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# Lowering Your IT Costs with Oracle Database 11g Release 2

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## INTRODUCTION

As business operations become more complex, the demand for change in IT increases accordingly, as do the associated risks that must be mitigated. Today's IT professionals are asked to manage more information and deliver it to their users, with ever-increasing quality of service, in a timely manner. And in today's economic climate, IT must also reduce budgets and derive greater value out of existing investments.

Oracle Database 11g Release 2, the latest release of the award-winning Oracle Database 11g, enables IT professionals to deliver more information with higher quality of service, make more-efficient use of their budgets, and reduce the risk of change in datacenters. By deploying Oracle Database 11g Release 2 as their data management foundation, organizations can utilize the full power of the world's leading database to

- Reduce server costs by a factor of 5
- Reduce storage requirements by a factor of 10
- Improve mission-critical system performance by a factor of 10
- Increase DBA and developer productivity by a factor of 2
- Maximize availability and eliminate idle redundancy
- Maximize security and enable compliance
- Simplify their overall IT software portfolio

This white paper identifies the key capabilities in Oracle Database 11g Release 2 that enable IT professionals to deliver more information with a higher quality of service—at a much lower cost—than has ever been possible before.

## REDUCE HARDWARE COSTS

"We've been able to save over US\$5 million dollars a year by re-platforming from our mainframe to Oracle Real Application Clusters."

Eugene Park, Senior Director of Platform Services

**PG&E**

### Reduce Hardware Costs Through Consolidation

Most datacenters today are a mishmash of hardware and software that have evolved over time to meet individual business requirements. Datacenters typically consist of a variety of server and storage silos, plus a complex software portfolio to integrate everything together.

Mixed datacenter environments are very expensive to maintain. A large part of any IT budget—estimated at as much as 30 percent—is spent on making sure that all these different components work well with each other, and more importantly, continue to work through the lifecycle of each component. Maintaining separate server and storage silos is also extremely inefficient. Individual systems are often over-provisioned with spare processing and storage capacity, which can cause a great deal of underutilization throughout the datacenter. Managing individual systems to meet performance, availability, and security expectations is both inefficient and costly.

To address this challenge, organizations can consolidate their data processing and storage infrastructure into shared environments, with a common, standardized platform available for all business applications. Server and storage consolidation can lead to savings from pure economies of scale alone. Oracle Database has enabled many organizations to consolidate onto their preferred hardware and operating systems. In addition, Oracle software enables significant commoditization of consolidated environments, greatly reducing the cost of hardware, often by a factor of 4x to 6x. This architecture can provide organizations with an efficient consolidated datacenter, and unlock the price and performance benefits of commodity hardware.

### Unlock the Price and Performance of Commodity Hardware

In the past, organizations have used stand-alone SMP servers as a single shared platform to consolidate multiple workloads, and Oracle Database 11g Release 2 works very well in this environment. Oracle Database has 20 years of experience in getting the best SMP performance and is supported by all major virtualization software, including Oracle VM and logical partitioning (LPAR) software. Oracle Database 11g Release 2 also offers instance caging, which enables databases to be confined to specific cores in the SMP environment, removing the need for virtualization or LPAR software.

However, large SMP servers continue to be very expensive both in initial costs and in the incremental costs of scaling. Alternatively, small commodity servers running open-source operating systems such as Linux can be clustered together, offering similar processor and memory capacity at 4-6x initial cost savings. And instead of incurring the “fork lift” cost of

expensive scale-up SMP servers, customers can simply scale-out their database cluster at a low incremental cost by adding more commodity servers.

### Consolidate All Data Processing onto Low-Cost Private Clouds

Oracle Real Application Clusters (Oracle RAC) enables a cluster of low-cost commodity servers to work together as a single shared database grid or private cloud. Applications can then be deployed without modification to provide the benefits of consolidation, higher availability, faster performance, and scalability on demand.

Because you can allocate resources within a private cloud to different server pools, consolidating multiple applications is easy. For example, a front-office server pool of nodes can be allocated to run all the databases for CRM systems and Websites. Similarly, a back-office server pool can be allocated for ERP databases. Nodes can also be allocated to a data warehouse and reporting server pool. Any unallocated nodes are managed as a free resource server pool.

If, for performance or availability reasons, additional nodes are required for any server pool, they can be dynamically assigned from the free pool, or re-assigned from another server pool with lower priority to meet service level requirements in private cloud environments.

#### **Oracle RAC One Node**

Consolidation is not only for mission-critical applications. Many IT organizations want to use this infrastructure to deploy the many departmental and line of business applications in their management portfolio. Oracle RAC One Node allows organizations to consolidate their many small to medium-scale databases onto the private cloud. Users get the fault tolerance and flexibility of Oracle RAC, but databases are run on just a single server. Oracle RAC One Node supports cluster failover, rolling upgrades of hardware and software, and the ability to move a database between servers in a private cloud.

New grid plug and play features in Oracle Database 11g Release 2 also make it easier to provision environments, and to add (or remove) additional servers to accommodate greater consolidation and future business growth.

With Oracle Database 11g Release 2 and Oracle Real Application Clusters, IT professionals can unlock the value of low-cost commodity hardware and deploy a reliable, low-cost consolidation platform for all their data processing requirements. These solutions can reduce the hardware costs caused by over-provisioning and underutilization in standalone hardware environments, and unlock the price differential between SMP and commodity hardware. They also benefit from the performance and availability management capabilities provided by Oracle RAC.

## Reduce Time to Market with Oracle Exadata Database Machine

Many Oracle customers build their own grids or private clouds piecemeal, purchasing hardware servers, storage, and switches and then architecting a solution from the ground up. But this bespoke approach to hardware deployment can be costly and introduce unnecessary complexity. It can also be difficult to build these systems into a balanced configuration that is optimized for maximum performance of the processors and storage devices used.



Oracle provides Oracle Exadata Database Machines for customers that want to deploy an optimized environment in the fastest possible manner. Oracle Exadata Database Machine delivers extreme database performance for online transaction processing (OLTP), data warehousing, and mixed workloads. Built using industry-standard hardware, Oracle Database 11g, and Oracle Exadata Storage Software, Oracle Exadata Database Machine is an optimized and preconfigured package of software, servers, and storage that delivers the ideal platform for private cloud database consolidation. By consolidating onto a shared computing environment and unlocking the price and performance advantage of commodity hardware, IT organizations can significantly reduce their infrastructure costs.

## IMPROVE PERFORMANCE BY A FACTOR OF 10X

"Existing queries are running about 16 to 17 times faster on Oracle Exadata on average."

Jim Duffy, Senior Data Warehouse Architect

**BNP Paribas**

Business users are always looking for greater performance from their day-to-day systems. Oracle Database 11g Release 2 enables performance improvements to be realized from the hardware resources that are already in place. For example, using Oracle Automatic Storage Management to fully utilize the I/O bandwidth of storage arrays offers increased performance and an instant return on investment.

### Offload OLTP Processing to the Middle Tier

IT departments can take advantage of the underutilized resources that may be available in the application (or middle) tier. Oracle In-Memory Database Cache allows data to be cached and processed in the memory of the applications themselves, offloading the data processing to middle tier resources. Any network latency between the middle tier and the back-end database is removed from the transaction path, so individual transactions can often be executed up to 10 times faster. This is particularly useful when very high rates of transaction processing is required, such as those in market trading systems, telco switching systems, and real-time manufacturing environments. All data in the middle tier is fully protected through local recovery and asynchronous posting to the back-end Oracle Database.

With Oracle Database 11g Release 2, the ability to transparently deploy Oracle In-Memory Database Cache with existing Oracle applications becomes much easier through common data types, SQL and PL/SQL support, and native support for Oracle Call Interface (OCI).

### Increase Parallelization and In-Memory Execution of Data Queries

Oracle has consistently led the data warehouse market, and continues to add intelligent optimizations to the database engine. These optimizations include advanced techniques such as parallel operations, bit-mapped indexing, materialized views and summary management, and integrated ETL, OLAP, and data mining capabilities. Oracle Database 11g Release 2 adds further optimizations, including capabilities to automatically determine the optimal degree of parallelization for a query based on available resources. With this comes automated parallel statement queuing, in which the database uses current resource availability to determine whether it is more effective to queue a query for later execution once required resources have freed up.

Oracle Database 11g Release 2 can also take advantage of the advanced compression capabilities and the increase in server memory across a cloud of low-cost servers. Oracle Database 11g Release 2 automatically distributes a large compressed table (or a smaller uncompressed table) into the available memory across all the servers in the cloud. It then localizes parallel query

processing to the data in memory on the individual nodes. This dramatically improves query performance, and is especially useful when large tables can be entirely compressed into the available memory.

## Extreme Performance with Oracle Exadata Storage Servers

Oracle Exadata Database Machine delivers a platform optimized to get extreme performance from databases—10 to 100 times faster than what customers are achieving today on their current infrastructure. The unique technology driving this performance advantage is the Oracle Exadata Storage Servers that are built into every Oracle Exadata Database Machine.



As data volumes have continued to grow exponentially, conventional storage arrays have struggled to efficiently process terabytes of data and push that data through storage networks fast enough for demanding database applications. Every Oracle

Exadata Database Machine includes intelligent Oracle Exadata Storage Servers, which provide a high-bandwidth, massively parallel storage solution that delivers up to 500 GB per second of raw I/O bandwidth and up to 1 million I/O operations per second.

Each Oracle Exadata Storage Server stores up to 10.75 TB of uncompressed user data, and also comes enabled with 384 GB of solid-state Flash cache. This Flash cache automatically caches active data from the magnetic disks in the Oracle Exadata Storage Server, delivering a performance gains for read and write operations under OLTP applications.

Oracle Database 11g Release 2 also pushes query processing to Oracle Exadata Storage Servers, where all disks operate in parallel to process the query, returning only the relevant rows and columns to the database server. This means business users often see performance that is 10 times faster when executing large database queries.

## REDUCE STORAGE COSTS BY A FACTOR OF 10

“The Hybrid Columnar Compression query mode option is giving us 10 to 15 times more compression, and the speed, the response, and performance improvement is outstanding.”

Douglas Millar, Director of Database Operations

**R L Polk**

Every organization is facing an information explosion. Business users today demand ready access to information about consumers, products, services, and competitors. And with increased regulation and governance, all business information has to be kept online longer. The result is skyrocketing storage growth within enterprises over the last few years. At the same time, storage utilization rates have plummeted as storage capacity becomes denser, but seek time and I/O throughput has not improved.

### Lower the Cost of Storage Management

Many IT organizations are deploying shared storage environments (in the form of large disk arrays) underneath their consolidated data processing platforms. In the past, DBAs and system administrators have spent a great deal of time determining how to best place data across these disk arrays for maximum performance and availability. The best procedure for data placement is to simply stripe and mirror everything; stripe data blocks equally across all disks in an array, and then mirror the blocks on at least two disks. This approach provides the perfect balance between performance, disk utilization, and ease of use.

Automatic Storage Management (ASM), a feature of Oracle Database 11g automates the striping and mirroring of the database without the need for third-party volume management software. As data volumes increase, more disks can be added, and ASM will automatically restripe and rebalance the data across available disks to ensure optimal performance. Similarly, disks that report errors can be removed from the disk array, and ASM will re-adjust accordingly.

Oracle Database 11g Release 2 improves ASM in significant areas. New intelligent data placement capabilities store infrequently accessed data on the inner rings of the physical disks, while frequently accessed data is placed on the outer rings, providing better performance optimization.

### Oracle Cloud File System

Now, the new Oracle Cloud File System capabilities means that enables ASM managed storage to be used for Oracle Databases, and also for general-purpose file systems, offering a single storage platform for Oracle Database files, Oracle software binaries, and non-Oracle-related files. Read-only snapshots are also supported, with up to 64 point-in-time copies of file system data available.

## Partition for Performance and Storage Cost Reduction

As databases become larger, they become more complicated to manage. What works well with a few gigabytes rarely works for terabytes of information. To this end, Oracle has been enhancing partitioning capabilities for over ten years. Oracle Partitioning allows very large tables (and their associated indexes) to be partitioned into smaller, more-manageable units, providing a “divide and conquer” approach to very large database management. Partitioning also improves performance, because the optimizer uses only the relevant partitions of a table or index in a lookup. Oracle Database 11g Release 2 provides multiple methods for partitioning data, and also allows different levels of partitioning on the same table, so a single partitioning strategy can be used to improve both performance and manageability.

Oracle Partitioning can also manage the lifecycle of information. Typically, all databases have active data—the information being processed during the current month or quarter, and historical data that is primarily read-only. Organizations can take advantage of the inherent lifecycle of data to implement a multi-tiered storage solution and lower their overall storage costs. For example, a large table within an order-entry system could contain all the orders processed in the last seven years. Oracle Partitioning can be used to set up monthly partitions, with the last four months of order data partitioned onto a high-end storage array, and all the other partitions placed on a lower-cost storage solution, often costing one-third to one-half as much as the high-end storage environment.

With this approach, the need to continually buy high-end storage can be mitigated, because the growth is constrained to a scalable, low-end storage solution. In addition, all the data is online, so business users have access to all their information within their applications, which offers significant advantages over off-line data archiving.

## Reduce Storage Usage with Advanced Compression Techniques

Oracle Database 11g also provides advanced compression techniques to further reduce storage requirements. Oracle Advanced Compression uses a continuous table compression capability that achieves a two to four times compression ratio with little performance impact on OLTP or data warehousing workloads. This compression technology replaces duplicate values in a table with a single value, and continuously adapts to data changes over time, so compression ratios are always maintained.

The Exadata Storage Servers in every Oracle Exadata Database Machine enable a new hybrid columnar compression technology that provides up to a 10 times compression ratio, without any loss of query performance. And for pure historical data, a new archival level of hybrid columnar compression can be used that provides up to 50 times compression ratios.



Example of partitioning and compression used to reduce storage costs

Assuming a model in which 5 percent of the data in a system is active and the remaining 95 percent is historical read-only and archive data, a 10:1 reduction in storage costs or more can easily be realized. These reductions stem from the partitioning and compression capabilities in Oracle Database 11g and Oracle Exadata, resulting in a substantially reduced need for future storage purchases, with the same or more likely increased performance of the applications. In addition, the savings cascade through the enterprise, because backups and copies of the databases also use less storage.

## MAXIMIZE AVAILABILITY

"[Oracle] Active Data Guard will enable us to reduce system costs by up to US\$100,000 on our larger mission-critical systems."

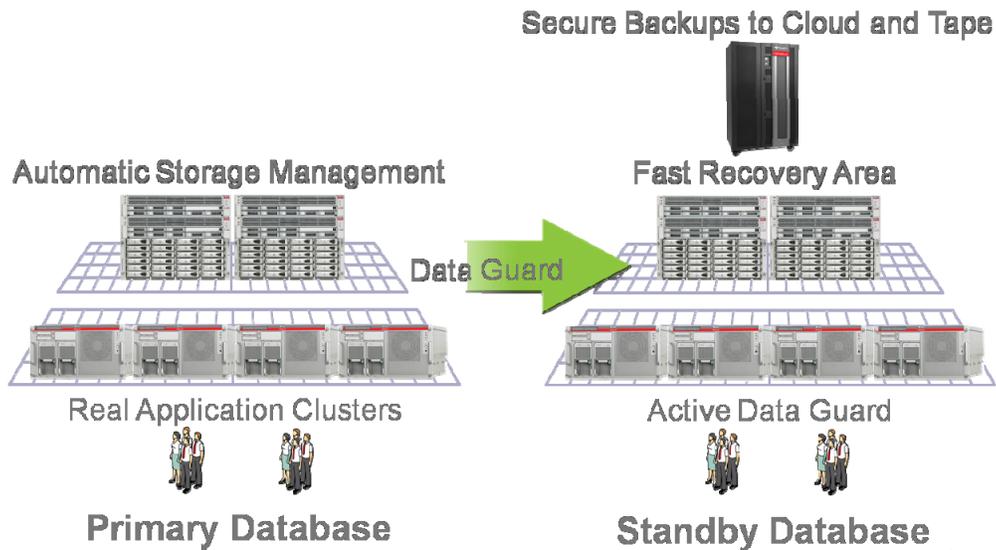
Aris Prassinos, Distinguished Member of Technical Staff

**MorphoTrak**

One of the primary reasons IT organizations consolidate their environments is to make it easier to manage the availability of their business applications. Providing 24/7 access to business applications requires protection from unplanned downtime and mitigation of planned maintenance operations. Plus, organizations need to be able to recover from human error.

Protection from unplanned downtime requires an architecture with redundant components. Extra disks are required for data mirroring, additional hardware is required for failover server processing, and additional datacenters are required for disaster recovery. All this redundancy is very expensive and typically only provides value when there is a component failure—it is essentially an expensive insurance policy. In addition, a great deal of software is often necessary to integrate these components, which are typically from different vendors. This introduces additional complexity and greater risk for human error.

### Simplify High-Availability Environments



## Oracle's Maximum Availability Architecture

Oracle provides a complete blueprint, Oracle's Maximum Availability Architecture, that includes all the software components required to protect the database and reduces complexity in the datacenter.

### Eliminate Idle Redundancy

The main advantage of Oracle's Maximum Availability Architecture is that it uses redundant components to not only protect against unplanned downtime, but also improve the performance and efficiency of the production systems. For example, as additional disks are added to an ASM environment to provide more storage for mirrored data, the additional I/O bandwidth provided by these disks is also applied to the production environment. On-disk backup and recovery areas allow backup and recovery operations to be automated, while unique incremental change-tracking and backup image merging ensure that both backup and recovery objectives can be met.

The same integrated software used to perform on-disk backup and recovery operations can also be used to backup securely to tape, and now also to storage in the Amazon Cloud.

Oracle Real Application Clusters not only provides protection from server failure, but also provides additional scalability for business applications.

For disaster recovery, the built-in Data Guard technology can be used to provide low-cost synchronization between the production databases and standby databases. And Oracle Active Data Guard enables reporting and backup operations to be offloaded from production to standby systems. This fully utilizes previously redundant resources to improve the performance of production systems while continuing to protect from disaster.

### Eliminate Planned Downtime

For many organizations, the real challenge lies in eliminating the need for planned downtime, and Oracle's Maximum Availability Architecture provides unique capabilities here as well.

Any hardware component in an Oracle grid or private cloud can be dynamically added or removed as required. Disks can be added or removed online with ASM, and the data is automatically rebalanced across the new disk infrastructure. Additional servers can also be easily added or removed to an Oracle RAC cluster; users connected to these nodes are rebalanced across the infrastructure.

This ability to migrate users from one server to another in an Oracle RAC cluster also enables rolling patching of the database software. When a patch needs to be applied, a server can be removed from the cluster, patched, and then put back into the cluster. The same operation can be repeated for the next server in the cluster until all are patched.

Similarly, users can be switched between production and standby databases in an Oracle Data Guard environment. Version differences of the database and the operating system between the production and standby environments are supported. This means that the standby database can be upgraded to the next major version, the new environment can then be tested, and then users on the older version can be switched over to the new one, without any downtime.

### **Online Application Upgrade**

Online table redefinition is fully supported with Oracle Database 11g, and now with Release 2, application upgrades can be performed online. With edition-based redefinition, changes to program code can be made in the privacy of a new edition within the database, separated from the current production edition. An editioning view exposes different projections of the same table into each edition, ensuring that the code in each edition only has access to its own specific view of the table. Cross-edition triggers propagate the data changes made by the old production edition into the new edition's columns, and vice-versa. This allows both old and new production environments to be used at the same time for testing, and allows users to be moved online from one edition to the other. Once upgraded, the old production edition can be dropped, unused table columns removed, and the new edition becomes the new de facto production edition.

### **Eliminate Data Loss Caused by Human Error**

It's an unfortunate truth that the #1 cause of data loss is simple human error. Database administrators log on to development systems to drop and clean up tables only to find that they logged onto a production system by mistake. Or a simple coding error is made in a large batch job, and suddenly many thousands of customers in the database all share the same mailing address.

In non-Oracle environments, these types of errors would require that the production database be shut down and a point-in-time recovery performed. The production environment would be unavailable while this backup was being performed, and both the mistakes and any useful work done from the time the mistake was made would be rolled back, requiring transaction rekeying.

Oracle Database 11g provides unique online capabilities to undo human errors. If a DBA inadvertently drops a table, it is sent to a wastebasket and can be returned with a simple command. Similarly, if one or more rows from a table are deleted or changed, the earlier versions of those rows can be queried online, and the specific transactions causing the mistake can be undone without any loss of the data changes performed in later transactions. And if needed, the entire database can be simply rewound in time, much like playing a video backward.

## MAXIMIZE SECURITY

"It is truly transparent data encryption. Within a matter of a few hours, the basic components were running and available, and we didn't notice any performance impact."

Sam Lebron, Senior Architect

### Dress Barn

Information within an organization is increasingly at risk. IT is now subject to numerous regulations that mandate strong control and protection of personally identifiable information. To meet these requirements, Oracle Database 11g Release 2 provides in-depth data security capabilities including data encryption and masking, access controls, high fidelity auditing and reporting, enterprise configuration scanning, and data change forensics.

One of the most pressing security challenges for IT professionals is recognizing where they are vulnerable. Oracle Configuration Management Pack, available with Oracle Enterprise Manager, provides more than 240 policies that implement and monitor best practices around security management, configuration, and storage for all Oracle Databases within an enterprise. Oracle Audit Vault provides a secure, centralized vault of audit information collected from multiple databases (including some non-Oracle databases), enabling simplified analysis, threat detection, and reporting of possible compliance issues across the entire information management infrastructure.

Oracle Total Recall saves all changes made to data in order to provide a complete change history. This means that auditors can not only see who did what when, but also see what the actual information was at the time, something that previously has only be available by building into the application or by expensive backup retention policies.

New internal control requirements in regulations can be difficult and expensive to implement in an environment with multiple applications. Oracle Database Vault allows access controls to be transparently applied underneath existing applications. Users can be prevented from accessing specific application data or accessing the database outside of normal hours. Separation-of-duty requirements can be enforced for different DBAs without a costly least privilege exercise.

Oracle Advanced Security can be used to transparently encrypt data at all levels: data in transit on the network, data at rest on physical storage, and data in backups. Similarly, Oracle Data Masking Pack can be used to obfuscate data as it moves from production to development, reducing potential violations of privacy regulations and the risk of sensitive data leaks.

And, the recently introduced Oracle Database Firewall provides customers with a first line of defense to prevent sophisticated internal and external attacks from reaching their enterprise databases. Oracle Database Firewall establishes a defensive perimeter around databases, monitoring and enforcing normal application behavior in real time, helping to prevent SQL injection attacks and unauthorized attempts to access sensitive information.

## DOUBLE DBA AND DEVELOPER PRODUCTIVITY

"Oracle Enterprise Manager has helped us address system management issues proactively, automate previously manual administrative tasks, and reduce the need for extensive DBA training."

Arup Nanda, Senior Director

### **Starwood Hotels & Resorts**

Business is increasingly dependent on IT, and users continually demand a higher quality of service; however, IT budgets have remained flat at best. To address this growing gap, Oracle has added more automated self-managing capabilities over successive releases, resulting in Oracle Database 11g Release 2 taking 50 percent less time to manage than previous releases.

Oracle's self-management approach takes two tacks. First, wherever possible, repeatable, labor-intensive, and error-prone tasks that can be fully automated in the database have been. For example, storage management, memory management, statistics collection, backup and recovery, and SQL tuning have all been automated.

Second, where operations cannot be fully automated, intelligent advisors are built into the database to mentor DBAs on how to get the best out of their systems. Advisors are provided for configuration management, patching, indexing, partitioning, performance diagnostics, data recovery, and new in Oracle Database 11g Release 2, compression and maximum availability.

The combination of built-in automation and intelligent advisors reduces the complexity gap between the available database administration resources and the business's service level objectives. As the vast majority of the analysis and troubleshooting is performed by the database itself, DBAs are now able to spend less time looking after the day-to-day operations of their databases and more time managing more databases in their environments. Recent studies performed by an independent research company shows that DBAs can expect to spend 26 percent less time managing their 11g environments compared to 10g environments, and as much as 50 percent less when compared to older Oracle9i deployments.

## DEVELOP QUICKLY AS WELL

Oracle Database 11g Release 2 provides a single integrated data management solution that is supported by all popular application development frameworks used by developers today. This protects IT's investment in developer resources, increases productivity, and reduces development cycles.

### .NET

Oracle Developer Tools for Visual Studio .NET is a tightly integrated add-in for Microsoft Visual Studio, making it easy for developers to write code for Oracle Databases. Oracle Data Provider for .NET provides optimized data access from a .NET environment, allowing developers to take advantage of the advanced functionality in Oracle Database 11g Release 2. Oracle Database 11g Release 2 on Windows also supports the development, deployment, and execution of stored procedures and functions written in a .NET managed language such as C# and VB.NET, reducing the need for .NET programmers to learn different languages.

### Java

Similarly, Oracle Database 11g Release 2 supports Java developers. It includes an embedded Java Virtual Machine (Java VM) that executes Java directly in the database. Client and middle-tier applications written in Java can also use Java Database Connectivity (JDBC), an industry-standard application-programming interface (API) that lets developers embed SQL statements in Java code.

### PHP

PHP is a popular interpreted scripting language commonly used to create Web 2.0 applications. It powers more than 20 million Websites and has a large user community. Oracle has partnered with the open source community to create a stable, high-performance PHP database driver that is fully integrated with Oracle Database 11g Release 2.

### Oracle Call Interface (OCI)

Oracle Call Interface provides a high-performance API for applications written in compiled languages such as C, C++, Cobol, and Fortran.

### PL/SQL

PL/SQL is a powerful procedural language designed specifically to seamlessly process SQL commands against the Oracle Database. It can be used to create stored procedures, functions, and triggers that execute within the Oracle Database. It can also be used in middle-tier and client applications.

## Oracle Application Express (Oracle APEX)

Oracle Application Express is a rapid Web application development tool created specifically for use with Oracle Database. With only a Web browser and limited programming experience, users can develop and deploy professional applications that are fast and secure. Oracle Application Express combines the productivity and ease of use of a personal database with the security, scalability, and availability of an enterprise database when building Web applications.

## Oracle SQL Developer

Oracle SQL Developer is a graphical tool that enhances productivity and simplifies database development tasks. Designed for Oracle Database developers, Oracle SQL Developer simplifies development cycles and reduces the need to buy third-party tools to develop and debug SQL and PL/SQL code. In addition, an integrated data modeler provides a suite of data and database modeling tools and utilities, including modeling for Entity Relationship Diagrams (ERD); Relational (database design), Data Type, and Multidimensional modeling; full forward and reverse engineering; and Data Definition Language code generation.

## SIMPLIFY THE SOFTWARE PORTFOLIO

"Oracle (Database 11g, VM, Unbreakable Linux, Enterprise Manager and Business Intelligence) allows us to focus on delivering the best user experience and continue to lower the cost of operations. We owe this in part to the consistent, proven software solutions from Oracle."

Nicholas Tang, VP of Technical Operations

### Interactive One

Just as a mishmash of hardware and storage incur additional IT costs, so can a complicated software portfolio. Over the years organizations have deployed multiple data management platforms, typically under different business applications. So they can end up with Oracle Databases running on UNIX and Linux systems, SQL Server on Windows, DB2 on the mainframe, pockets of legacy and specialist databases for data marts, plus XML and other spatial and multimedia management solutions.

Each of these data management solutions has different levels of capabilities, so all sustain additional software environments and supporting infrastructure. In addition they require different solutions for database management, cluster volume management, cluster failover, backup and recovery, data integration, data replication, and more. Yet the cost of integrating all these solutions into a single, coherent solution is paid for by the customer—and on an annual basis. Plus, a single change in release level of any one of these components requires that the integration and testing be started all over again.

Oracle Database 11g Release 2 provides a single integrated solution for all information management requirements. It's available on all open system platforms and supported by all major third-party applications. In addition to relational data, it stores documents, XML, multimedia files, and location and spatial information, and it supports advanced data types such as RFID tags, DICOM medical images, and semantic data. Performance is optimized for these data types—for example, files stored in the database using the SecureFiles feature can be delivered faster than typical operating systems. Indexing and SQL access is provided to all the extended data types stored in the database, allowing easy integration of the new data types into existing applications. Native access via the protocols normally associated with the specific data type is also provided. For example, http and XPath can access XML data, SPARQL can access semantic data (new in Oracle Database 11g Release 2), and native NFS-type interfaces can access documents and images stored in the database via the Secure File capabilities.

All data stored in the database inherits the cost reduction, security, and high availability provided by Oracle Database 11g Release 2. So by standardizing on Oracle Database 11g as their single data management platform, IT organizations can vastly simplify their software portfolio and reduce ongoing integration and maintenance costs, while at the same time simplifying the consolidation, governance and compliance, high availability, and management of their environment.

## ACHIEVE BUSINESS VALUE IN A QUARTER OF THE TIME

“Each Oracle upgrade—from Database 8 through to 8i, 9i, 10g and now 11g—has increased system performance, stability, and availability, while cutting management overheads, and providing ever-higher levels of service”

Charlotte Melén, Web Technology Manager

### Comic Relief

One of the biggest challenges for IT lies in effectively realizing the value of change. As systems become more complex and more mission-critical, it becomes more difficult to make changes in the datacenter. Even though there is business value in adopting change—greater performance, lower cost, and higher availability—making the change itself can be seen as risky. This means that instead of getting regular improvements, IT will often delay changes, incurring additional costs to the detriment of business operations.

New versions of database software and operating systems (OSs) come out regularly. In the past, upgrading the database and OS for individual environments has been very expensive and a never-ending job—by the time all the business systems are upgraded, it’s time to start again.

Consolidation provides the important benefit of reducing the cost and time required to perform updates. And by consolidating applications onto a low-cost grid or private cloud, modern organizations can take advantage of the additional agility offered by this configuration. When necessary, a private cloud containing the latest database and OS software can be easily and cost-effectively provisioned. Then the databases and associated end-user communities can simply be moved from the old consolidated environment to the new one. Once all databases have been migrated in this way, the older hardware can be re-provisioned for the next generational update.

Oracle Database 11g Release 2 also includes features that significantly reduce the cost and risk associated with making these changes. Oracle Real Application Testing enables the capture of production workloads from Oracle Database 10g and Oracle9i Database for replay against the latest release of Oracle Database 11g.



Real Application Testing capturing and replaying production workload onto test environment

This enables IT to test infrastructure changes with actual production workloads and automatically detect any change in behavior. IT can quickly determine the impact changes will have on their production environment, and will be able to mitigate any negative impact before the changes go into production. Oracle Real Application Testing can reduce the time and cost of testing changes by at least factor of four. The risk and time associated with frequent incremental upgrades to the database environment are significantly reduced, enabling IT to deliver continuous innovation to the business faster and with less risk.

## CONCLUSION

Oracle Database 11g Release 2, the second release of the award-winning Oracle Database 11g, provides the necessary foundation for IT departments to successfully deliver more information with higher quality of service, and to efficiently manage change within the IT environment to deliver better value to the business.

By deploying Oracle Database 11g Release 2 as the data management solution within their IT architecture, enterprises can leverage the full power of the world's leading database to reduce their hardware and storage costs, improve their system performance by a factor of 10, dramatically simplify their software portfolio, double the productivity of their IT personal, and reduce the time needed to realize business value.



Lowering your IT Costs  
with Oracle Database 11g Release 2

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