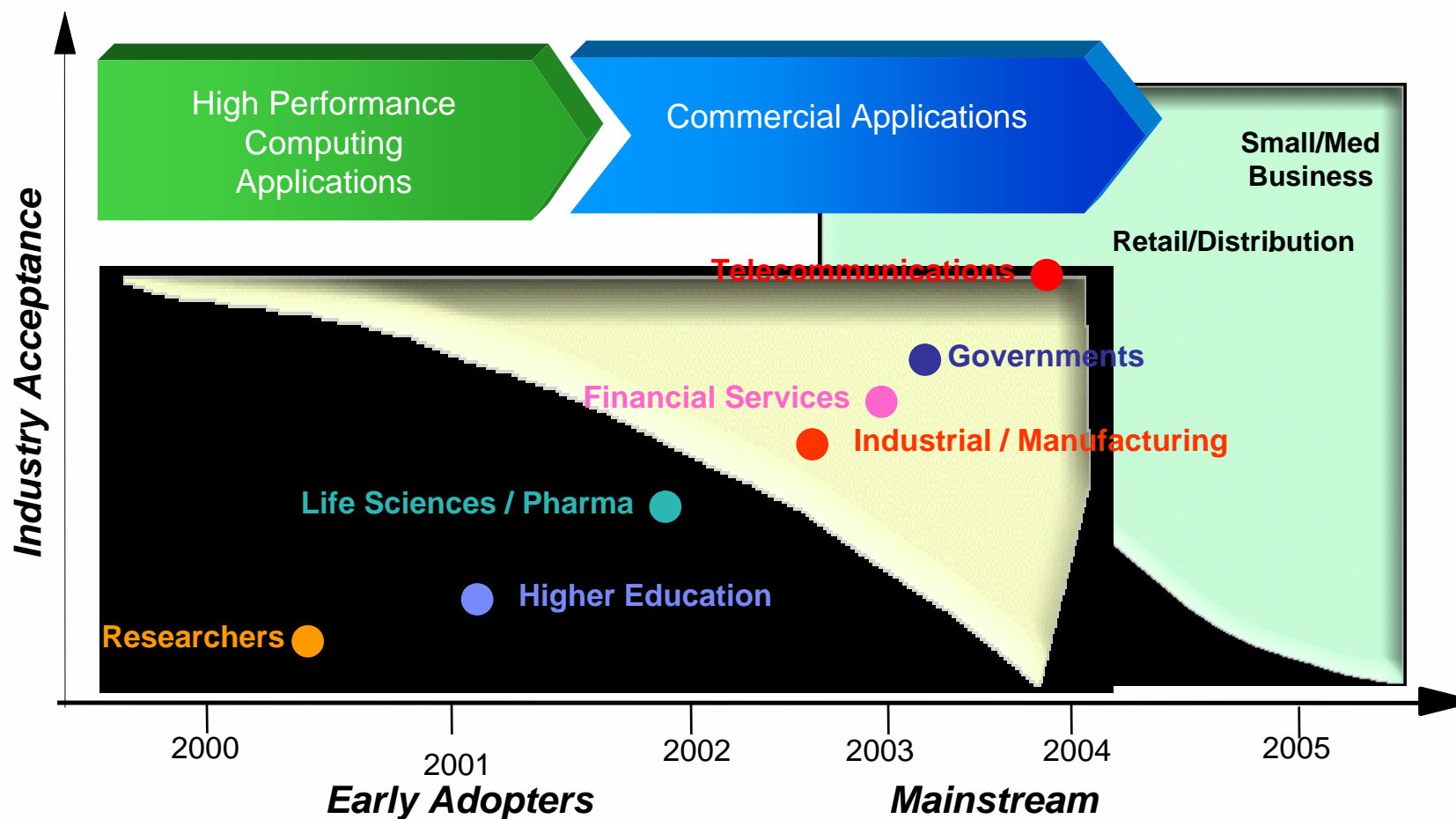
The Value of Open Standards



Cooperation on Standards



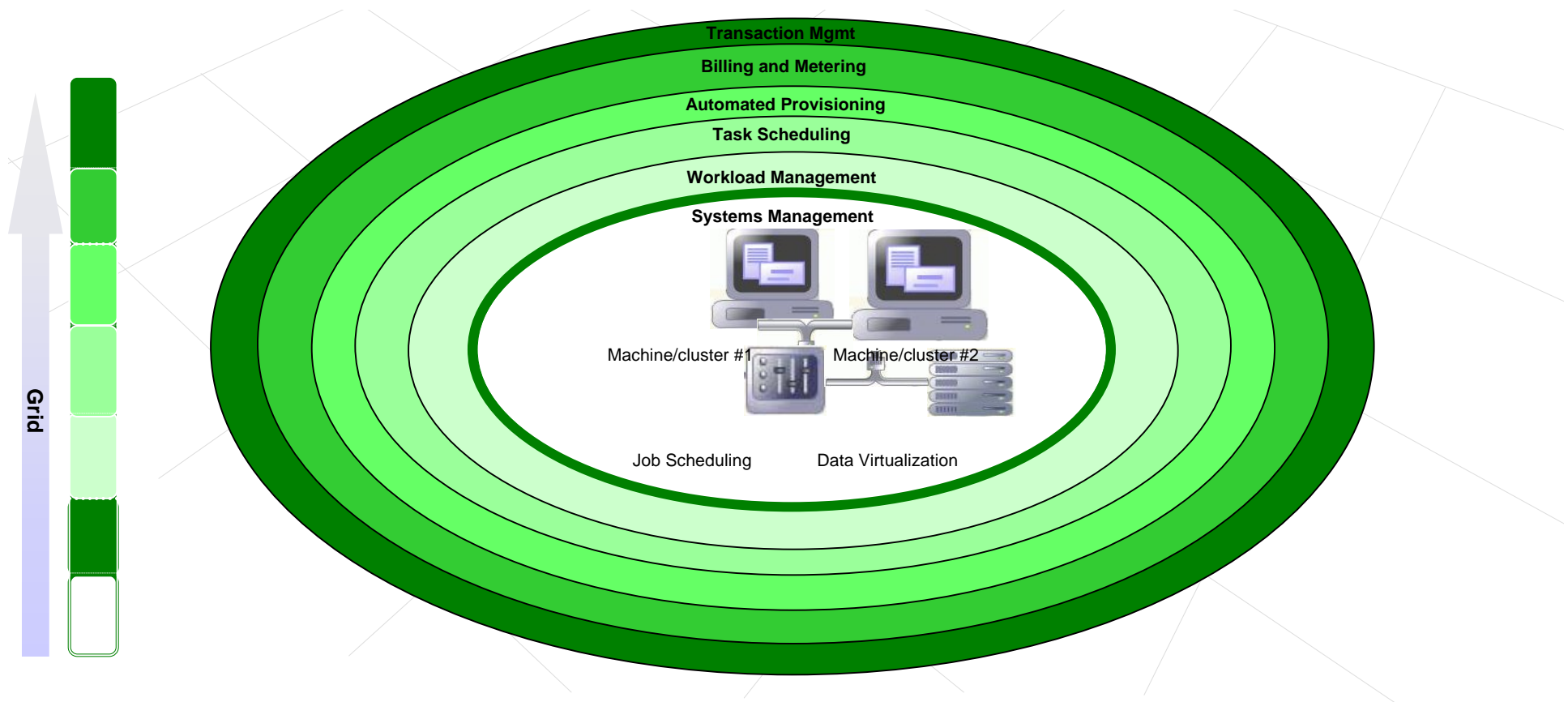
Grid Computing Adoption Curve by Industry



What Makes Up a Grid

Transaction Management:

- Manage the execution of e-business transactions across distributed resources
- Enable dynamic allocation of resources for transactional and parallel application models



On Demand Roadmap

On Demand Capabilities

Transaction Management

WebSphere.

Billing and Metering

Tivoli.

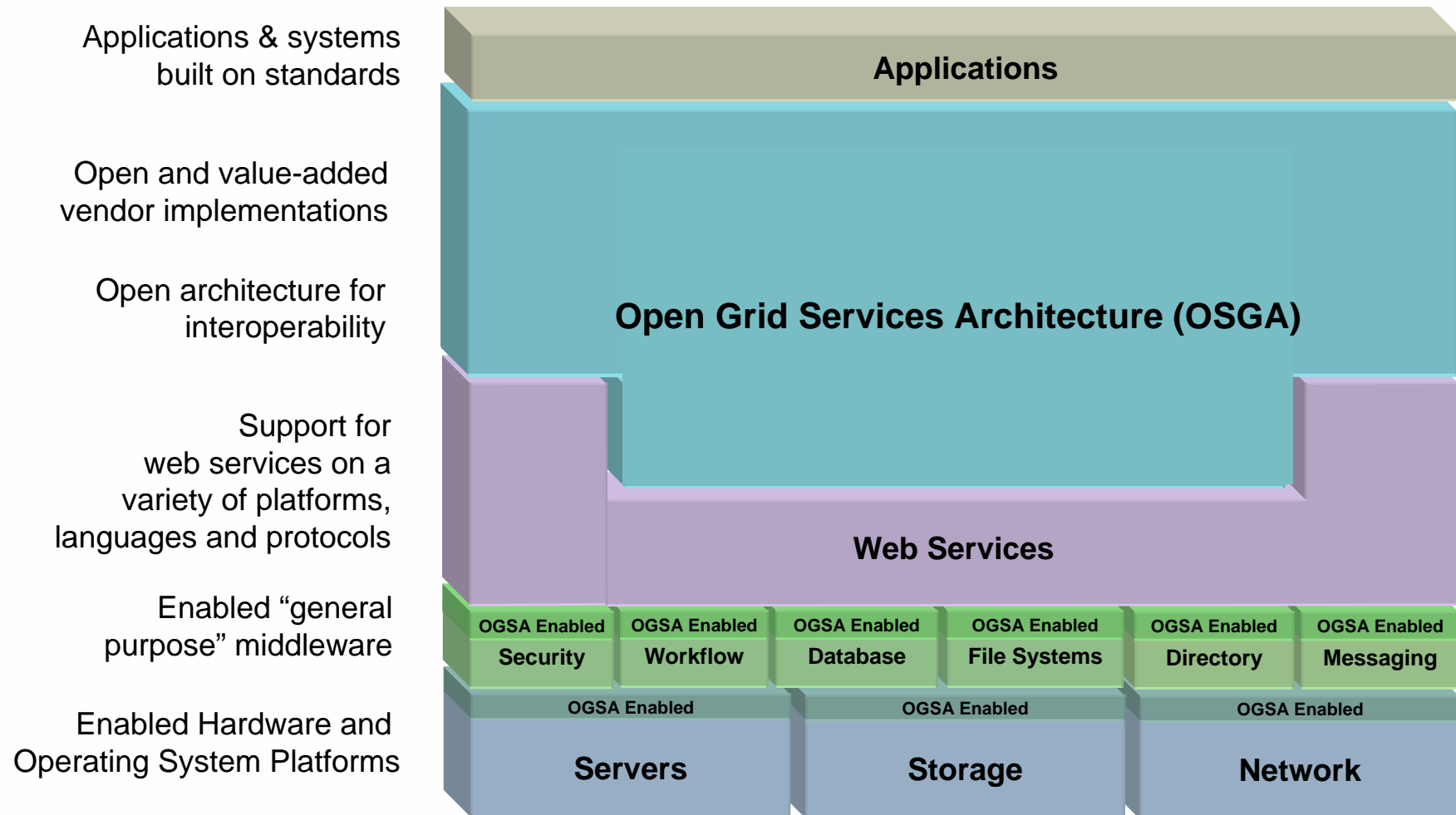
Workload Management

@server

Tivoli.

Open Architecture

OGSA – Open Grid Services Architecture



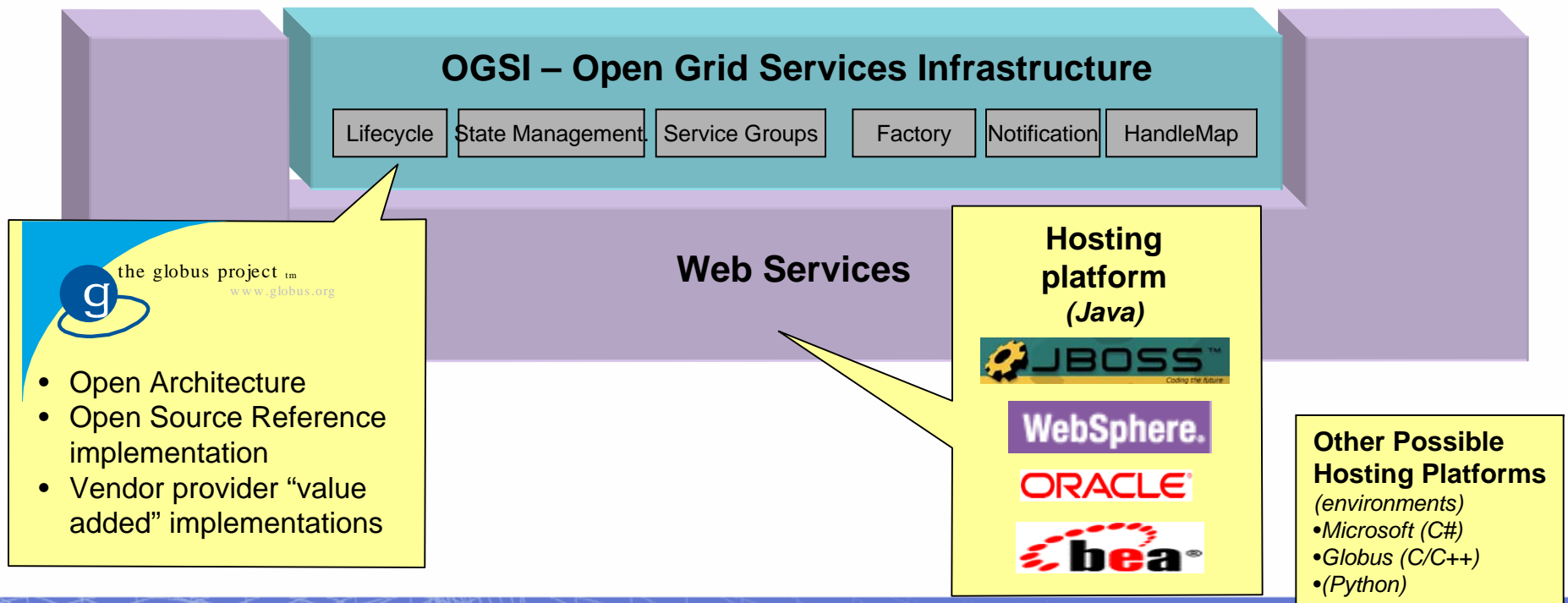
OGSA Structure – OGSi (from December)

Exploits existing web services properties

- Interface abstraction (WSDL)
- Protocol, language, hosting platform independence

Enhancement to web services

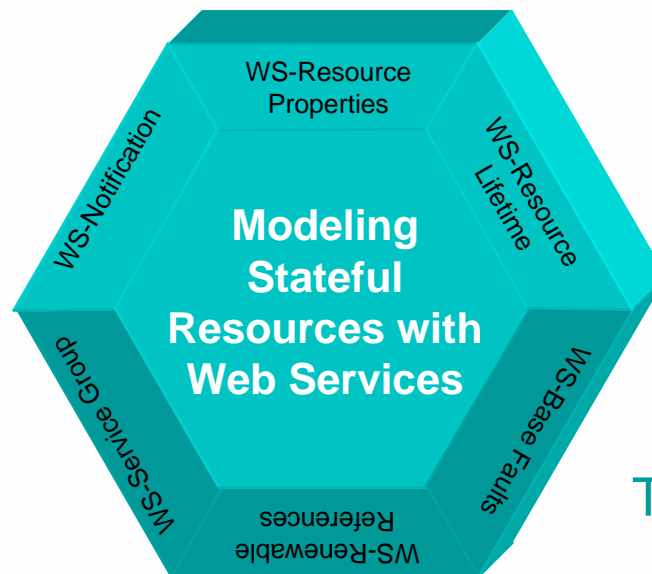
- Dynamic Creation
- State Management
- Event Notification
- Referenceable Handles
- Lifecycle Management
- Service Groups



What was announced

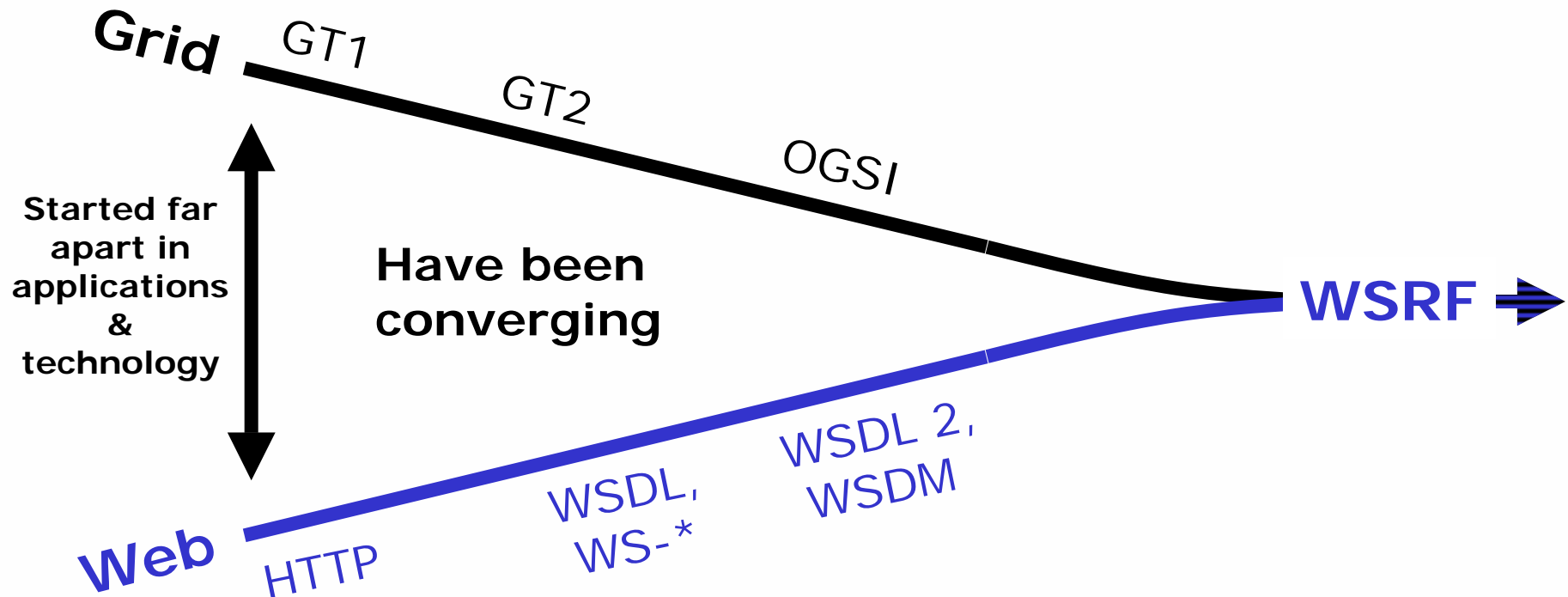
- **A family of Web services specification proposals**
 - **Introduces a design pattern to specify how to use Web services to access “stateful” components**
 - **Introduce message based publish-subscribe to Web services**

Introduced
Today



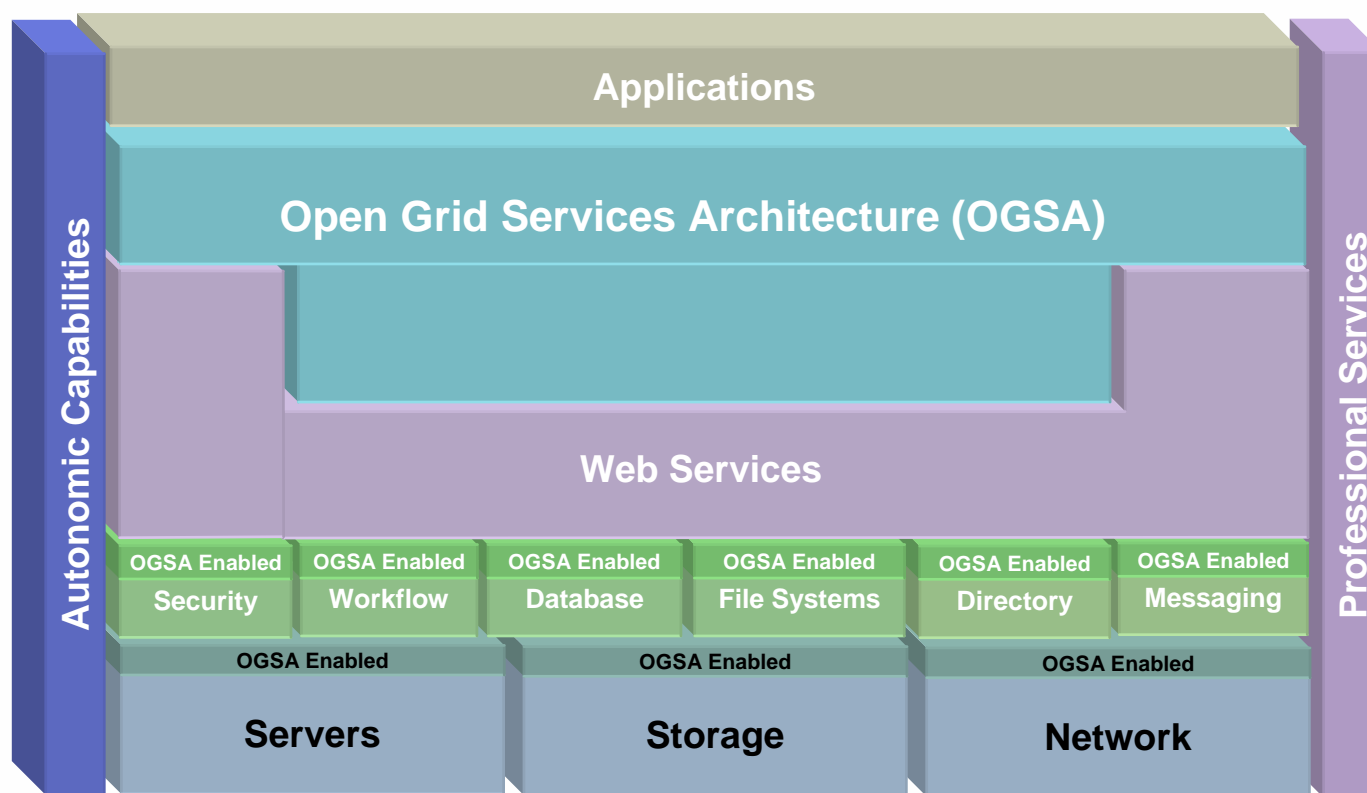
To be developed

Grid and Web Services: Convergence?

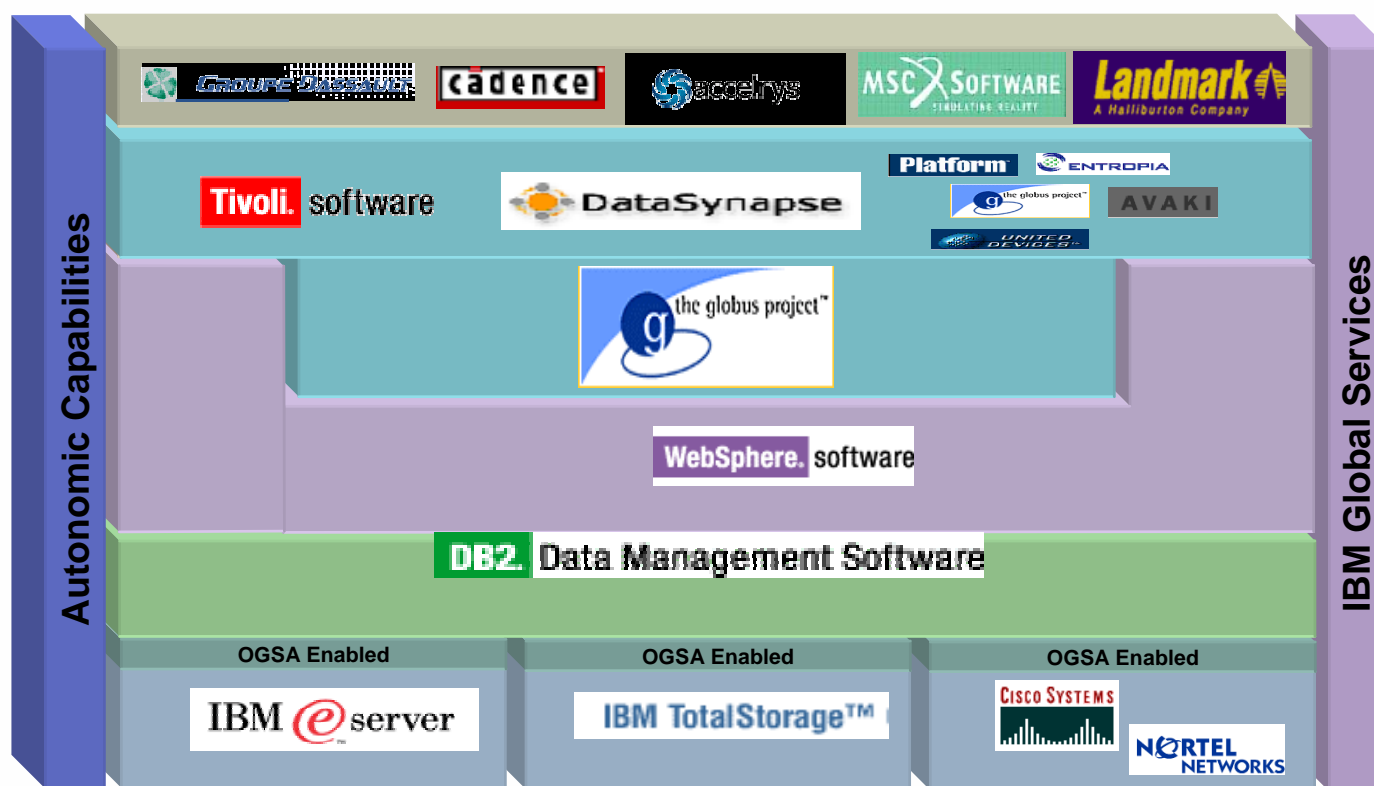


The definition of WSRF means that Grid and Web communities can move forward on a common base

Architecture Framework








Architecture Framework



Which IBM products are key Grid components?

- Open Grid Services Architecture
 - IBM Grid Toolbox for multi platforms
- Storage
 - IBM SAN File System: **Virtualize heterogeneous SAN storage system and enable access from heterogeneous servers.**
- Systems Management & Policy Based Provisioning
 - IBM Tivoli Provisioning Manager V1.1: **Provisions and configures servers, operating systems, middleware, applications, and network devices.**
 - IBM Tivoli Intelligent ThinkDynamic Orchestrator V1.1: **Sense, anticipates, plans, and controls responses to real-time production requirements.**
- Data Access
 - DB2 Information Integrator: **Designed to address customer requirements for integrating structured, semistructured and unstructured information effectively and efficiently across DB2, Oracle, Informix, Sybase, and MS SQL.**
- Job Management
 - Server Allocation for WebSphere Application Server (SAWAS): **Makes underutilized websphere Application Servers temporarily available for high performance parallel computing**
- Job Scheduling
 - LoadLeveler: **Used for dynamic workload scheduling**

IBM is focusing its Grid effort in five key areas

Business Analytics	Engineering & Design	Research & Development	Government Development	Enterprise Optimization
<p>Enable faster and more comprehensive business planning and analysis through the sharing of data and computing power</p> 	<p>Share data and computing power, for computing intensive engineering and scientific applications, to accelerate product design</p> 	<p>Accelerate and enhance the R&D process by enabling the sharing data and computing power seamlessly for research intensive applications</p> 	<p>Create large-scale IT infrastructures to drive economic development and/or enable new government services</p> 	<p>Optimize computing and data assets to improve utilization, efficiency and business continuity</p> 
<p>Financial Svcs, Public, Auto, Aero, Oil/Gas, Telco</p>	<p>Auto, Aero, Oil/Gas, Telco</p>	<p>Public, Auto, Aero, Oil/Gas</p>	<p>Public</p>	<p>Financial Svcs, Public, Auto, Aero, Oil/Gas, Telco</p>

IBM Grid Toolbox for Multiplatforms V3.0



- A commercial derivative of the Globus Toolkit 3.0 with IBM Value Add
 - A platform for the **Grid Developer** to develop and test grid service and grid applications.
 - A platform for the **Grid Builder/Deployer** to host grid service and grid applications.

Customer scenarios used to design, document and test....

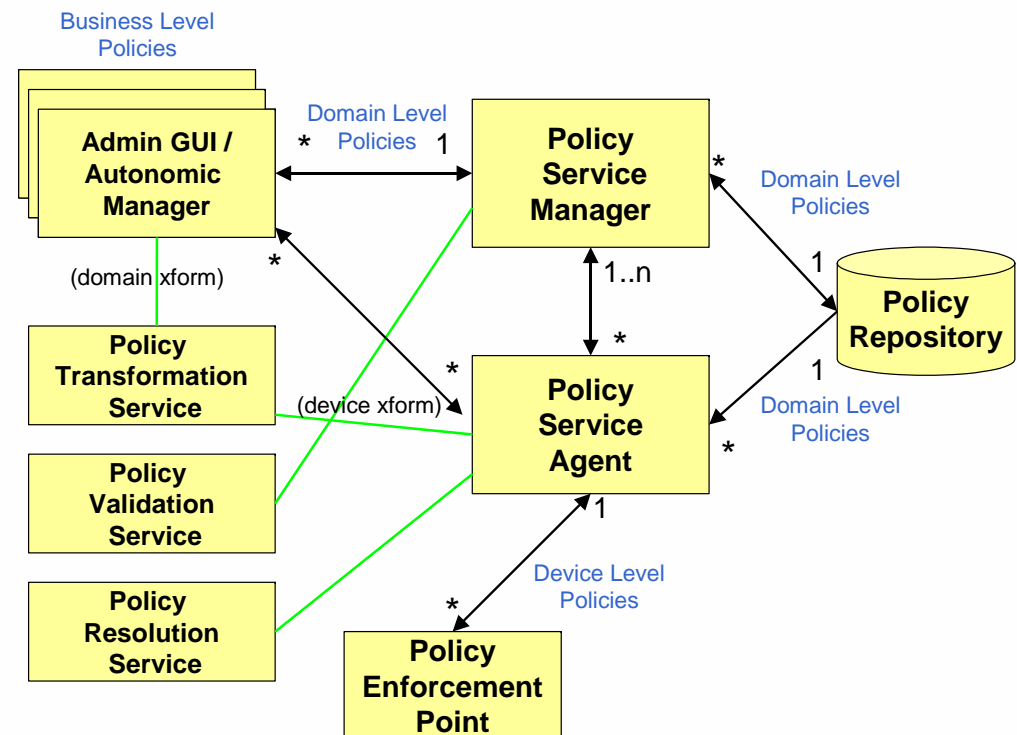
IBM Grid Toolbox– the details....

- Integrated **wizard based installation**
- A **grid service runtime** environment based on the GGF Grid Service (OGSI) specification for hosting grid services.
- A web-based **management application** used to manage services within the runtime environment.
- A digital certificate base grid security infrastructure (**GSI**).
- Complete set of **configuration** and **administration** commands.
- **Development tools** to build, package and use grid services.
- Common (base) **grid services** for...
 - Discovery via Service Group
 - Policy Management
 - Common Management Models (CMM)
 - GT3.0 Program Execution Service (GT3.0 GRAM - MMJFS, MJS, UHE)
 - GT3.0 Information Services (GT3.0 MDS - Index)
 - GT3.0 Data Management Services (Multi-RFT)
- **Information Center** including tutorials to assist with the education and understanding of the technologies and capabilities packaged within the product.
 - **Sample** grid services and applications demonstrating key capabilities.

Common Policy Management Services

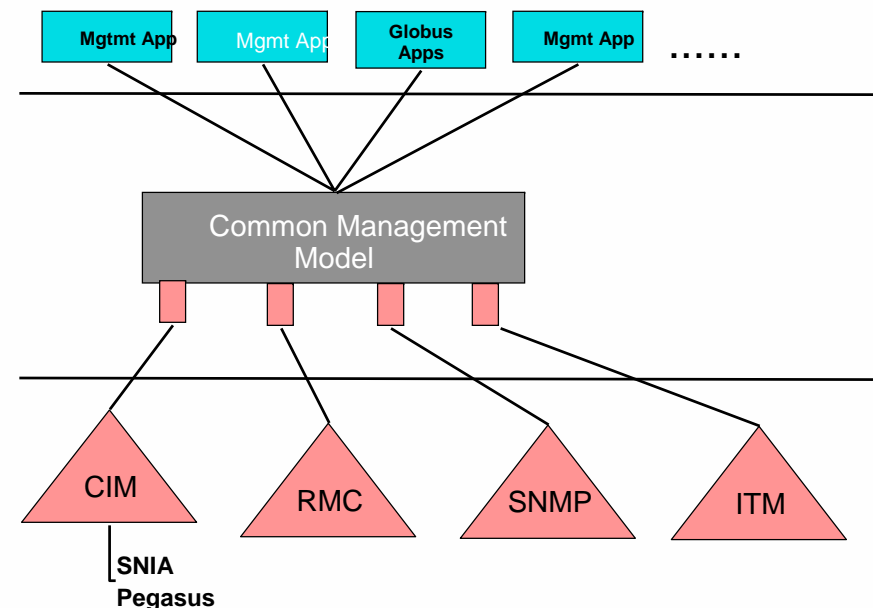
- Common policy service manager (PSM) and policy service agent (PSA).
 - Includes a sample Network QoS discipline.
- PSM and PSA provide common components required for any policy based application or solution.
- PSM allows policies to be generically..
 - Added
 - Updated
 - Removed
 - Discovered (found)
- PSA generically...
 - Activates/Deactivates policies
 - Manages active policies
- Repository implemented using embedded database.

OGSA Policy Architecture

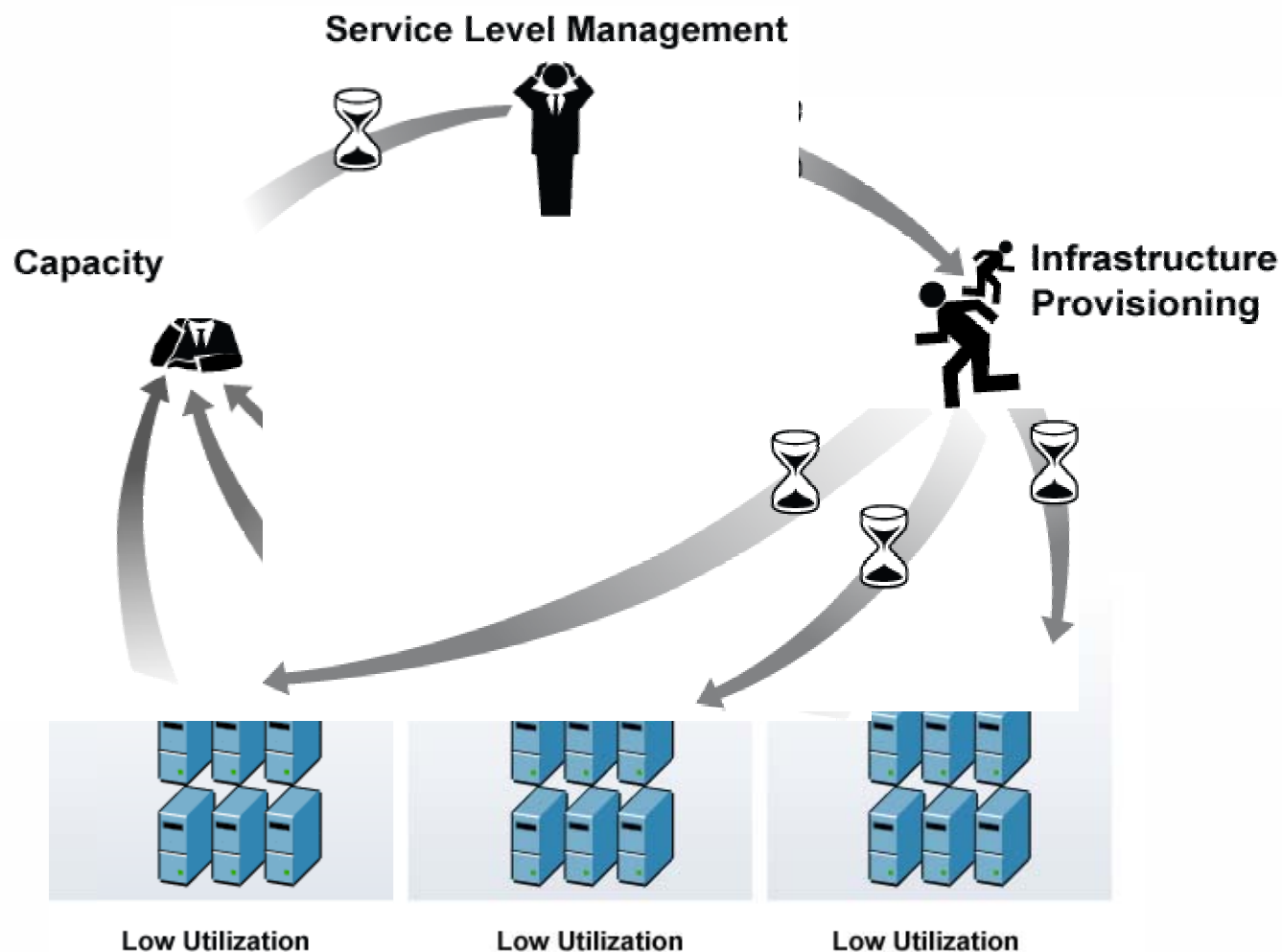


Common Management Models - CMM

- Exposes systems resources as services
 - System, filesystem, os, etc.
- Defines and models resource associations with service data
 - Hosted filesystems, running os, etc.
- Provides mapping layer (abstraction) between existing systems management systems and technologies (i.e. CIM, SNMP)
- JCA used to manage interactions with instrumentation.
 - Adapter needed per instrumentation type.
- Initial release includes a JCA Adapter for CIM allowing interactions with Pegasus CIMOM.



Just-in-Case Provisioning



Orchestrated Provisioning

Capacity Mgmt

- Capacity Prediction
- Performance Analytics
- Application Performance
- Infrastructure Performance
- Existing agents

Orchestration

- Service Level Mgmt
- Service Level Optimization
- Service Level Reporting
- Service Level Measurement
- Service Level Definition

Provisioning

- Extensible Best Practices
- N-Tier Topology Provisioning
- Cluster/Array Provisioning
- Application Provisioning
- OS/Package Provisioning
- Network Provisioning
- Server Provisioning
- Resource Pooling



Information Virtualization

“Core component of the Grid Computing model...

- Allows end-users and applications secure access to any information source regardless of it where it exists
- Provides access to heterogeneous files, databases, or storage systems
- Supports sharing of data for processing and/or large-scale collaboration

...in an environment that is autonomic, virtualized, and open.”

Information Virtualization Products

Data

- **Global Naming**
- **Meta-data and catalog**
- **Federation and Transformation**

File

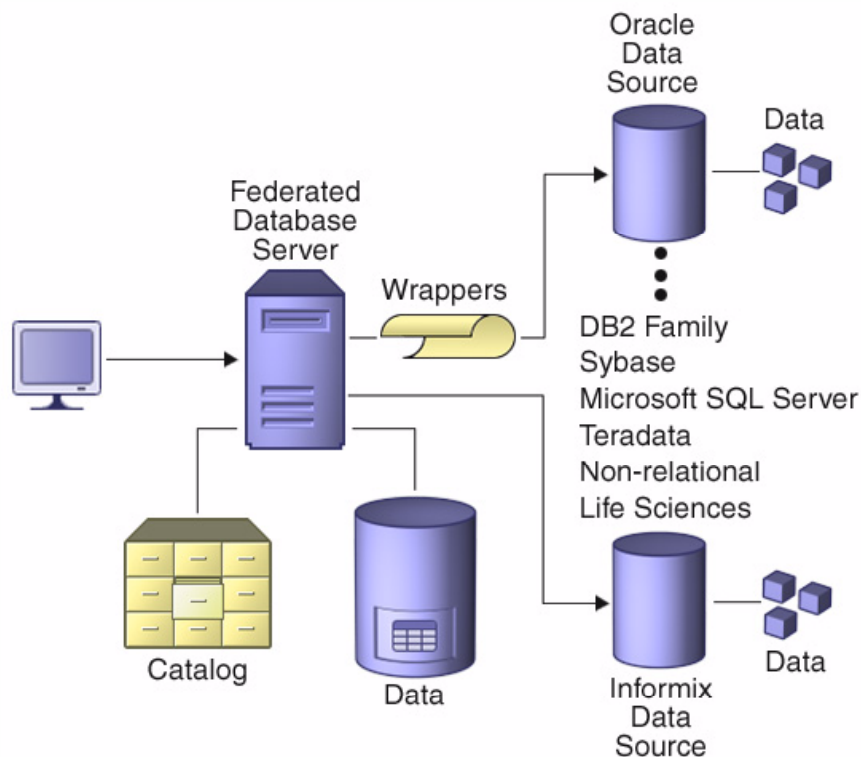
- **Distributed File Systems / Remote Access**
- **File Transfer / Data Replication**
- **Caching**

Storage

- **NAS / SAN “Storage Cluster”**
- **Automatic or Dynamic provisioning of storage**
- **Support for hierarchy management**

One type of Grid data virtualization is a virtual and consistent interface to heterogeneous federated data.

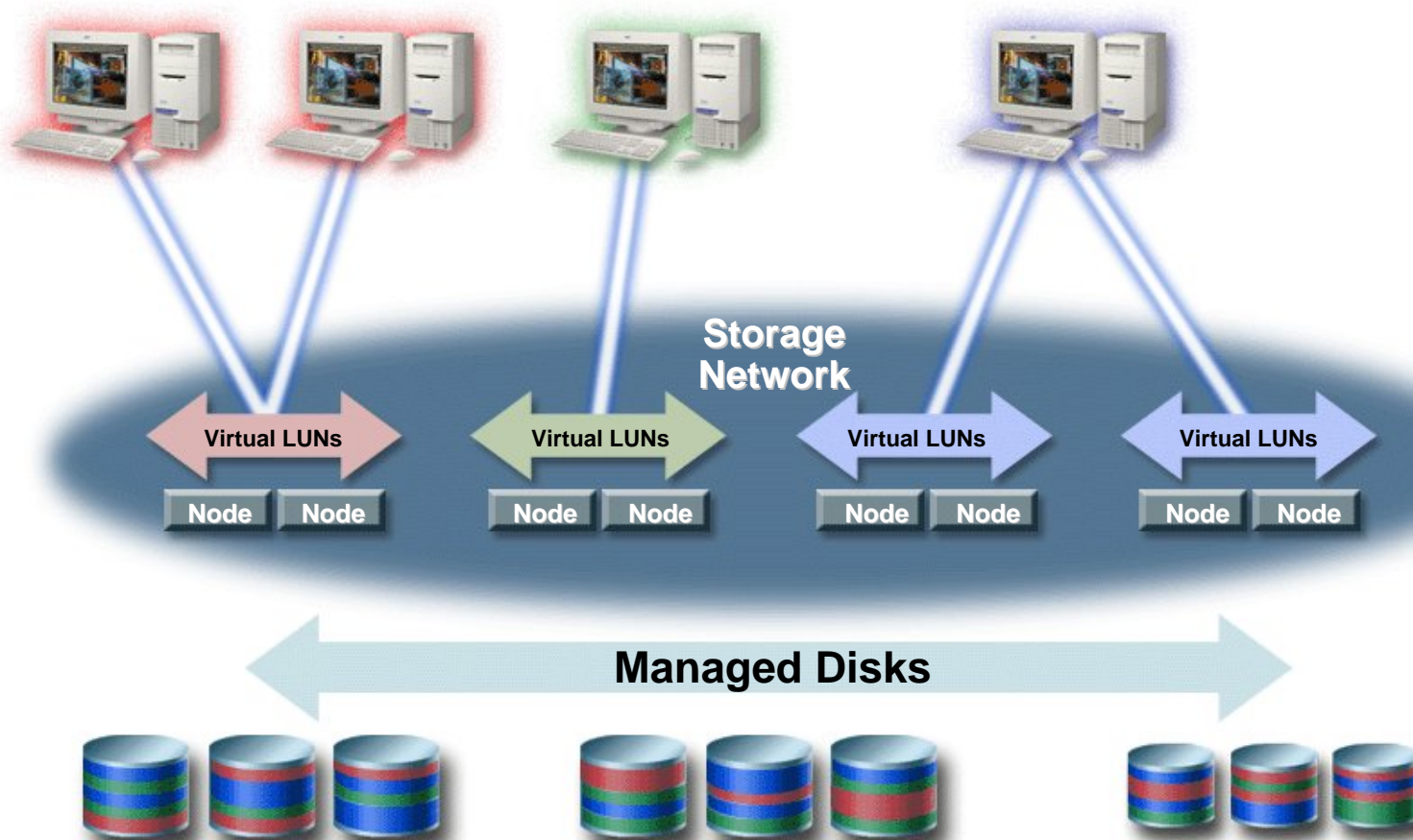
Federation of Data



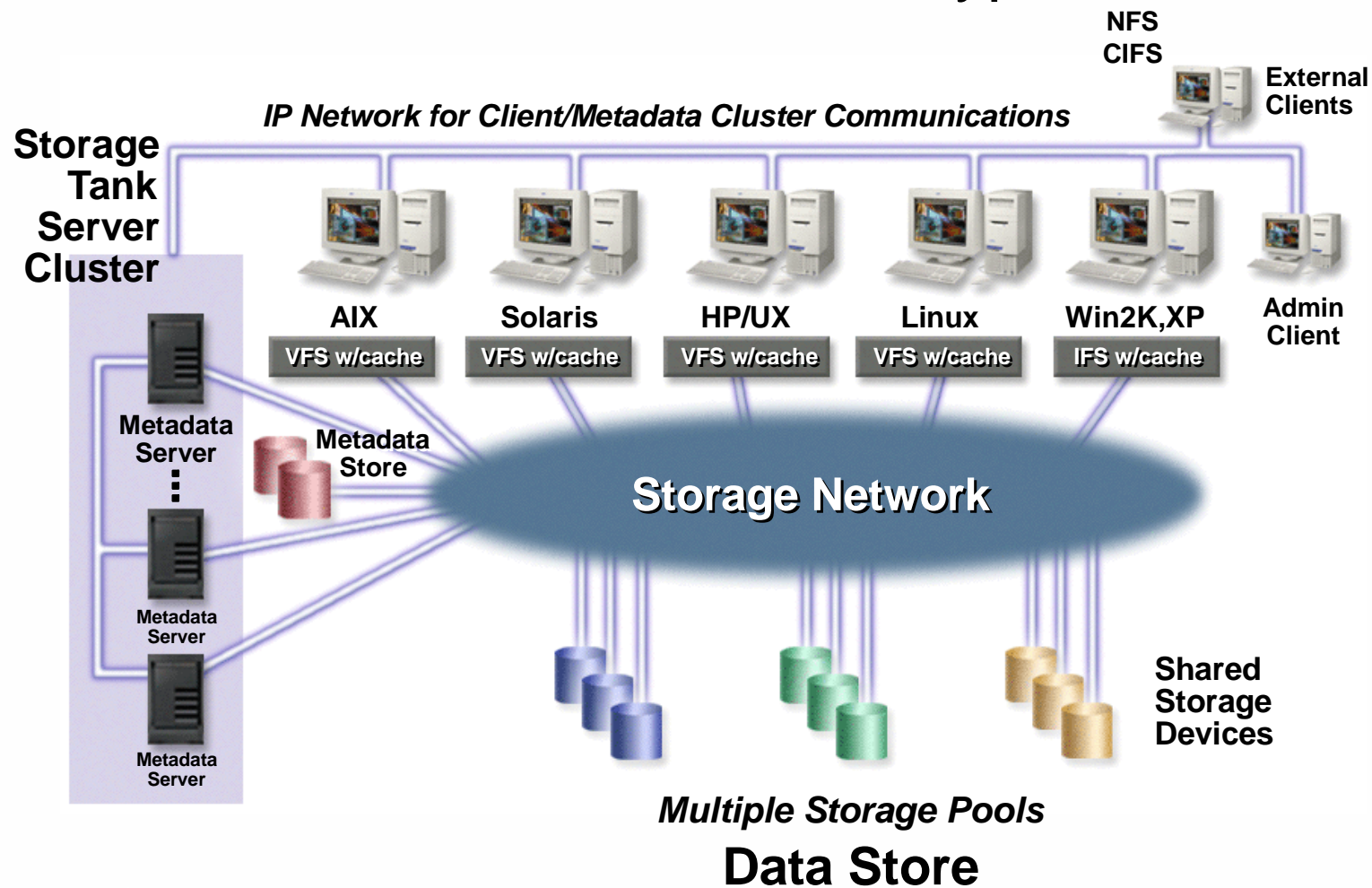
- Transparency
 - Appears to be one source
- Heterogeneity
 - Integrates data from diverse sources
 - Relational, Structured, XML, messages, Web, ...
- Extensibility
 - Federate almost any data source.
 - Development tooling provided
- High Function
 - Full query support against all data
 - Capabilities of sources as well
- Autonomy
 - Non-disruptive to data sources, existing applications, systems.
- Performance
 - Optimization of distributed queries

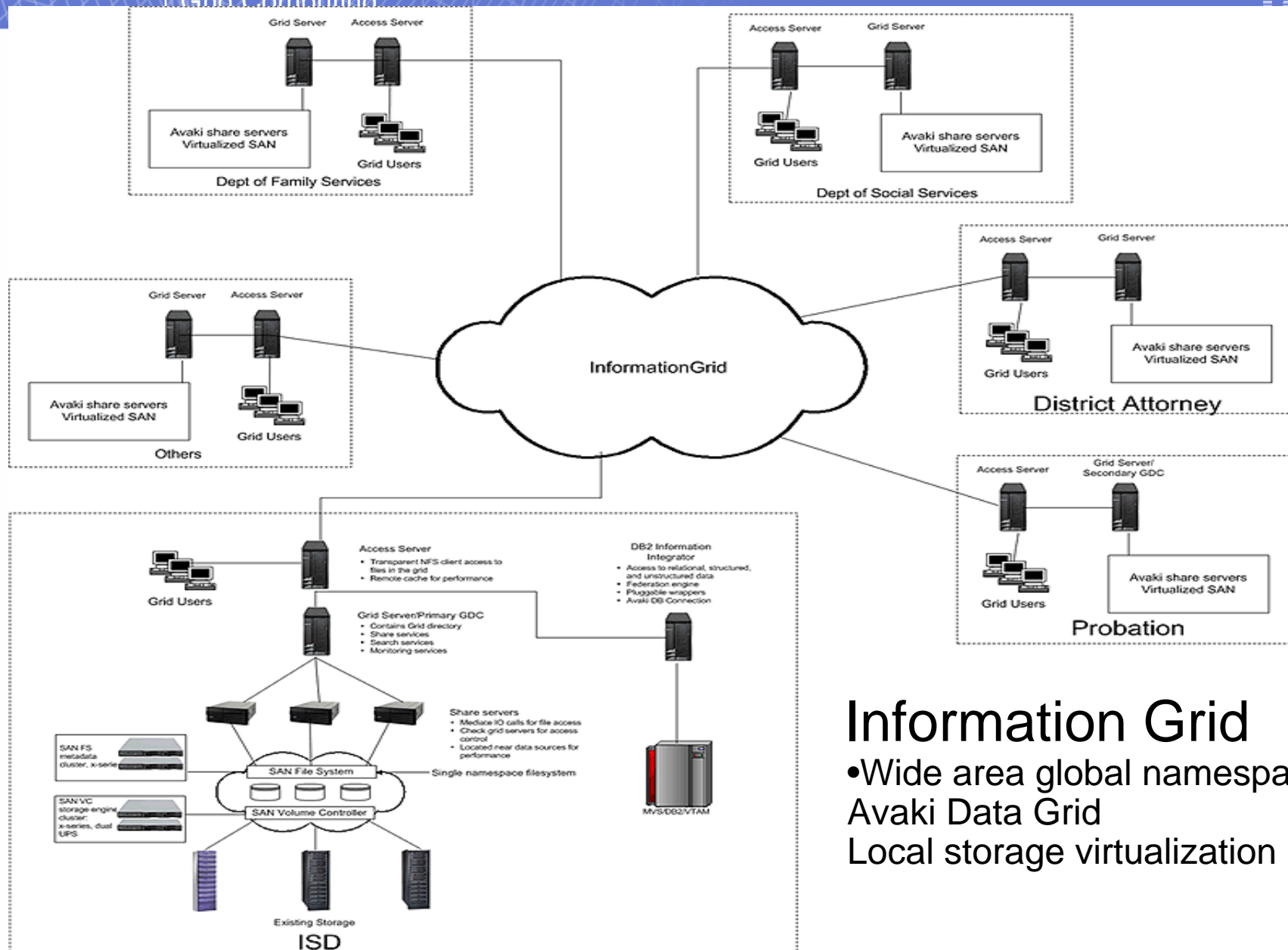
Grid Storage Virtualization

Virtual Logical Disks (LUNs)



Grid storage virtualization is another type of data
Grid that provides single namespace and
consistent access to numerous types of clients.

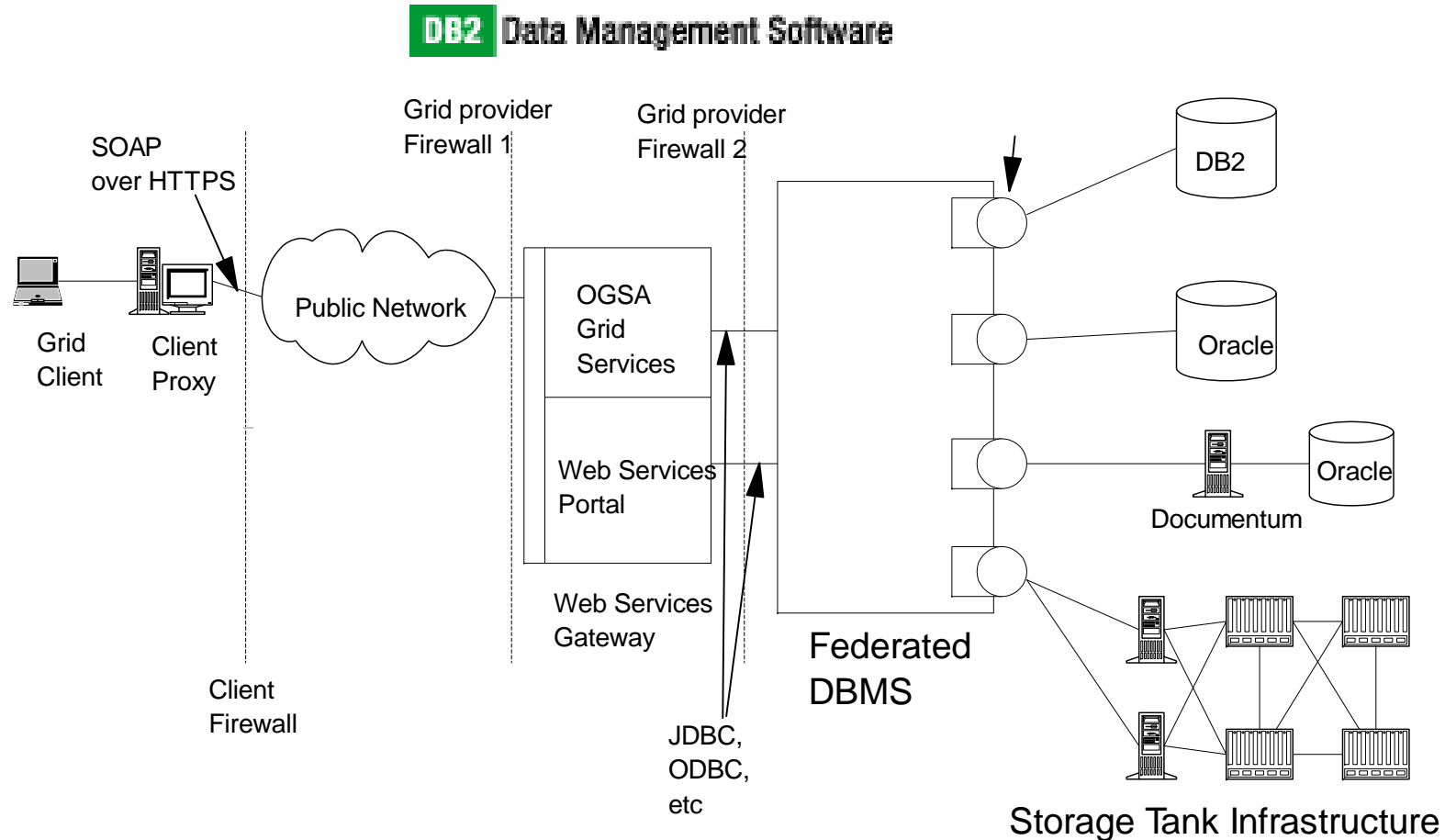




Information Grid

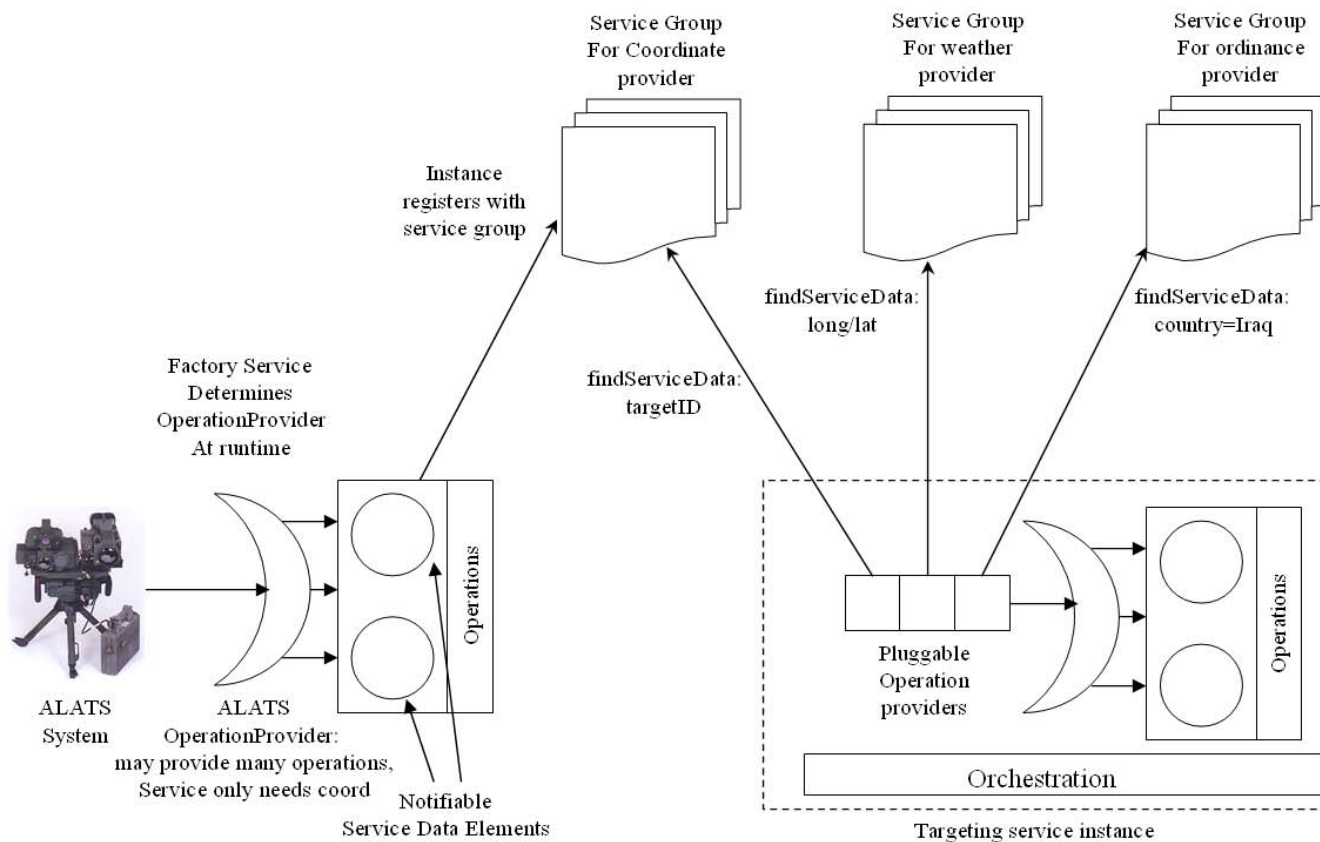
- Wide area global namespace
- Avaki Data Grid
- Local storage virtualization

A sample Grid service provider could include a Grid services portal and a federated DBMS.

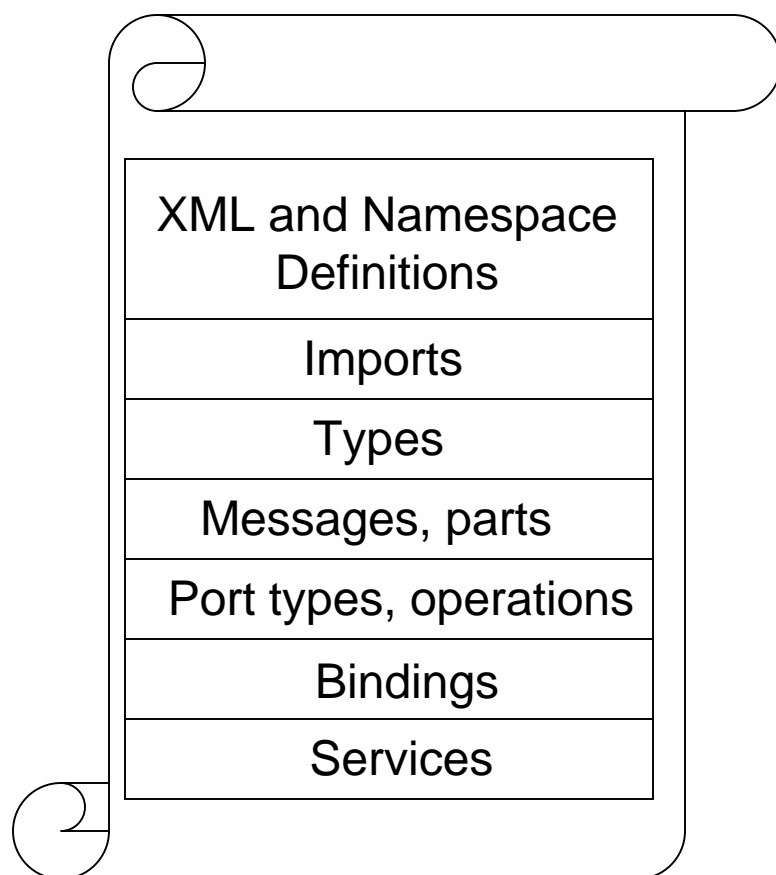


WebSphere. software

Targeting Service

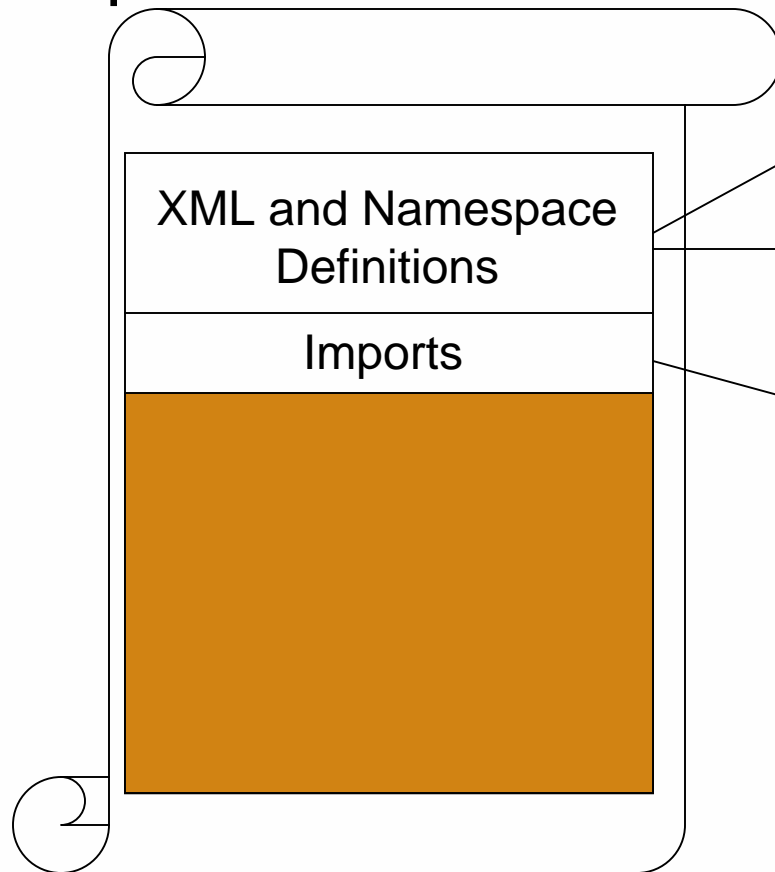


GWSDL, or Grid WSDL, is an extension of WSDL used in OGSF specification and is used for defining Grid services.



GWSDL document
and parts

Declarations specify OGSI namespaces and imports



GWSDL document
and parts

Target Namespace:

<http://www.targetingc2c.mil/namespaces/0.2/core/gwsdl/Targeting>

OGSI Namespaces:

`xmlns:ogsi=http://www.gridforum.org/namespaces/2003/03/OGSI`

`xmlns:gwsdl="http://www.gridforum.org/namespaces/2003/03/gridWSDLExtensions"`

Import OGSI types, messages, portTypes:

`<import location="../../ogsi/ogsi.gwsdl"`

`namespace="http://www.gridforum.org/namespaces/2003/03/OGSI"/>`

Complete Header

`<?xml version="1.0" encoding="UTF-8"?>`

`<definitions name="TargetService"`

`targetNamespace="http://www.targetingc2c.mil/namespaces/0.2/core/gwsdl/Targeting"`

`xmlns:tns="http://www.targetingc2c.mil/namespaces/0.2/core/gwsdl/Targeting"`

`xmlns:ogsi="http://www.gridforum.org/namespaces/2003/03/OGSI"`

`xmlns:gwsdl="http://www.gridforum.org/namespaces/2003/03/gridWSDLExtensions"`

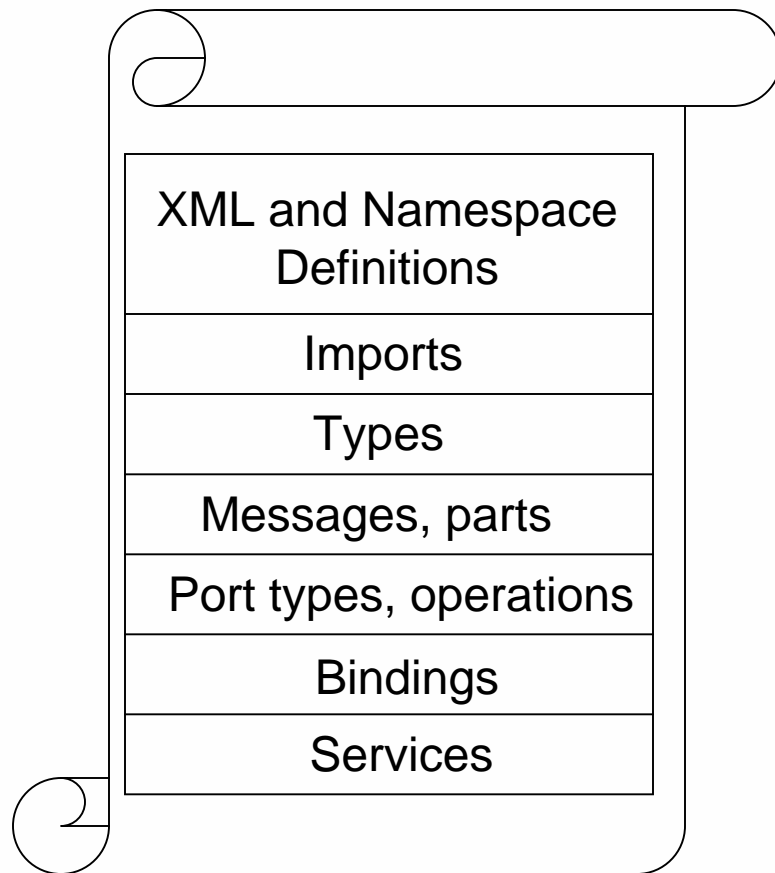
`xmlns:xsd="http://www.w3.org/2001/XMLSchema"`

`xmlns="http://schemas.xmlsoap.org/wsdl/">`

`<import location="../../ogsi/ogsi.gwsdl"`

`namespace="http://www.gridforum.org/namespaces/2003/03/OGSI"/>`

Differences between WSDL and GWSDL



- **GWSDL is extension of WSDL**
 - Provides features not available in WSDL 1.1
 - Port type inheritance
 - All grid services extend GridService and implement the interface
 - Service data
 - Needed for maintaining service state in service instances
 - Temporary solution until WSDL 1.2
- **No bindings specified**
 - Generated by IBM GTB

Marketplace Momentum

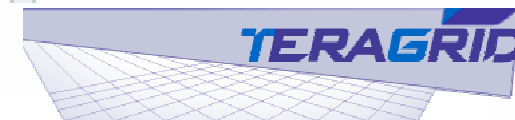


BOWNE

Morgan Stanley



GROUPE DASSAULT



charles SCHWAB



SONY



WACHOVIA


European Aeronautic Defense and Space Company

Challenge

- EADS wanted to build an “on demand computing” model for the simulation tools used by their engineers to shorten analysis completion time and provide a single image of computer resources.

Solution

- Shorten the product design cycle with a Grid Computing platform based on:
 - IBM ^{ATM}**
 - Linux**
 - Globus Toolkit**
 - GridXpert technology**



The screenshot shows the EADS corporate website. At the top, there are links for Corporate Research Center, Job Market, and a sign-up for a newsletter. Below this is a navigation bar with links for EADS, Product Range, Photo Gallery, Press, Contact, Jobs & Career, and Financial Information. The main content area is divided into several sections: EADS Divisions (listing Airbus, Military Transport, Helicopters, Space, and EADS CASA), Breaking News (with a headline about the EADS 2003 report), and Specials (listing various EADS services and projects). The website is designed with a blue and white color scheme and includes a footer with logos for various countries.

Technology Benefits:

- More robust, scalable IT infrastructure that adjusts as requests fluctuate**
- Open standards permit easy integration of existing software**

Business Benefits:

- Cut analysis and simulation time, while improving the quality of the output**
- Improve the productivity of the Design Office**

Charles Schwab

Business Analytics

Challenge:

Reduce the processing time on an existing wealth management application.

Solution:

- IBM ^ xSeries® servers
- Linux Red Hat
- Globus Toolkit v3.0
- IBM Research
- Server Allocation for WebSphere® Application Server

Technology Benefits:

- Reduced processing time from more than four minutes to fifteen seconds
- Planning to explore leveraging Grid computing into other areas

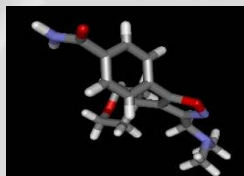
Business Benefits:

- Potential to increase customer satisfaction by responding to inquiries at a faster pace
- Potential to enable Schwab to provide more robust wealth management applications

“We believe that Grid computing ... has the potential to greatly improve our quality of service and be a truly disruptive technology.”

-- Oren Leiman, Managing Director, Charles Schwab

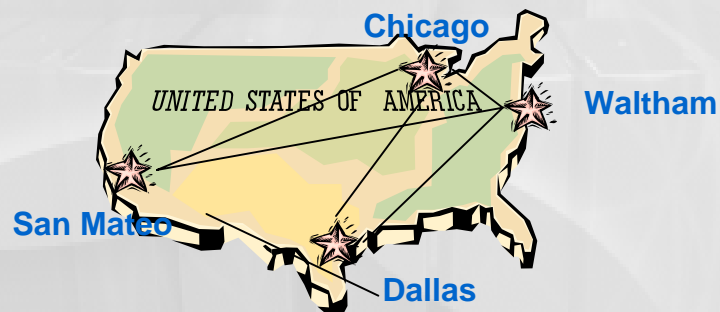
Grid @ IBM



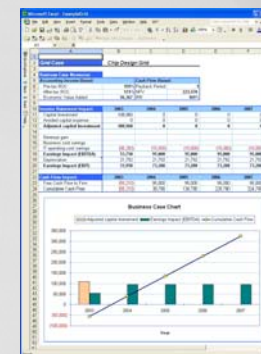
**“Donate the Power of
Your PC to Fight
Smallpox”**
PC World



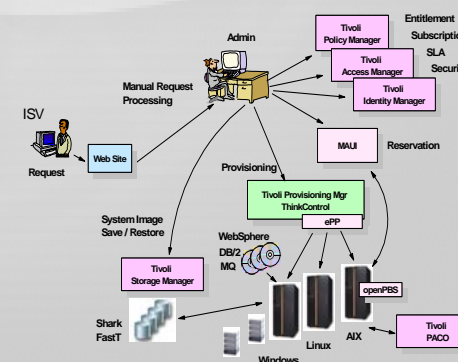
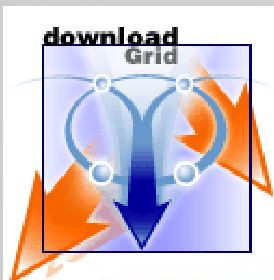
On Demand Design Centers



Grid Value at Work

Solutions Grid for Business
Partners

IBM intraGrid



Virtual Loaner Program

Steps to Building Grids

IGS provides end-to end services in order to receive full business benefit



- Value Assessment
- IT & Business Analysis
- Business Case Development
- Develop Implementation Plan

Grid Enablement

- Integrate Application
- Deploy Applications
- Design Process Flows

Set Up Environment

- Consolidate & Virtualize Resources

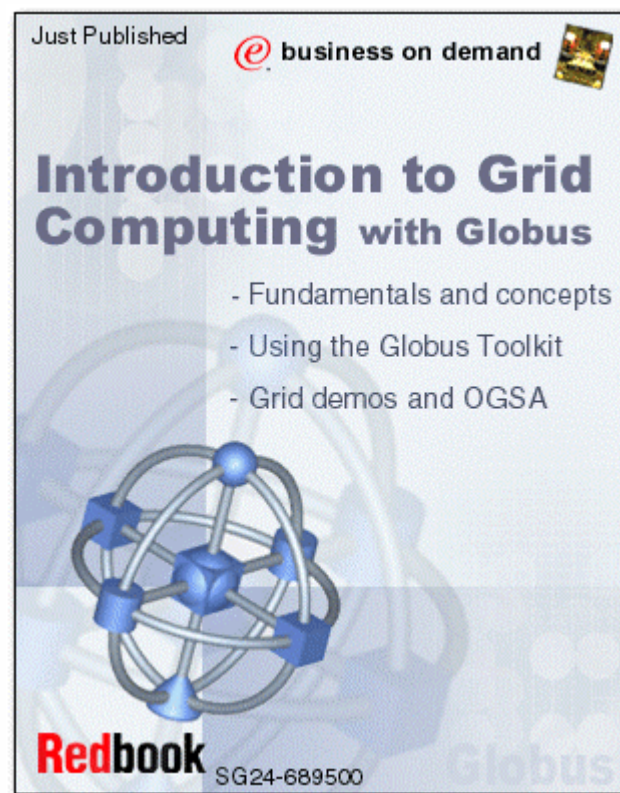
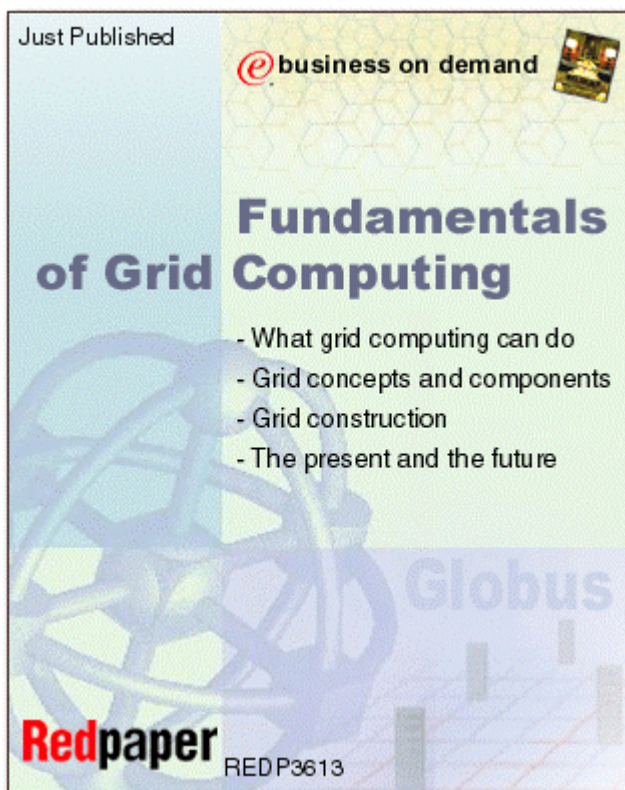
Workload & Job Distribution

- Application Enablement
- Automate Process Flows

Sustain Environment

- IT Monitoring & Measurement
- Gain Business Insight
- Plan Evaluation & Adjustment

Additional IBM Grid Information: Red Papers & Red Books



- Download from www.redbooks.ibm.com

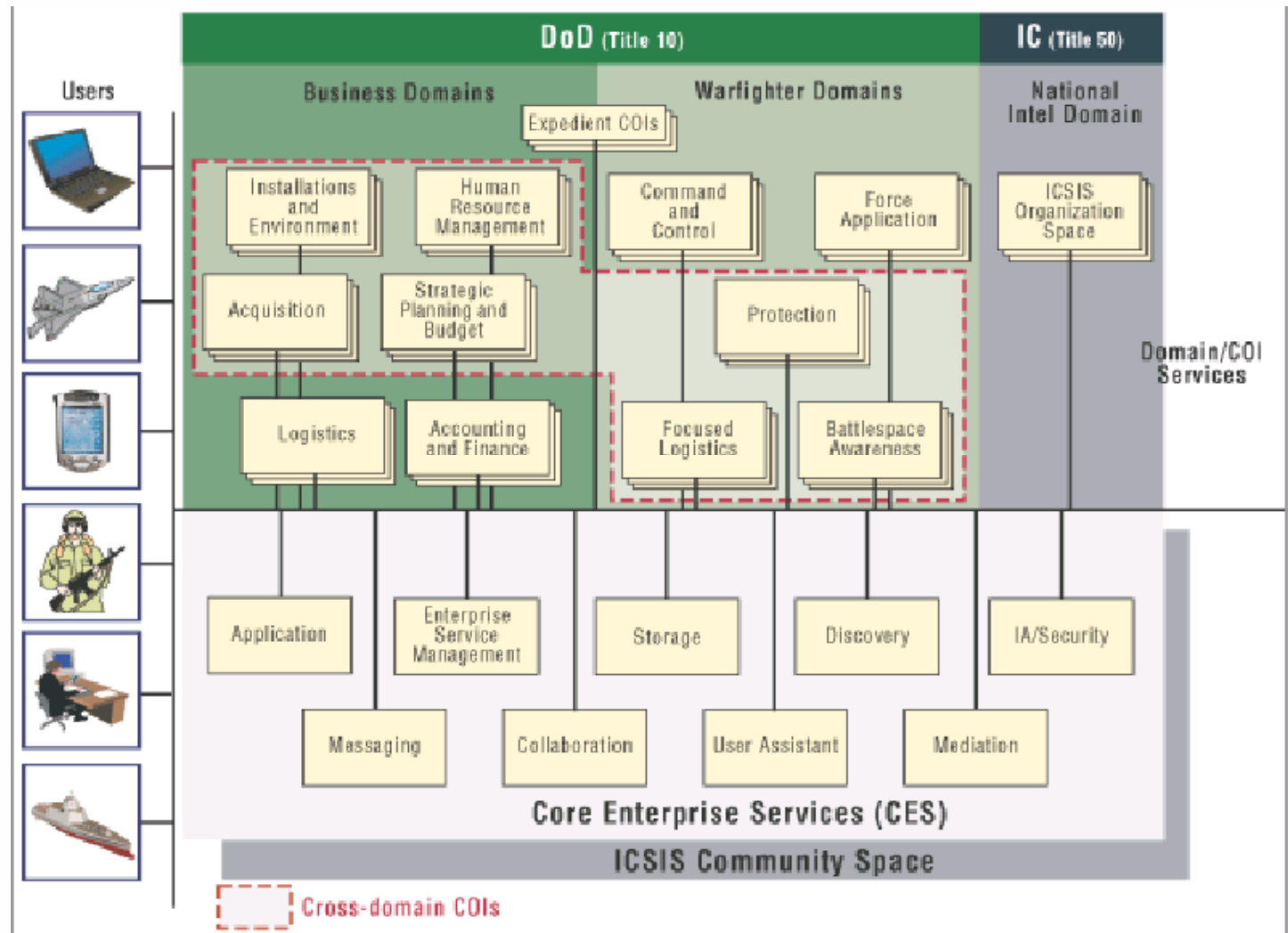
DoD Global Information Grid

Moving from
System Focus to
Service Focus

Edge Services
Domain Services
Core Services

Challenges:

- How to exploit Grid Computing?
- How do cross Domains?





DoD View of how GRID applies to Transformation

- Technical Objective: Transform Defense Intranets into powerful, self-managing, virtual computers
 - Enable Processing Environment for full Net-Centricity
- Fits with DoD Global Information Grid (GIG) Vision
 - Next evolutionary step in Distributed Computing
- DoD's Current State:
 - VAST collection of heterogeneous systems, just beginning to share communications and computing resources on Wide Area Nets
- Coming Soon: GIG Enterprise Services (GES)
 - Provides ubiquitous **Service-Oriented** access to DoD data
 - Allows rapid, efficient coupling of legacy transactions systems *and* new Warrior or Business applications
 - ***Will begin to address globally distributed computing issues***

UNCLASSIFIED

9

Thank You



Michael J Osias

mosias@us.ibm.com

<http://w3.ibm.com/grid>