Global Trends in Grid Computing
Development and Use

Stuart Feldman
VP, Internet Technology
Outline

- Grid – What: Technology, Usage Scenarios
- Grid – Why: Benefits and Expectations
- Grid – When: Technical & Business Roll-outs
- Grid – Where: Global Trends
- Grid – Who: Early Adopters,
- Grid and On Demand: A unified story
- Grid & Hong Kong: Opportunities and Significance
- Summary Next Steps, Key Messages
Grid - What

Technology Scenarios
Usage Scenarios
Grid – Definition and Technology

A Grid is a system that:

► coordinates resources that are not subject to centralized control
► using standard, open, general-purpose protocols and interfaces
► to deliver nontrivial qualities of service
  – (Ian Foster, Argonne National Lab, co-creator of original Grid)

Stages of the Technology

► Current Grid (as in Globus Toolkit 2) provides organized sharing of remote independent resources

► Future Grid (as in Globus Toolkit 3) provides access to managed services, of which computing resources are an important case.
  – First release of software for GT3 a few months ago.
Grid Computing

Distributed Computing Over a Network, Using Open Standards to Enable Heterogeneous Operations
Open Grid Services Architecture (OGSA)
Architecture Framework

Applications

Open Grid Services Architecture (OGSA)

Web Services

Autonomic Capabilities

OGSA Enabled Security
OGSA Enabled Workflow
OGSA Enabled Database
OGSA Enabled File Systems
OGSA Enabled Directory
OGSA Enabled Messaging

Professional Services

OGSA Enabled
OGSA Enabled
OGSA Enabled

Servers
Storage
Network
Grid - Why

Benefits
Expectations
Grid Computing Enables IT and Business Value

Business Value

- Improve Operating Efficiency/ROI
- Reduce Capital Expenses
- Accelerate Business Processes
- Enhance Employee Productivity
- Quickly Adapt to Changing Requirements

IT Value

- Improve Asset Optimization
- Integrate Heterogeneous Resources
- Enable Data Access, Integration and Collaboration
- Strengthen Redundancy and Resiliency
- Quickly Respond to Variable Demands
Imagine the possibilities...

What would it mean if your business could...

- Analyze the value or risk of an investment portfolio in minutes, rather than hours?
- Significantly accelerate the drug discovery process?
- Scale your business to meet cyclical demands – while cutting IT expenditures
- Reduce the design time of your products, while reducing the instances of defects?
- Unite your research teams with others around the world to take advantage of the most up-to-date learnings?
Grid - When

Technical and business Rollouts
Grid Adoption Steps – Roadmap to Value

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

Billing and Metering:
- Enable applications to be set up in a usage-based charging model
- Track usage and bill/chargeback users based on cost models

Automated Provisioning:
- Identify and allocate resources to meet quality of service goals for applications
- Configure and initiate these resources as required

Task Scheduling:
- Manage the execution of parallel, short running tasks across distributed resources
- Provide a programming model to enable applications to leverage this capability

Workload Management:
- Monitor and manage resources to help applications achieve quality of service goals
- Manage the prioritization and resource selection for tasks and jobs

Data Virtualization:
- Enable data federation, location, replication, caching, and access
- Data Grids work on block level data, files, or information in databases

Base Grid:
- Machines/Clusters to run workload
- Middleware and agents to make machines/clusters accessible and manageable
- Management functions to distribute and manage tasks and machines/clusters
Rollout Sequence

- Research community (physics, astronomy, biosciences, etc.)
- Technical community (engineering, etc.) within companies
- Government (infrastructure and first uses)
- Large enterprises for internal operations
- Inter-company virtual organizations (including SMB participants in value nets)
# Grid Focus Areas

<table>
<thead>
<tr>
<th>Description</th>
<th>Research &amp; Development Grid</th>
<th>Engineering &amp; Design Grid</th>
<th>Business Analytics Grid</th>
<th>Enterprise Optimization Grid</th>
<th>Government Development Grid</th>
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<tbody>
<tr>
<td>Accelerate and enhance the R&amp;D process by enabling the sharing data and computing power seamlessly for research intensive applications</td>
<td>Share data and computing power, for computing intensive engineering and scientific applications, to accelerate product design</td>
<td>Enable faster and more comprehensive business planning and analysis through the sharing of data and computing power</td>
<td>Optimize computing and data assets to improve utilization, efficiency and business continuity</td>
<td>Create large-scale IT infrastructures to drive economic development and/or enable new government services</td>
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| Priority Sectors | Public, Industrial | Industrial | Financial Services, Public, Industrial | Financial Services, Public, Industrial | Public |
Grid - Where

Global Trends
Grid Usage

- Sectoral, then geography drive
- First the scientific research organizations
  - Grid originally created for those problems, head start
  - Significant investment by science authorities worldwide
    - Initially US, now EU committed, with A-P participation growing
- Then experiments by major multinationals and governments
  - Earliest interest in Finance, Manufacturing sectors
  - Resource sharing and optimization within the corporation
    - First examples in US, rapid mirroring elsewhere
  - Web services evolving to distributed execution
- Next the inter-enterprise collaboration
  - Supply chain
  - Service provision
  - Essential for small and medium, not just mega-corporations
Grid - Who

Market Participants
Examples of Early Adopters
# Grid Ecosystem

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<tr>
<td>• Accelrys</td>
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<td>• Cornerstone Systems</td>
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<td>• MSC Software</td>
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<td>• Systems</td>
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<td>• Japan Research</td>
<td>• Kobelco Systems</td>
<td>• Morse</td>
<td>• Beacon</td>
<td>• Malaysia Debt</td>
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<td>Institute</td>
<td>• Science + Computing</td>
<td>• Anix</td>
<td>• Information Technology</td>
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<td>• TBC</td>
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<td>• C.a.r.u.s Info. Tech.</td>
<td>• Globus</td>
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<td>• Global Information</td>
<td>• Comparex Informationsysteme GmbH</td>
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<td>• Anterio Consult &amp; Research</td>
<td>• Platform Computing</td>
<td>• Platform</td>
<td>• Technology</td>
<td>• Bechtle Logistik und Service GmbH</td>
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Aventis

Challenge

• Distributed, diverse data sources across continents
• Limited ability to consolidate, construct and analyze data sets

Solution

• Linux
• IBM @server
• IBM Discovery Link

Technology Benefits:
• Using IBM DiscoveryLink to bring together data sources in one coherent view

Business Benefits:
• Significant increase in researcher productivity due to improved collaboration
• Better data quality and currency
Royal Dutch/Shell

Challenge
• Improve accuracy and speed of summarization and scientific modeling applications

Solution
▪ IBM @server
▪ Linux
▪ Globus Toolkit

"Grid computing is important to Shell because it offers the potential to create a truly unlimited resource, with a uniform interface to a variety of services. This is a significant opportunity for Shell to engage its independent companies in closer cooperation. “ J.N. Buur, Principal Research Physicist, Shell International Exploration and Production B.V.

Technology Benefits:
▪ More robust, scalable IT infrastructure that adjusts as volumes fluctuate
▪ Open standards permit easy integration of existing software

Business Benefits:
▪ Cut processing time of seismic data, while improving the quality of the output
▪ Focus employees on key scientific, not IT problems
Challenge

- Microprocessor Design
- Benchmarking & Testing
- Server Design

Solution

- IBM @server
- Globus Toolkit
- IBM Global Services

**Microprocessor Design Grid**
- Chip simulation driving 80% resource utilization
- Lower error rates in microprocessor designs
- Reduced development cycle, improved ROI and design engineer productivity

**Benchmarking/Testing Grid**
- Allows for larger scaling tests at lower costs by pooling all the servers across multiple sites

**Z Series Design Grid**
- Production environment is adjusted to average workload, lowering fixed cost
- Increased computing power for HW simulations
- 40% increase in productivity of hardware engineers
Charles Schwab

Challenge

• Reduce the processing time on an existing wealth management application to improve customer service.

Solution

• IBM @server
• Linux
• Globus Toolkit
• IBM Infrastructure Technology Services
• IBM Research

Technology Benefits:

• Reduced processing time from four minutes to fifteen seconds...
• Leverages existing infrastructure...
• Grid enabling many more applications

Business Benefits:

• Increase customer satisfaction by responding to inquiries in real time...
• Enabling Schwab to move from a low cost transactional broker to an advice based wealth manager

“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

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RBC Insurance

Challenge
• Reduce the time it takes for an insurance policy valuation application to run

Solution
• IBM @server
• IBM Infrastructure Technology Services
• Platform Computing (ISV)

Technology Benefits:
• Reduced processing time from eighteen hours to thirty-four minutes
• Automated job-scheduling
• Expanding implementation

Business Benefits:
• Can run more complex scenarios to reduce risk exposure
• Actuaries can spend less time scheduling application
Shanghai City Grid

Challenge

• Shanghai municipal government will integrate and manage decentralized IT resources among departments, enhance resource sharing and collaboration between departments with a virtual intranet environment, increase working efficiency, reduce costs.

Solution

• IBM working with Shanghai government and universities to build City Grid.
• IBM is assisting in the planning of the grid infrastructure as well as training

Technology Benefits

• Integrate computing resources
• Early experience with process sharing and grid service models

Business Benefits

• Increase efficiency of government services
Kansai Electric Power

Challenge
• Japan’s second largest electric utility company has various information in a heterogeneous, distributed database environment
• Integrate information beyond departments and affiliated companies to enable information sharing

Solution
• Create virtual database federated from heterogeneous database environment
• IBM DB2 Data Federation Technology
• Wrapper to access other RDBs including legacy database

“KEPCO has been working very closely with IBM and IBM's Grid computing technologies to develop an information based grid that will allow KEPCO to federate and virtualize their various data sources across the enterprise”

Technology Benefits:
▪ Virtualize various data sources across the enterprise
▪ Enable information sharing using existing systems including legacy database
▪ Enable to develop new businesses more rapidly at a minimum cost
The Taiwanese government is building a grid between their leading academic and research institutions for research and collaboration in the areas nanotechnology and life sciences.

IBM and NCHC building National Grid Test Bed

IBM is assisting in the planning and implementation of the grid infrastructure.

Technology Benefits

- Integrate in-country academic and research computing resources
- Test implementations and investigations into billing and provisioning systems will take place

Business Benefits

- Stimulate research in Life Sciences and Nanotech
Grid and On Demand

Chicken and Egg –
Part of a Single Story
An enterprise whose business processes - integrated end-to-end across the company and with key partners, suppliers and customers - can respond with speed to any customer demand, market opportunity or external threat.
<table>
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<th>Description</th>
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<tbody>
<tr>
<td><strong>Responsive</strong></td>
<td>Anticipating and forecasting changes in the marketplace&lt;br&gt;Responding quickly to opportunities, competitor’s moves or regulations&lt;br&gt;Simplifying and improving collaboration with partners and customers&lt;br&gt;Delivering customized information, products to customers and partners&lt;br&gt;Exploiting technology in support of business strategy</td>
</tr>
<tr>
<td><strong>Focused</strong></td>
<td>Managing capital investment to improve short-term ROI&lt;br&gt;Reducing risk of under- or over- estimating demand&lt;br&gt;Making cost structures more variable to adapt to business conditions&lt;br&gt;Adjusting IT resources (computing resources or people) when needed&lt;br&gt;Increasing or decreasing business process capabilities when needed</td>
</tr>
<tr>
<td><strong>Variable</strong></td>
<td>Simplifying and streamlining core or strategic business processes&lt;br&gt;Integrating business processes tightly with partners including suppliers&lt;br&gt;Facilitating changing of partners/suppliers by making business processes modular&lt;br&gt;Outsourcing non-core or non-strategic business processes&lt;br&gt;Selling company’s business process or IT capabilities as a product/service</td>
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<tr>
<td><strong>Resilient</strong></td>
<td>Protecting privacy of customer and employee information&lt;br&gt;Ensuring continuity of business operations in the event of disruption&lt;br&gt;Securing corporate assets, such as facilities and intellectual property&lt;br&gt;Managing complexity of business operations&lt;br&gt;Managing risk from expanding strategic partner and supplier networks</td>
</tr>
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</table>
The Three Market Plays

- Business Transformation
- Financial & Utility Offerings
- Operating Environment
On Demand Operating Environment

Integration of People – Process – Information
Anywhere, any time, from any device

Collaboration
Transactional Processes
Information Management

Application Development, Deployment & Maintenance

Policy-based Orchestration

Availability
Security
Optimization
Provisioning

Virtualization Engine

Servers
Storage
Distributed Systems
Network

Business Objectives and Policies

Integration
Automation
Virtualization

Open Standards-based
Delivering the Operating Environment

Based on an evolving set of components that simplify development, deployment and maintenance

Based on open standards

- XML
- Web services
- J2EEM
- OGSA Open Grid Services Architecture
- Common Information Model

Shared components

- Integrated system console
- Security and identity
- Choreography
- Transaction coordination
- Data persistence
- Workload management
- Collaboration
- Application connectivity
- Configuration tool
Grid and Hong Kong

Readiness Opportunities
Hong Kong Readiness

- Network infrastructure in place
- Computing capabilities ready
  - Some specialized Grid services needed
- Software knowledge base strong
Hong Kong Opportunities

- Participation in worldwide scientific research
- Participation in worldwide value nets
- More effective government operations
- Leadership in consortia (PRD especially)
Summary

What To Do

Key Messages
Getting Started

- Gain knowledge and get educated on Grid
- Determine the value of Grid to your organization
- Identify the right Grid offering(s) for your business
- Develop and prioritize a list of Grid projects and/or pilot implementations
- Architect and implement Grid solution(s)
Make Grid a part of your competitive strategy

- Higher Quality of Service
- Increased Productivity
- Improved Resiliency
- Increased Efficiency
- Reduced Complexity & Cost
IBM Commitment & Focus

**Commitment**

- Open standards
- R&D and investments in grid and related technologies
- Industry-leading partners
- Multiplatform experience and expertise
- Worldwide grid strategy, design, implementation and integration services

**Focus**

- Industry-specific offerings
- Product development roadmaps
- Ecosystem build-out
- Implementing grids in commercial and public organizations
- Integrated solutions: HW, SW, Services and Partners
Key Messages

• Grid is real and growing today!

• Grid is about business value/business transformation!

• Grid is creating value for commercial enterprises TODAY!

• Grid functionality is being built on open standards!

• Grid is a great first step toward on demand!

• Hong Kong is well positioned for exploiting Grid