

Oracle Grid Computing

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EXECUTIVE OVERVIEW

The speed and unpredictability of business cycles have pushed many enterprises to the limit of manageability. Organizations need to become more adaptable but often their information systems are slow to respond. To compensate, IT departments build costly infrastructure designed with excess capacity and redundancy to deal with any contingency.

To address these challenges, Oracle Corporation has introduced Oracle Database 10g, Oracle Application Server 10g, and Oracle Enterprise Manager 10g, the first infrastructure software specifically designed for the next generation of computing–enterprise grids.

Oracle 10g infrastructure software adapts to your changing business needs. Even better, Oracle grid computing revolutionizes IT economics. With enterprise grid computing you can build a powerful infrastructure with a variable cost structure that can be adjusted as needed. Oracle infrastructure software protects your technology investments today as your data center evolves to enterprise grid computing.

INTRODUCTION

Volatility is now a permanent feature of business life. While change is normal, the growing speed and unpredictability of change—which is increasingly technology-driven—have pushed many enterprises to the limit of manageability. Businesses have to develop more adaptive techniques to create value, no matter how unstable the economic environment may be.

Enterprise grid computing is about using technology as a way of delivering business value quickly and reliably, despite changes in the environment. Oracle Database 10g and Oracle Application Server 10g make up the first infrastructure software specifically designed for the next generation of computing–enterprise grids.

Oracle 10g infrastructure software adapts to your changing business needs. That means you can spend more time thinking about how to run your business, knowing that Oracle 10g will respond with the reliable, secure performance that your applications need, so you get the answers you need. No other software infrastructure can do this.

Even better, Oracle grid computing revolutionizes IT economics. Faced with tight budgets, every business needs to cut IT costs, improve staff productivity, and reduce costly downtime. With Oracle grid computing you can build a powerful infrastructure with a variable cost structure that you can adjust as needed.

Oracle infrastructure software also protects your technology investments today as your data center evolves to enterprise grid computing. At each step on the way, you can lower costs and improve business performance, ensuring a solid return on investment as you go.

WHAT IS GRID COMPUTING?

“Utility,” “On-Demand,” “Grid,” and many other terms are being used today to describe the next generation of computing. It’s important to understand the distinctions between these different concepts.

Utility or On-Demand Computing

At the highest level, the central idea of grid computing is computing as a utility. You shouldn’t care where your data resides, or what computer processes your request. You should be able to request information or computation and have it delivered—as much as you want, whenever you want. This is analogous to the way electric utilities work, in that you don’t know where the generator is, or how the electric grid is wired. You just ask for electricity and you get it. The goal is to make computing a utility—a ubiquitous commodity.

There are many possible ways to implement utility computing. Today, the most common method is simply to provide new licensing policies for existing technology. For example, some server vendors promote the capability to partition large Symmetric Multiprocessing (SMP) servers and turn on spare processors when needed. This model was pioneered by the mainframe many years ago.

While these large SMPs can provide capacity on-demand, and therefore deliver a form of utility computing, these systems do not necessarily deliver significantly lower cost. In the end, SMP servers are still built with exotic and expensive technologies and have scalability problems. In fact, this type of on-demand computing is exactly like a mainframe with all its costs and limitations. The true technology revolution is elsewhere.

Grid Computing

Grid computing is a fundamentally new computing architecture designed to address utility computing needs. Grid computing pools large numbers of servers and storage into flexible resources for all enterprise computing needs.

Business applications interface with the grid computing infrastructure through common Web services for identity management, resource provisioning, etc. The Grid computing infrastructure continually analyzes demand for resources and adjusts supply accordingly.

Scientific Grids versus Enterprise Grids

Currently, grid computing is used primarily for specialized scientific or academic applications. But more and more mainstream businesses are considering enterprise grid computing applications.

- **Scientific grid computing** focuses on highly specialized scientific problems such as large computations and technical simulations.
- **Enterprise grid computing** pools business computing resources in order to cost effectively harness the ever-growing power of clustered, industry standard servers and storage.

BENEFITS OF GRID COMPUTING

Grid computing provides the following benefits:

- Flexibility to meet changing business needs.
- Highest quality of service at the lowest cost.
- Investment protection and rapid return.

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Flexibility to meet changing business needs

Grid computing enables an organization to tie its business architecture, through service level agreements, to its IT architecture. Most applications today use resources from just one server in a single location. When business processes change, new server capacity may need to be purchased, new integration software written, and more testing done. The infrastructure may take a very long time to change to reflect new business requirements.

Grid computing introduces sophisticated workload management capabilities that make it possible for applications to share resources across many servers. Data processing capacity can be added or removed on demand, and resources within a location can be dynamically provisioned. Web services can quickly integrate applications to create new business processes. As a result, your IT infrastructure can respond immediately to changes in your business needs.

High quality of service at a low cost.

With a grid computing architecture you can quickly and easily create a large-scale computing infrastructure from inexpensive, off-the-shelf components like server blades and commodity storage. Grid computing's unique centralized clustering and load balancing delivers the highest performance, scalability, reliability, and security.

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- Grid computing offers high performance and scalability because all computing resources can be flexibly allocated to applications as needed.
- Grid computing tolerates all the common sources of system downtime including hardware, software, network and operator error.

- By centralizing resources and treating them as a single unit, grid computing makes it possible to create a far more secure infrastructure than any other architecture.

Investment protection and rapid return.

Typically, grid solutions from other vendors require custom applications and completely new infrastructure.

With Oracle you can move from your existing infrastructure to grid computing at your own pace. At each step along the way you can achieve higher levels of efficiency, lower operating costs, and a more rapid return on investment. And you can run all your existing applications.

Oracle grid computing is platform independent. With the Oracle Database 10g and Oracle Application Server 10g, you can pool servers and storage into a flexible, on-demand computing resource for all enterprise computing needs. Any kind of system—mainframes, UNIX, Windows, and Linux servers—can be used to build an enterprise grid based on the Oracle 10g infrastructure software. Oracle 10g infrastructure software can even integrate applications and data held in non-Oracle systems into a grid.

APPLICATIONS FOR ORACLE GRID COMPUTING

Oracle 10g infrastructure software can be used with many different applications.

Enterprise Applications

Existing enterprise applications such as ERP, CRM, and SCM benefit from the higher utilization, reliability, and security that Oracle grid computing can offer. Oracle grid computing enables these applications to share resources on demand. For example, toward the end of fiscal quarter, order processing may be in high demand while business intelligence systems sit idle. At the beginning of the following quarter, business intelligence applications require more resources while order processing drops.

Compute-Intensive Applications

Today, there are applications that are too expensive to run on dedicated systems. However, using grid resources for a short period makes them economically feasible. For example, take the case of a company trying to plan how to deliver a consumer product to all its distributors and retailers, or a government agency planning how to deliver social care to its citizens. Those are incredibly complex scheduling problems that require massive amounts of computing power for a limited time.

Simulations offer a similar opportunity. A small architectural firm could model buildings far more complex than is possible using technology it could afford now.

Weather models, financial models, marketing models and so on could be made available to businesses at much lower costs.

Distributed Data Applications

Finally, there are numerous large data sources that would be valuable to link into applications for short periods but there is no technologically feasible way to do this today. For example, a mortgage loan company may want to send out a direct mail piece to qualified customers. Grid computing offers the possibility of rapidly integrating third-party credit, census, and marketing databases to generate an optimal mailing list.

ORACLE GRID COMPUTING FEATURES

Oracle Database 10g and Oracle Application Server 10g are especially designed for enterprise grid computing:

- **Performance and scalability with low cost hardware clusters.** Oracle is the leading infrastructure software for Intel Itanium and Linux clusters. And only Oracle offers workload management across application server clusters and database server clusters for maximum performance and efficiency.
- **Reliability.** Enterprise grids require continuous availability of data and applications. Oracle 10g infrastructure software has the highest availability features.
- **Security and privacy.** Oracle 10g infrastructure software has industry leading security features that enable users to share enterprise grid resources with confidence that privacy is maintained.
- **Automated management.** The sheer size of enterprise grid computing infrastructures put them beyond the capability of current management tools to control them. Oracle 10g infrastructure software automates many of these functions so that a single administrator can manage hundreds of servers.
- **Distributed computing.** Enterprise grid computing enables applications and data to run anywhere in the network. Oracle 10g infrastructure software has advanced integration features that can handle any type of requirement.

For a complete description of Oracle 10g grid computing features, see *Oracle10g Grid Computing: A Technical White Paper, August 2003*.

IMPLEMENTING ORACLE GRID COMPUTING

As more and more companies deploy clusters of industry standard servers, IT infrastructures resembling enterprise grids will naturally result. This growing trend

to standardize as many hardware and software components as possible will make stable Grid-like infrastructures the most reliable and cost effective.

Oracle 10g is the first infrastructure software designed for enterprise grid computing and will provide a smooth transition from current IT infrastructure to a time-and-money saving grid computing infrastructure. There are four major areas of innovation that are combining together to make grid computing possible.

- **Standardization** on low-cost, high-density modular servers and storage based on technology such as Intel Itanium processors, blade servers, and Linux.
- **Consolidation** of clusters of servers and storage shared among one or more data centers.
- **Automation** of all day-to-day management tasks, enabling a single administrator to simultaneously handle hundreds of servers in clusters.
- **Optimization** using common infrastructure services such as provisioning and identity management through distributed computing technologies like Web services.

Standardization

Every business today has a mix of server and storage technologies, but an enterprise grid computing infrastructure is built on large arrays of small, standardized servers and storage. The first step to lowering costs with grid computing is to designate these standard units of computing and storage that will form the basis of a new grid. The units can be very simple—even disposable—because redundancy ensures high availability. The lower the cost of these basic units of computing and storage, the lower will be the cost of the overall infrastructure.

You can start with a single small cluster of servers and storage running one application. As you decommission old systems, you can add new capacity into your grid and move your applications over. Over time, the complexity of your infrastructure will drop and the cost savings will multiply.

Here are some of the computing technologies developed over the last five years that are revolutionizing the cost of server and storage systems:

- **Processors.** New low-cost, high volume Intel Itanium 2, Sun SPARC, and IBM PowerPC 64-bit processors now deliver performance equal or better than exotic processors used in high-end SMP servers.
- **Servers.** Blade server technology reduces the cost of hardware and increases the density of servers (which further reduces expensive data center real estate requirements).

- **Networked storage.** Disk storage costs continue to plummet even faster than processor costs. Network storage technologies such as Network Attached Storage (NAS) and Storage Area Networks (SANs) further reduce these costs by enabling sharing of storage across systems for greater efficiency.
- **Network interconnects.** Gigabit Ethernet and Infiniband interconnect technologies are driving down the cost of connecting clusters of servers.
- **Linux operating system.** The Linux operating system provides a solid and cost-effective server operating system that can be used throughout a grid.

Consolidation

The second step toward grid computing is to consolidate your infrastructure in one or a few data centers. By consolidating, you can have fewer grids with larger pools of resources available for your applications. The larger grids also increase reliability and reduce management costs. Oracle 10g is the only infrastructure that has full grid server cluster capabilities for all applications—transaction processing, decision support, and enterprise content management. That means that only Oracle can run your existing applications in a grid computing environment—no rewrite required. For further information on consolidation, see *Infrastructure Consolidation with Oracle: A Business White Paper*, August 2003.

Automation

The third step is to automate your grid so that you can manage it effectively as it grows. Because enterprise grids can have hundreds, potentially thousands of servers, a grid is simply too large to be managed manually server-by-server. Oracle Enterprise Manager 10g has automated the day-to-day maintenance required for an enterprise grid, and provides a centralized management console called Oracle Grid Control. Software installation, patching, upgrading, workload balancing, security, and much more are all handled centrally from Oracle Grid Control. This means the entire infrastructure can be managed as one large computing system. One or a few administrators can maintain even the largest grid data center.

Optimization

The final step in grid adoption is to adapt your applications to use the grid services architecture. Using the grid, your existing applications will run with high performance, scalability, and reliability. And by upgrading applications to take advantage of this new, services-oriented architecture, you can improve application integration and business process management even further.

Oracle 10g enterprise grid computing provides important standard services such as identity management and application provisioning in the form of Web services.

This means that any application that understands Web services can tap into and share these Oracle 10g services, which means greater standardization and better integration. For example, today most applications have their own user login and password management. Oracle 10g offers single sign-on through a standard Web service. Users can have one login and one password to all grid applications.

Oracle provides tools to help wrap existing applications in Web services as well as tools to write new applications.

HOW ORACLE USES GRID COMPUTING

Oracle Corporation itself is using grid computing to improve its business processes, making our infrastructure more efficient and less expensive.

Oracle's Application Demo Systems (ADS) is used by its global sales organization to give demonstrations of Oracle products to prospects, customers, and partners. ADS runs the entire Oracle E-Business Suite—some 180 modules—in a single instance, with 450 copies of the environment maintained and supported for the sales force. In addition, we have a separate farm for technology demos that consists of about 50 environments. ADS hardware includes 300 Dell PE2650 servers running Linux, with dual P4 Xeon processors and 6GB memory and 75 Terabytes of raw storage. Running our demonstration environment—where performance is critical to a successful sale—on a Linux grid is a strong testament to the power and benefits of such an architecture.

Linux on low-cost, commodity hardware is a proven technology for mission-critical applications such as Oracle E-Business Suite. In fact, Oracle runs its own business on E-Business Suite on a Linux/Intel middle tier. This deployment includes a Global Single Instance (GSI) in our Austin, Texas Data Center which provides mission-critical applications to more than 42,000 Oracle employees worldwide. The GSI database consists of Oracle9i Database with Real Application Clusters (3-nodes) running on 3 Sun F12K machines with 104GB RAM and more than 3TB of storage; separately, the middle tier includes 21 Dell 2650 machines and 6GB RAM running Linux.

The benefit to Oracle? Lower cost and faster performance. Running our E-Business Suite internally on the GSI on Linux is 5 times cheaper and 3 times faster than on conventional UNIX/RISC.

CONCLUSION

Only Oracle's grid computing architecture provides short-term and long-term benefits. With Oracle 10g infrastructure software, enterprise grid computing is available today. This is not a massive paradigm shift that will take years, millions of dollars, or an army of consultants to implement. Real businesses can begin to adopt grid technologies with minimal investment, zero disruption, and fast ROI. And Oracle 10g puts you on the path to even greater long-term benefits as grid computing evolves and matures.



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