



**HP's Grid  
strategy**

**white  
paper**

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## Prologue

The Grid is a software architecture to enable the secure sharing of IT resources among the members of a virtual organization. The resources that are to be shared are rendered as "Grid services" and can include computer cycles, storage space, a database, an application, a file, a scientific instrument, or almost anything else in the IT arena. Once rendered as a Grid service a resource may be registered, discovered, accessed, provisioned, shared, monitored, modified, etc. The virtual organization only needs to be connected by the Internet. Geographic proximity is not a requirement, nor is it necessary that the resources be in the same ownership or management domain(s). Unlike "the Web" there is not just one Grid, many disjoint Grids can exist even within a single enterprise.

Grid is the convergence of several important trends in the IT industry. The Grid enables a robust distributed computing model, it allows for better utilization of IT resources (i.e., better RoIT), it employs the emerging Web services standards such as XML, SOAP, WSDL, etc. and it enables broader, yet more secure, remote sharing and collaboration among partner organizations. The Grid also uses open standards in achieving its goals.

HP understands the importance of the Grid for our customers and is working to provide viable and robust Grid solutions where appropriate. In this brief note we outline the strategy HP is following to deliver Grid technology and solutions to our customers.

## Why is Grid important

The Grid is an important, strategic technology for Hewlett-Packard. HP sees the Grid evolving to become a very general and powerful way to virtualize resources—that is, to abstract resources connected to a network from their physical instantiations—and to present these resources to clients as services. This is exactly the model that our customers are evolving toward in order to achieve better return on IT investments.

HP is working with the standards setting bodies to insure that open standards exist in the Grid space. The significant benefits of the Grid derive from heterogeneity and interoperability. Proprietary approaches will hinder our customers' ability to benefit from Grid technology. Additionally, with open and interoperable Grids the promise of both Metcalfe's<sup>†</sup> and Reed's<sup>‡</sup> laws will be realized. This applies equally to the consumer space as well as the enterprise.

HP sees the Grid as an important component of the enabling of the agile enterprise. Within our Adaptive Enterprise architecture the Grid plays a key role in the "middle layer" (see

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<sup>†</sup> Metcalfe's Law states that the utility or value of a network is proportional to the square of the number of entities connected to the network. These are the pair-wise connections. In this specific instance we apply it to the number of entities on a Grid.

<sup>‡</sup> Reed's Law states that the possible number of groups in a network will have more value than the possible pair-wise connections. In the limit this can be  $2^N$  versus Metcalfe's Law's  $N^2$ .

Figure 1). Business practices and policies will invoke the Grid technologies to enable the necessary IT instantiations to honor the business requirement. Through Grid technologies the actual infrastructure is accessed and employed on behalf of the business needs.

In less fully-integrated circumstances than a deployed Adaptive Enterprise architecture, the Grid will be integral to our customers' need to deploy and practice service-centric, distributed computing.

In specific vertical markets, for example life sciences, the Grid plays an important role in allowing the IT infrastructure to both achieve higher utilization and enable new applications to be deployed that could otherwise not be achieved within a traditional IT infrastructure.

### **Grid-enabled systems**

All of HP's systems are enabled to run the de facto reference implementation of the Grid. This is the Globus Toolkit. At the time of this note the released version of Globus is version 2. This is being deployed with multiple customers on Linux, HP-UX, and Tru64 servers involving PA-RISC, Alpha, ia32, and IPF processors.

More important from a strategic perspective is version 3 of the Globus Toolkit. It is this version that renders all Grid resources as services. This version is in beta test and is being ported and tested on all HP platforms.

### **HP Services**

It is often the case that the customer is aware of the Grid. However, in some instances neither the full benefit nor the deployment method has been fully appreciated. To help customers understand, scope, and deploy Grid solutions, HP Services has developed a practice for Grid technology. HP Services consultants are trained and available to work with customers to plan for, deploy, utilize, and maintain Grid technology across the breadth of their IT.

### **Vertical markets opportunities**

Grid technology is being utilized today in several vertical markets. These include the life sciences, manufacturing, and financial markets. It is the case that today, many of these opportunities are in the HPTC space. HP's high-performance computing division has deployed Grid solutions in these markets. They serve as exemplars of Grid technology in use on HP equipment.

Over time HP expects that Grid will have more impact and more opportunity in the greater commercial space as well as in the IT infrastructure arena. As Grid leverages Web services and its extensibility is enhanced the areas of applicability grow more numerous.

## Open standards

HP personnel are actively involved with the *Global Grid Forum (GGF)*. The *GGF* is the standards setting body for the *Grid*. It has membership spanning the computer vendors, national laboratories, software companies, country governments and universities. Within the *GGF* are a large number of *Working Groups* and *Research Groups* that are defining and enhancing the *Grid's* architecture, APIs, functionality and applications. HP participates in these groups to insure that our customers' and partners' interests are represented and reflected in the standards.

The *Grid* will be more powerful, more widely deployed and more rapidly deployed if there is a high degree of standardization and interoperability. HP is working to insure this through our efforts in the *GGF*. Generally our approach when bringing technology to *GGF* is to contribute this to the *GGF* under open-source and royalty-free licensing.

## Third-party partners

Today there is a small, but growing, set of third-party software companies that are providing *Grid* and *Grid-like* offerings. This includes the spectrum from simple load-sharing to complete *Grid* offerings. Since it is seldom the case that one solution suits all end-users, HP has partnered with many of these third-party companies. In some cases we work with the partner to port and certify the code. With some of the third-party providers we have active reseller agreements in place. Our goal is to be positioned to offer the best solution(s) that fits the needs of our customers.

## Adaptive Enterprise

HP has launched a major initiative to define an architecture through which enterprises can achieve business agility via automated management and control of IT resources that service a company's business processes. This is HP's Adaptive Enterprise (AE).

The benefits of implementing an adaptive enterprise are lower operational costs, lower cost of change, ease of use, risk mitigation, greater deployment options for the delivery of new business systems, and reduced time-to-market for new business initiatives. An adaptive enterprise helps deliver increased agility in the areas most needed by the organization, and is emerging as a major focus for businesses today. Increasing business agility requires:

- Measuring an organization's ability to change
- Proving the value of improving agility measurements
- Architecting and implementing infrastructure adaptability

From an architectural perspective AE can be viewed as three horizontal layers with a single vertical column spanning the three layers; see Figure 1. From the highest layer down we have the business practices, the "plumbing" layer and the infrastructure layer. Alongside is

the management column. In the AE we are utilizing Grid in the middle layer. Given the large development effort and the interoperable, and open standards, nature of the Grid this provides the ideal glue to marry business practices software to the infrastructure. It is not a coincidence that the Grid is well suited to this task. Be mindful that the mega-trends in the IT industry are what drives the Grid functionality; services-style computing, distributed computing, xSP models, etc.

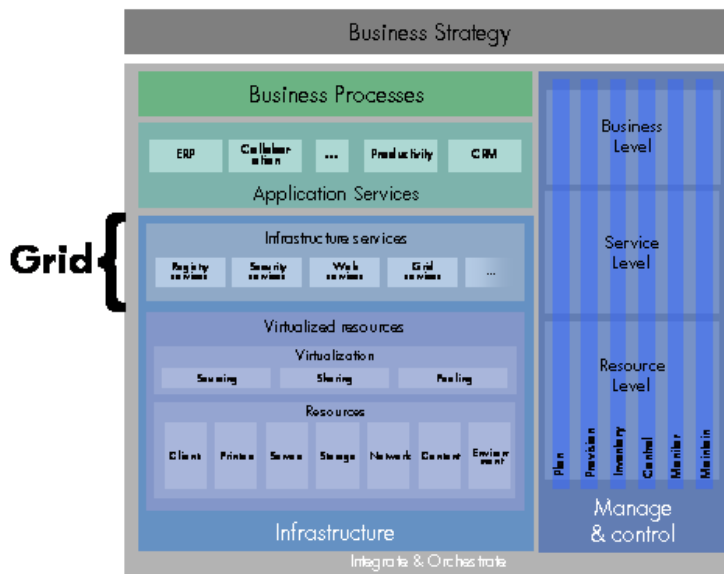


Figure1. A block diagram of the Adaptive Enterprise architecture. The three major tiers are business practices at the top, infrastructure at the bottom and Grid and Grid Services in the middle. Grid technology is used to connect Business Practices to Infrastructure.

In addition to the utilization of Grid technologies to connect business practices to infrastructure, HP is also employing Grid technologies we are developing for the management of AE and Grid services. This is in the right-hand vertical column in Figure 1. We say more about our management approach below.

## UDC

Stated earlier was that the AE product can be viewed as having three macroscopic layers. At the lowest layer is infrastructure. The HP UDC is a more capable form of infrastructure owing to its programmatic reconfigurability. HP has developed a Grid interface to the UDC. For a simple working example of the power of coupling Grid and UDC consider a Grid service request for, say, three ia32 Linux systems. If no such resource

currently exists in the *Grid*, the UDC is able to programmatically reconfigure a portion of its resource pool to meet this *Grid* service request. The union of UDC and *Grid* provides benefit to the users and offers significantly better RoIT than statically configured resource pools.

## **Grid management**

The management and monitoring of *Grid* services is an area that remains under development. HP's Software Global Business Unit has developed a software suite called the Web Services Management Framework (WSMF). WSMF's original design goal was for Web services. However, the closeness of Web Services to *Grid* Services and their common needs dictated that the original design of WSMF be extended to include, and be compatible with, *Grid* services. HP is actively working with the GGF and others in the community to place WSMF at the center of the management of *Grid* Services. The expectation is that WSMF will eventually become part of the *Grid* standards being developed in the GGF.

WSMF will be integrated with HP's OpenView suite so that the management of *Grids* and *Grid* services will be within the same powerful framework that OpenView provides for other management and monitoring tasks.

## **Grid research and technology development**

There are multiple groups within HP Labs that are developing fundamental technologies for *Grids*. Some examples of these technologies include peer-to-peer appliance aggregation, interactive*Grid*, *Grid* services management, service descriptions and others. Much of this work is published externally in a series of HP Labs technical reports on *Grid* research. HP Labs teams are working with the UDC business on the federated programmable resource utility of the future and with the OpenView business on Web Services management applied to *Grids*.

HP is working with leading edge customers and research institutes on developing, deploying and testing *Grid* technology; e.g., CERN OpenLab for Data*Grid* Applications, Wellcome Trust Sanger Institute, Pittsburgh Supercomputing Center, US Biomedical Informatics Research Network, Canadian West*Grid*, Samsung Advanced Institute of Technology.

Our efforts are to make the overall technology and functionality of the *Grid* more useful to our customers.

## **Epilogue**

HP is pursuing *Grid* in a very methodical fashion on a timeline that is commensurate with the ways that our customers will need, and deploy, the technology. The *Grid* addresses a challenging problem offering large potential benefit to our customers. Our holistic, measured approach will deliver what is needed, when it is ready, and in an industrial strength fashion.