Accelerating the Adoption of Grid Solutions in the Enterprise

December 2004

Table of Contents

2400 Camino Ramon, Suite 375, San Ramon, CA 94538
Tel: 925.275.6644
Email: info@gridalliance.org
Web: www.gridalliance.org

I Executive Summary

To date, grid computing has been effectively put to use in academic and research institutions to power high-performance and technical computing applications and to solve scientific grand-challenge problems. It has also been deployed effectively for batch-oriented, computationally intensive production tasks such as engineering analysis, seismic analysis, portfolio analysis, and risk management. Adoption of grid technology by the larger community of commercial and public sector businesses has been slower, however, and limited in scope. Although the benefits are clear, current grid technologies and products need to be adapted to suit evolving data center requirements.

Early adopters of grid computing in the enterprise are demonstrating the importance of this new computing paradigm to add new information systems value and reduce the cost of business operations. The Enterprise Grid Alliance (EGA) was formed specifically to represent the needs of commercial and public sector enterprise organizations, further accelerate the development of enterprise grid computing solutions, reduce costs by advocating standards, and drive adoption of grid technologies.

An important step in this process is to build consensus around standards and specifications that can be used as foundational technologies for developing grid solutions that meet the needs of enterprise organizations. The EGA aims to facilitate the transfer of the proven benefits of grid computing from the research and scientific community to the mainstream enterprise. These benefits include:

- higher utilization of IT resources
- agility in allocating compute power in alignment with business priorities
- cost-effective deployment of scalable applications that process larger amounts of data than previously feasible

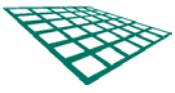
The EGA is investigating and articulating the needs of enterprise organizations in order to accelerate development of grid technologies and eliminate remaining barriers to adoption. Rather than conducting this work in a vacuum, the EGA is collaborating closely with other standards-making bodies and with users who are evaluating and developing grid solutions for their data centers.

The EGA is taking a very pragmatic approach to focus on near-term practical solutions that are not currently being addressed by the wider grid community. Initially, the EGA is focusing on enterprise grid computing within a single administrative domain, to satisfy the immediate need for a flexible, adaptable infrastructure to support existing core applications such as enterprise resource planning (ERP), customer relationship management (CRM), business intelligence (BI), and enterprise data integration.

Over the next two to five years, the EGA plans to expand its technological charter to enable resource sharing and collaboration between data center grids and between organizational entities. The EGA will also broaden its scope to address business technical applications such as modeling, simulation, financial portfolio analysis, and others that are not already addressed by existing grid technologies and specifications.

The first step is to define common grid terminology to facilitate understanding and communication between grid developers, interest groups, and users. The EGA's goal is to enable grid components to interoperate over their entire lifecycles, enabling cross-departmental and cross-organizational interactions between compute resources, applications, data, people, and processes.

The EGA is driving open standards, establishing a common lexicon, collaborating with existing interest groups, identifying gaps, and creating specifications, where none exist. EGA working groups have been formed to address technical, marketing, and regional issues relevant to the development and consistent deployment of grid computing solutions. The EGA will work to create consensus among groups to smooth the path to grid adoption.



II Alliance Goals

What is the EGA?
The EGA is a consortium of leading vendors and end-users focused on developing enterprise grid solutions and accelerating the deployment of grid computing in the enterprise. It is open, independent, and vendor-neutral. Anyone can join the EGA by executing relevant agreements and paying dues.

EGA member companies can select their level of involvement by joining at the Sponsor, Contributor, or Associate levels. EGA oversight is provided by a Board of Directors, which is elected by and from Sponsor Member representatives. This board is responsible for the overall operation of the alliance. Steering Committees oversee working groups, formed to address specific technical, marketing, and regional activities related to driving adoption of enterprise grid computing.

EGA Goals
The overall goal of the EGA is to promote adoption of grid computing within and between organizations. EGA is concerned with accelerating the use of grid technology in data centers, behind firewalls, in public and private sector enterprises. This charter includes the following work:

- advocating the unique requirements of enterprise data centers
- establishing a lexicon for grid computing technology
- driving adoption of industry standards and specifications for grid computing
- fostering agreement between interest groups, vendors, and users, enabling the development of interoperable grid components
- identifying gaps and creating standards and specifications, when necessary

Enabling Development of Solutions
The EGA is dedicated to supporting development of practical, real-world, cost-effective solutions that can deliver the benefits of grid computing to enterprise data centers in the near term. The purpose of the EGA is to provide enterprise users with:

- a clear understanding of what grid is and what it can mean to their organizations
- access to grid computing technologies from various suppliers conforming to EGA specifications, which are designed to enable robust, interoperable grid computing within the enterprise
- the ability to build grid environments more quickly and easily, and ensure interoperability between components

III What Is Grid?

Rather then defining grid as specific components, attributes, or configurations – which change over time as technology changes, the Enterprise Grid Alliance (EGA) defines grid computing as a style of computing. The EGA's evolving definition of enterprise grid computing focuses on the functionality a grid can provide to enterprise data centers. EGA will provide additional levels of definition in the first half of 2005 when the EGA Reference Model and Glossary will be available for public review.

Defined by Functionality
At the highest level, "enterprise grid computing" is characterized by an architecture that aggregates IT resources into dynamically assignable pools managed at a higher level of abstraction, enabling organizations to:

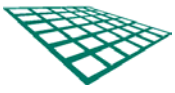
- provision resources to dynamically meet application requirements and business priorities
- consolidate computing components into a few large resource pools, simplifying provisioning tasks
- standardize computing components, configurations, processes, and applications across an enterprise
- scale as resources and workloads grow

Grids in Context
Grid computing evolved from, and is a confluence of, many trends in modern computing. Virtual access across the internet has made physical location less important. Virtual processing environments are becoming common. Virtual storage is already in use in many organizations. Failover clusters and high-performance clusters are being deployed by more users. Management frameworks are becoming more sophisticated. Growth in network bandwidth has enabled networks of servers to function as a fabric of resources that interacts with other application components and gets data across networks. From these trends and technologies, grid computing inherits some important attributes, including:

- fault resilience through redundant systems and interconnects
- ability to scale up (vertically) and out (horizontally)
- load-balancing capabilities for heavy workloads
- support for a variety of systems, including legacy and low-cost servers
- on-the-fly addition of new systems, to support incremental growth

Enterprise data centers have additional requirements that are unique to enterprise computing. Hence, the participants in the Alliance have joined together to identify and address these requirements. The Alliance is concentrating on pulling these trends together to give the best solutions for enterprises.

NOTE: The EGA is not initially addressing certain types of grids used in the scientific community: desktop grids, vector supercomputers, and academic research grids. The EGA believes these technologies are already being addressed by existing grid interest groups.



IV The State of the Art

To be successful with grid today, enterprise customers must be resourceful. Success requires careful integration of:

- Computers, networks, and storage
- Operating systems and resource management software
- Applications from a small (but growing) set of vendors
- Custom applications developed in-house

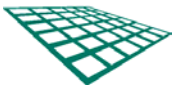
The EGA wants to make all this easier by advocating ready-to-deploy robust grid solutions based on open, industry-standard technology. Users will then be able to select best-of-breed products from many suppliers, so they can avoid vendor lock-in, get the best value for their money, and consistently meet their IT needs over the years, even as their IT requirements change. Grid technologies based on open industry standards preserve choice and flexibility for enterprise users.

Grid standards also let vendors commit to product development roadmaps and invest time and capital in developing solutions that interoperate with other vendors' products. Open standards also enable grid solutions to be forward and backward compatible over time, preserving enterprise investment in a grid infrastructure. Established standards and specifications help level the playing field for small vendors and individual programmers who can deliver significant value with innovative point products. Wide industry involvement preserves customer choice and makes the best solutions available to the market, regardless of the size or reach of the manufacturer.

Building Momentum

The EGA brings together members of the grid community to evaluate and drive acceptance of standards and specifications that can be used as a foundation for developing future grid capabilities. By building grid standards and specifications into products in the near term, grid solution providers can offer building block technologies that deliver immediate benefits, such as scalability, interoperability, and investment protection, to early adopters.

The goal of the EGA is to create a taxonomy and vocabulary for grid computing; promote standards and specifications as they emerge; identify gaps in the technology; and create standards when necessary. In this way, the EGA aims to unite vendors, users, and existing consortia and interest groups, so they can share a consistent vision of grid computing and how it will operate in enterprise data centers on a local and a global scale.



V EGA Roadmap

The EGA has set out a grid development roadmap with three distinct phases. These phases show where the EGA will focus, but do not preclude the Alliance from working on any useful aspect of enterprise grid computing.

Phase I – Core Capability

In its first year, the EGA is focusing tightly on enterprise grid computing within a single administrative domain. This means applications and systems running behind a firewall in one data center of a single organization.

In Phase I, the EGA is focusing on:

- applications running in a single administrative domain
- operations within a data center owned by a single legal entity
- commercial applications, including enterprise resource planning (ERP), customer relationship management (CRM), business intelligence (BI), and enterprise data integration.

The ultimate goal of Phase I work is to provide basic interoperability between grid components from many vendors in a single data center. It may also address interaction between data centers to enable high availability, load-balancing, and cooperative processing.

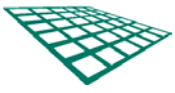
Phase II – Include and Extend

In the next two years, the EGA plans to broaden its focus to include a wider variety of application types, such as simulation, modeling, and financial portfolio analysis, and to address data and compute cyclesharing between multiple grids.

In Phase II, the EGA will focus on:

- technical grid applications
- message-passing between applications such as supply chain and trading
- supporting Web service calls between applications
- scheduling compute-intensive tasks during off hours, for faster rendering and efficient utilization of IT resources without priority conflicts
- extending application functionality to partner organizations and to customers

In Phase II, basic interoperation can be built between enterprise grid environments.



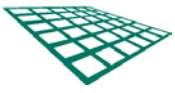
Phase III – Unify and Complete

In the next three to five years, the grid computing paradigm will be opened up to include cross-entity resources sharing, which may include extending data stores, applications, and compute resources over a dedicated network or over the open Internet.

Capabilities for Phase III grids include seamless interoperation between enterprise grids, including:

- cooperative processing between data centers
- full interoperation between enterprise grids owned by separate entities
- dynamic capacity addition to grow grids quickly
- support for all enterprise applications

This final phase of development of the grid concept will allow for service provider business models, so any company can purchase IT resources just as they would any other utility. The utility computing model will be enabled by capacity-on-demand, dynamic capacity addition, and complete support for a wide range of enterprise applications.



VI Barriers to Enterprise Adoption

A new paradigm raises a lot of questions from those evaluating whether to deploy it within their organizations. The same is true of grid computing. Here are six areas in which enterprise users expressed concern about grid operation and management, as they try to understand how grid computing could be put to work in their data centers.

The EGA has begun to address these concerns in its Technical Working Groups, which are working to create solutions so enterprises can achieve maximum benefits from the grid technologies they deploy today, and in its Regional Groups, that address issues specific to certain geographies.

1. What is a grid? How does it work?

Problems:

- Enterprise grids have no standard model for component interactions.
- Solutions to individual problems lack an overall context.
- It's not clear how components and interactions create solutions.
- The taxonomy and vocabulary are not widely agreed upon.

Solution: Establish common terms and a reference model for grids that are accepted and understood in the industry, so component vendors can communicate clearly and consistently with enterprise users and with one another. The EGA will address this in its Reference Model Working Group and attempt to align efforts with other standards groups.

2. How can grid components from different vendors interoperate? How will enterprises do data and component provisioning in a grid environment?

Problems:

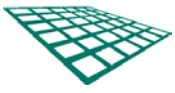
- No standard provisioning interfaces exist for enterprise grid components.
- Proprietary interfaces restrict development of cross-vendor solutions and limit provisioning capabilities within and between data centers.
- Enterprise grids have massive amounts of data.
- Enterprise grids need a standard interface to modern storage subsystems.
- Users need a standard interface for moving and copying files across and within storage subsystems.

Solution: Drive acceptance of provisioning standards that enable consistent access to data and storage regardless of the component type or resource provider.. Standard interfaces allow users to minimize investment in tools and skills required to manage a grid infrastructure. Open standards enable creation of integrated, cross-vendor grid solutions. The EGA will address the above problems in its Data and Component Provisioning Working Groups.

3. How can my IT department charge for CPU and applications usage?

Problems:

- Enterprise grids need standards for resource accounting.
- There is no standard way to collect and report usage information.
- There is no agreement on usage metrics.



Solution: Enable metering and chargeback capabilities. The EGA Utility Accounting Working Group will:

- drive the industry towards standardized usage accounting for software and hardware
- leverage existing utility frameworks
- enable a pay-per-use model, so enterprises can charge-back to users and departments

4. Once IT resources are virtualized, how can I guarantee the security of my applications and data? How do I authenticate users across all components?

Problems:

- Enterprise grid security is not well understood.
- Lack of understanding may inhibit grid adoption.
- Some enterprise customers believe security issues make it difficult to safely deploy grid technology today.

Solution: Identify security requirements and recommend solutions. The EGA will address these problems in its Grid Security Working Group. Once this group has defined the security issues that can result from consolidated shared components, it can begin the work of evaluating existing solutions and proposing a safe and reliable set of security best practices.

5. How will so many players in the grid market come together to decide on a set of standards?

Problems:

- There is no momentum around a single vendor, technology, or standards organization to clarify what the standards should be.
- Efforts are often duplicated between groups, vendors, and users, creating confusion.

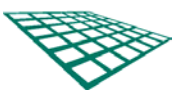
Solution: Drive standards adoption and gain traction in the grid market. The EGA is building momentum around technologies and specifications that can accelerate development of standards-based grid solutions. The EGA's role is to collaborate with standards-making bodies, identify synergies, and evangelize membership in the EGA to all grid vendors and enterprise users. The EGA Marketing Working Group is continuing to investigate new ways to promote the advancement of grid solutions, so the good work from a wide variety of organizations can be leveraged by others. The EGA has a shared goal with other consortia: to develop and market open, secure, scalable grid solutions to the enterprise market.

6. How can global enterprises use grid computing efficiently across international boundaries?

Problems:

- There is no current support for global standards or specifications for grids.
- No one group is addressing the needs of enterprises operating globally and in specific regions.
- Users need to standardize grid implementations in data centers, regardless of location, and train local staff to administer them.
- Vendors need to understand requirements of regional government agencies and major NGOs.

Solution: Create global parity in standards and available technologies. EGA Regional Groups have been established to promote adoption and development of equivalent grid technologies on an international basis. The goal is to enable global enterprises to implement excellent grid solutions consistently across multiple data centers, regardless of the location or language. This capability enables enterprises to create reproducible configurations, lowering cost of operation and management for large data centers.



VII EGA Working Groups

The EGA is addressing an initial set of identified enterprise requirements in its Technical Working Groups and regional committees. Each of these groups is focusing on specific problems that may be slowing the wider adoption of enterprise grid computing.

The deliverables for these Technical Working Groups may range from prototype implementations to recommended architectures and standards. Interaction with other standards bodies may range from providing feedback to existing standards and identifying gaps in existing standards, to suggesting new working groups within the appropriate body to develop additional standards.

EGA Reference Model Working Group
The EGA Reference Model Working Group is establishing a lexicon for grid computing, so vendors and users can have a common vocabulary for discussing, developing, and deploying grid technologies. The group is defining grid terminology in a Glossary, and it is developing a Reference Model that defines the overall architecture of a grid, including its components, interfaces, interactions, and data models.

This Reference Model is designed to enable interoperability among heterogeneous grid applications or products and to improve integration of grid applications or services. The work of this group is necessary to help enterprises understand the opportunities for effectively using grid technologies to optimize IT resources in their data centers.

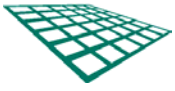
The role of the Reference Model Working Group is to provide all of the other EGA working groups with a shared context. This includes:

- A **Glossary of terms and taxonomy** which ensure that EGA members share a common vocabulary and can communicate effectively.
- A **Reference Model** which describes how the various grid components function in the data center, their relationship to each another, their life cycles, and so on. This is to ensure that working groups tackling specific problems to do with a specific enterprise grid component are not doing so in isolation.
- A **set of Use Cases** which provide the context for the management of the various enterprise grid components, and thus for the problems which exist within data centers today. Each Working Group is expected to take a high-level use case associated with a specific customer problem and develop it in greater detail, to flesh out the context for the real world problem they are chartered to solve.

EGA Data Provisioning Working Group
The EGA Data Provisioning Working Group is chartered with identifying the requirements of data provisioning in enterprise grids. Specifically, this group is developing usage scenarios and reference implementations. The initial focus of the working group is on bulk operations and simple paradigms, such as deployment and redeployment. Subsequent focus will be on incremental and fine-grained data operations.

Initial scope:
- Initial focus on bulk operations
- Profile and evaluate existing specifications such as SMI-S
- Define enterprise requirements and identify where not met by existing specifications

This group will work on establishing APIs for data provisioning in enterprise-class grids. The EGA's approach involves exploratory code for getting experience, with a longer term goal of writing an SMI-S profile for eventual standardization by INCITS/ANSI.



EGA Working Groups

EGA Component Provisioning Working Group
The EGA Component Provisioning Working Group is chartered with defining Use Cases, reference implementation, and technical specification for foundational provisioning operations. The group will determine and gain approval for a basic reference technology stack to support the first implementations of provisioning interfaces.

Initial scope:

- Evaluate enterprise components, including storage, servers, databases, application servers, and networks.
- Determine a basic technology stack for first implementations.
- Create a capability interrogation mechanism to avoid lowest-common-denominator interfaces.
- Begin with small primitives (install, start, stop, uninstall), and move to higher-value operations over time.
- Publish intermediate results to enable incremental adoption.

EGA Utility Accounting Working Group
The EGA Utility Accounting working group is creating Use Cases to help define utility accounting requirements in enterprise grid environments. It will also investigate usage accounting models across utility industries, such as telecommunications, and map these to usage metrics, APIs, and processes created by other standards bodies.

The Utility Accounting Working Group is working in two major areas to:

- Create a report on all relevant standards or works in progress in standards bodies such as TMF/NGOSS and Distributed Management Task Force (DMTF)
- Create a set of Use Cases in which usage accounting is a key benefit of adopting a grid computing architecture

From these exercises, the group will outline recommended usage accounting models and data collection mechanisms for each component in an enterprise grid implementation and resolve issues with aggregation and virtualization of components.

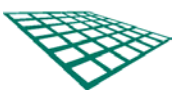
EGA Security Working Group
The EGA Security Working Group is chartered with identifying unique security requirements that may result from deploying an enterprise grid. The initial focus of the working group will be to address security issues arising from shared component usage and identify solutions that use existing technology.

Initial scope:

- Identify security requirements that may result from having consolidated or shared components.
- Determine how to solve security issues specific to grid computing in the enterprise with existing technology.

EGA Marketing Working Group
The EGA Marketing Working Group is tasked with positioning and promoting EGA as a driving force for the acceleration of grid computing in the enterprise. The group manages ongoing marketing activities to:

- build brand awareness in the market
- sustain market momentum
- recruit new members
- launch organizational news
- evangelize technology deliverables



EGA Regional Groups
The EGA recently launched Regional Groups to evaluate the needs of multinational and non-U.S. enterprise customers that might be overlooked by U.S.-centric working groups. Different regions may have unique needs and regulations that dictate how a grid must function. The EGA aims to explore the needs of both large and small organizations across geographical areas and promote enterprise grid adoption globally.

Two steering committees were established earlier this year:

- EGA Japan Regional Steering Committee (J-RSC)
- EGA EMEA Regional Steering Committee (E-RSC)

The goal of the Regional Groups is to support multinational enterprise customers who wish to deploy and operate grid solutions that are consistent and equivalent between geographical domains, and also to support small companies in all countries that wish to make use of grid computing technologies.

VIII Standards Compliance and Collaboration

Besides proposing solutions for specific barriers to adoption, the EGA will also play an ongoing role in evaluating products and technologies that comply with grid standards. This work includes:

- assembling and profiling component specifications
- endorsing specific products and architectures
- defining new specifications where needed
- testing interoperability between components
- documenting best practices
- collaborating with standards-making bodies to identify synergies and support parallel work

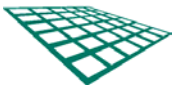
How will EGA work with other standards-development organizations?

The EGA has a pragmatic approach. Our goal is interoperable solutions for grid computing that meet enterprise needs. To reach this goal, we will work with other consortia and standards organizations through liaison relationships as well as through overlapping memberships. Many of these relationships are currently under discussion and will be announced in due course.

Similar to the early adopters of the worldwide Web, each driving body brings unique value to each segment. The EGA has the market influence and ability to drive a collaborative approach to developing and delivering solutions that address the needs and challenges of the enterprise grid marketplace that encompasses the activities of groups such as:

- Global Grid Forum
- Globus
- Distributed Management Task Force (DMTF)
- OASIS
- W3C
- SNIA

The EGA will also actively evaluate current activities and solutions, as well as identify existing solutions or propose new solutions to issues and gaps in the required solution set.



IX EGA Structure and Membership

The EGA is a consortium of leading vendors and users focused on developing enterprise grid solutions. It is an open, independent, vendor-neutral group. Anyone can join by executing relevant agreements and paying member dues.

Multiple participation tiers allow member organizations to select their engagement level based on their size, business model, and relevant technology. No single company controls the EGA; Every participant has the same rights and privileges as all other participants at that level.

As of December 2004, the EGA has 29 member companies. Sponsor members are elected to the board of directors. Find out more about EGA membership by visiting the EGA Web site at: www.gridalliance.org.

Board Members

- EMC Corporation
- Fujitsu Siemens Computers
- Hewlett-Packard Company
- Intel Corporation
- NEC Corporation
- Network Appliance, Inc.
- Oracle Corporation
- Sun Microsystems, Inc.

Sponsor Members

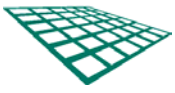
- Ascential Software Corporation
- Optena Corporation
- Paremus, Ltd.

Contributor Members

- Advanced Micro Devices, Inc.
- Cassatt Corporation
- Enigmatic Corporation
- Novell, Inc.
- UK e-Science Core Programme

Associate Members

- AvarSYS, Inc.
- Cisco Systems, Inc.
- Citrix Systems, Inc.
- Data Synapse
- Dell Inc.
- Force10 Networks, Inc.
- MCNC
- Qlusters
- The 451 Group
- Topspin Communications, Inc.
- UBS AG
- Unisys
- Voltaire Associates



X Conclusion

A new computing paradigm raises a lot of questions. How is grid different from other distributed computing architectures? How will I be able to use this new architecture in my environment, and what benefits will it bring me?

The EGA intends to address these questions and pave the way for widespread adoption of grid computing in the enterprise. EGA members believe that grid computing offers significant benefits to enterprise organizations– for cutting costs, increasing flexibility, raising productivity and utilization, and opening up new computing models.

Successful grid implementations will bring significant competitive advantages to the organizations that deploy them. Grids can enable faster product development cycles and allow developers to work with larger data sets and test more scenarios to bring the best goods and services to market, ahead of the competition. Grids enable dynamic resource allocation, so an entire data center can turn on a dime and reallocate resources to a high-priority project. Grids will contain tools for flexible provisioning, automating many of the tasks associated with maintaining a large and complex software infrastructure. Lastly, grids enable higher utilization of valuable capital assets, such as server and storage systems.

The EGA's role is to drive adoption of grid technologies by enterprise organizations. Our work is just beginning, but already we are tackling some of the thorniest problems of early enterprise adoption and are gaining traction and mindshare in the growing enterprise grid market. Our members represent vendors in many regions and businesses who are evaluating grid technologies and learning how to get the best use of them in their environments.

Most importantly, the EGA is doing work on behalf of users -- to understand their unique requirements and evaluate how to best meet those needs with existing grid technologies. Rather than reinventing the wheel with each implementation, the EGA aims to document best practices for grid design and operation and make that intellectual property freely available to enterprises, large and small, regardless of their budget or location.

The EGA holds to a vision of open, interoperable grid components that will preserve choice and protect investments for user organizations. This vision is not dominated by a single vendor or technology, but rather based on standards and specifications that will be agreed upon by the EGA and outside standards-making bodies.

Grid solutions are deployable today. To help grid users make the most of them, the EGA will work to drive adoption of standards and specifications that will enable development of practical next-generation grid computing solutions, appropriate for enterprises of all sizes and in any location.