Migrating from Unix to Oracle on Linux

Sponsored by Red Hat

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EXECUTIVE OVERVIEW

In today's environment, the need for cost containment combined with increasing demands for computing capacity and performance have presented a challenge for IT organizations, and a new model for the creation of an agile, low-cost infrastructure based on the Linux operating system has emerged. This model relies on low-cost Intel based commodity server hardware running Linux, combined with enterprise software that enables the deployment of large mission critical systems that are fault tolerant, scalable, and highly performant.

Oracle's close engineering partnerships with major Linux distributors like Red Hat, resulted in enhancements to the Linux kernel, as well as a joint support model, that allows Oracle on Linux to become the platform of choice for realizing the benefits of Linux.

Recognized as the leading enterprise provider on Linux, Oracle is at the forefront of the Linux movement. Some highlights of our commitment and success on Linux include:

- Release of the first commercial Database for Linux in 1998

- Availability of all of Oracle software products on Linux.

- Contributions to the Linux kernel in the form of stability and scalability enhancements including the Clustered File System.

- Integrated and code-level support for all Oracle on Linux software and the Linux OS

- Widespread internal use of Linux to run mission-critical systems, such as Oracle Outsourcing, Oracle E-mail systems, and Web sites.

The migration of database applications from legacy platforms to Oracle on Linux is a process many customers are undertaking in order to realize the benefits of the latest Oracle functionality and the low-cost and flexibility of the Linux infrastructure. The length and costs associated with the migration can be significantly minimized with proper planning, education, and available services and software tools. This paper will highlight the steps involved in migrating to Linux, including the software and services available from Oracle to assist in the process.

UNBREAKABLE LINUX AND LOW-COST COMPUTING

Linux on low-cost Intel-based hardware is the foundation of a modern IT infrastructure. With Oracle on Linux, you get unbreakable reliability, performance, and scalability.

One-Call Support

Oracle is the only major enterprise software company to offer direct technical support Linux operating systems, including code level support, for Red Hat Enterprise Linux. Unbreakable Linux support requires that customers use production releases of certified Linux distributions, and not modify the kernels in any way, including the use of 3rd party closed source modules or drivers.

Oracle customers running Red Hat Enterprise Linux receive enterprise level support, including rapid response and resolution for the entire technology stack. This level of support is only offered on Linux, it is not available on any other platform running Oracle. In short, Oracle on Linux offers the highest level of support available from Oracle.

Total Cost of Ownership

The challenge of reducing costs, that businesses and technology groups face today, is the driver that has resulted in the widespread interest in Linux. The importance of lower initial acquisition costs is only a piece of the overall picture. Oracle Real Application Clusters is the technology that enables clusters of small, commodity Intel servers to replace much larger systems, while at the same time allowing for flexibility and horizontal scalability, without compromising the availability of the system. The lower cost, and equivalent or better performance combine to create a significantly lower price/performance system.

Flexibility

Fluctuations in business demand in today's turbulent marketplace frequently result in the need for short-term technology flexibility and scalability. The commoditization of server hardware results in increased flexibility on the part of IT organizations with respect to responding both to increased demands of user communities, as well as the incorporation of new technologies.

Performance

The application of large, expensive proprietary hardware in enterprise computing solutions has some significant limitations that impact the ability of an IT organization to adapt to changing requirements.   Firstly, the large capital expenditure and significant depreciation time associated with the acquisition of these systems simply locks the user in to a long lifetime for use of the hardware.

This lifetime represents a significantly long time horizon relative to advances in technology. For example, CPU speed for Intel based servers running Linux can be expected to increase several fold during the depreciation lifetime of a large SMP server. This has the potential to significantly impact the ability to utilize hardware improvements for performance critical applications, as the significant expense associated with the legacy hardware makes a short replacement cycle cost prohibitive. Additionally, improvements in other areas of the technology stack, such as Infiniband, will be more readily incorporated into environments when they are built with open systems and standards as a basis.

Capacity

Oracle Real Application Clusters, as an enabling technology, provides horizontal scalability by the addition of low cost Intel servers (or blades) to the configuration. As demand fluctuates, nodes can be added or removed with no downtime. This flexibility is critical in with respect to the need to adapt to changing demands for computing capacity. In addition, it allows for optimal utilization of server resources, and provides the foundation for Grid Computing.

ORACLE ON RED HAT ENTERPRISE LINUX

Oracle has partnered with Red Hat to introduce several key enhancements to the Linux kernel that have helped make Oracle on Red Hat Enterprise Linux a reliable platform for running mission critical applications. In addition, Oracle's Unbreakable support model provides enterprise level support for systems running Oracle on Linux. Some of the key enhancements to the Linux kernel are mentioned below:

- Cluster File System

- Asynchronous I/O

- I/O driver optimizations

- Large SGA for systems with up to 4GB of RAM

- Very Large Memory (VLM) on systems with up to 64GB of RAM

- Process Scheduler Enhancements

Oracle is continuing to promote innovation and acceptance of the Linux operating system through work with our partners and the open source community on future distributions. For more technical information on performance and stability enhancements on Linux, as well as tuning and configuration information, please see the detailed technical white papers in the Resources section.

PLANNING THE MIGRATION

The migration to Linux is facilitated by a proper planning and assessment period. During this assessment the business requirements and technical factors impacting the migration are determined. This assessment should include business requirements such as availability and performance, as well as technical requirements such as interoperability of components in the software stack. Some key areas that need to be considered in the migration process are described below.

- **Platform Assessment** – A top down assessment of all the hardware components and associated drivers in the proposed stack should be performed to ensure interoperability and functionality.

- **Applications** – Availability of packaged applications on the target Linux distribution should be determined in advance of the migration. Custom code that is platform generic may need only to be recompiled on the new platform. In other cases, the migration to Linux may involve other infrastructure changes such as a move to the Oracle Application Server that will need to be considered.

- **Databases** – The features of the Oracle Database are platform independent, so there is no difference in functionality between Linux and other platforms. In many cases, the migration of the database platform to Linux also includes an upgrade to the current release of the Oracle Database or the addition of Real Application Clusters functionality. These factors provide an opportunity to introduce enhanced functionality as part of the migration.

- **Proof-of-Concept** – For the initial systems migrating to Linux, a proof of concept exercise can be valuable in helping gain an understanding of the functionality and performance of the target platform. This may also serve as an introduction and education exercise for system and database administrators new to Linux. The proof of concept can also help demonstrate to the end user community performance, stability, and cost savings that can be expected by migrating to Linux.

Migration Tips & Tricks

- **Stay current** – Keeping up to date on the current errata release of Red Hat Enterprise Linux helps ensure optimal stability and performance. Releases of Red Hat Enterprise Linux are done on a quarterly basis to help customers manage updates. See resource section for the link to the Red Hat errata site.

- **One-Call Support** – Implementing Oracle on Linux simplifies the support process because Oracle provides support for both the Oracle on

Linux software and the Linux operating system. No other vendor provides this level of support.

- **Oracle Tuning on Linux** – The Oracle Technology Network (http://otn.oracle.com/linux) website is the best source of information for Linux specific tuning and implementation on Linux, as well as discussion forums.

PLATFORM MIGRATION TO LINUX

The maturation of the Linux operating system, along with Oracle's Unbreakable support model, has reduced the risk proposition of migrating to Linux. Proper planning, and consideration of the points mentioned herein, can help simplify the process.

Cultural Changes

Some of the most significant challenges involved in migrating to Linux are cultural, rather than technical. The proliferation of Intel-based Linux servers, relative to large RISC-based Unix systems, requires a change in approach with respect to the way systems are provisioned and managed. A standardized, automated approach to building, managing and provisioning server hardware will assist in this area, as opposed to managing each system in a unique manner. In addition, the management tools and processes by which changes in Linux systems are managed are different in Linux, relative to other Unix systems.

Fortunately, Linux is similar enough to the other varieties of Unix to allow for experienced System Administrators to make the move to Linux with minimal disruption, and there are numerous sources of education available to assist with the transition.

Education

For Unix System Administrators new to Linux, there are a number of education offerings available from Red Hat on their website at http://www.redhat.com (see the "Training" section therein). Additionally, Oracle offers a number of education offerings for Oracle DBA's and developers that highlight the features of the Linux operating system. These offerings can be reviewed at http://education.oracle.com (search for "Linux").

In addition, there is a wealth of Oracle on Linux information on the Oracle Technology Network website (http://otn.oracle.com/linux). This site includes downloads of the Oracle Database, Application Server and other products, white papers, and sample code to help get your migration and development projects started.

Infrastructure: Functional and Technical Aspects of the Migration to Linux

An important aspect of the migration to Linux consists of assessing the infrastructure requirements of the current Unix platform with respect to functional areas, such as:

- High Availability

- Disaster Recovery

- Backup and Recovery

- Monitoring

Tools and applications used to accomplish the tasks above on Unix on RISC-based hardware need to be evaluated on the current platform, and then a pathway needs to be determined whereby equivalent functionality can be delivered on Linux. In some cases, the existing tools supplied by ISV's on Unix on RISC-based hardware will be available on Linux and suitable for use with minimal disruption. In other cases, the move to Linux will require a different approach to achieving business requirements, such as high availability.

High Availability

It is critical to have a clear understanding of the business requirements for the availability of the systems to be ported to Linux when considering implementing a high availability (HA) solution. In a large Unix on RISC-based environment, the business requirement for HA may be met by implementing proprietary, hardware vendor specific methods. In addition, these solutions are typically Active/Passive systems, requiring another large, expensive Unix on RISC-based server to be available (and idle) in the event of a server outage. A platform migration to Linux requires a different model to ensure high availability. Fortunately, Oracle products such as Oracle Database with Real Application Clusters, and Oracle Application Server provide the functionality to failover connections, and route requests to available machines, among other things, for you. This functionality allows you to deploy on clusters of smaller Linux on Intel-based servers and insulates you against an outage should any one node fail. Your hardware infrastructure is more fully utilized in this model, as the requirement for an entire monolithic "hot standby" system is removed.

Disaster Recovery

Although sometimes confused with High Availability, Disaster Recovery is the ability to recover not from the loss of a single machine, but from a catastrophic failure that impacts most or all of a physical infrastructure and the data associated with it. In many cases, customers are using storage centric or "hardware" based disaster recovery solution, which involves replicating changes made to storage

media (disks) to a remote location, for use as required. In many cases, the Linux on Intel-based hardware you are migrating to will be fully compatible with the storage solution being used, thus providing minimal impact to the architecture and not changing the disaster recovery strategy. In other cases, the move to Linux may not be compatible with the disaster recovery mechanism in place on Unix on RISC-based environment. In a situation like this, it may be beneficial to consider a software-based disaster recovery method, such Oracle Data Guard, which is a feature of the Oracle9*i* Database. Oracle Data Guard provides replication of atomic database changes to a remote site in conjunction with the primary site.

Backup and Recovery

A thorough assessment of the business requirements for recovery and the technologies that perform backup and recovery of all aspects of the Unix on RISC-based installation, including application software and data, should be performed. Availability of 3rd party tools to perform above functions on Linux should be determined as early in the process as possible to identify possible issues. For backups of Oracle databases, RMAN is platform independent and media managers are available for Linux that will allow for this solution to be used.

Monitoring

In the case where you are using Oracle Enterprise Manager for management and performance monitoring of your Oracle products, there is no impact to the migration to Linux. This is because your monitoring tool has all the same functionality and is certified for use on Linux out-of-the-box. In the event that you are using 3rd party tools for systems monitoring and management, their availability on Linux will need to be determined. There are also some minor differences in the standard diagnostic utilities on Linux, relative to those on other UNIX on RISC-based platforms.

The Oracle Unbreakable Linux Solution

There may be a situation where you want to make modifications to a standard Linux distribution or include closed-source modules in a Linux deployment in order to achieve a desired functionality. In this scenario, Oracle can only provide support for the Oracle product, rather than the entire technology stack. We believe that when weighed against the overwhelming benefit of integrated support from Oracle, the use of an Oracle Unbreakable Linux solution is of far greater benefit in these cases. For example, the benefit of employing a third party file system in the case where a clustered solution is being created is far outweighed by the supportability problems it could create. Utilization of the Oracle Clustered File System, a fully supported, open source clustered file system for Linux would be a preferable option.

APPLICATION MIGRATION

Oracle E-Business Suite

Migration of the E-Business Suite has been greatly simplified with the release of the Oracle Platform Migration Utility. This utility allows you to migrate your E-business Suite applications tier to Linux in less than one day. Documentation for the Linux Migration Utility can be found on Metalink (note 238276.1). This utility uses your existing applications source code files and preserves many of your customizations, to minimize the impact of the migration. Benchmarking the performance of the migrated Linux applications tier can be achieved by comparing its performance to the Unix on RISC based mid-tier server running the same Oracle Applications database. The migration of an Oracle E-Business Suite database tier to Linux can be achieved using the standard supported procedure documented on Metalink in note 230627.1 "Export/Import Process for Oracle Applications Release 11*i* Database Instances Using Oracle9*i* Enterprise Edition". Refer to the white paper in the resources section for information detailing the Oracle E-Business Suite implementation on Linux.

Web Applications

The steps and factors impacting the migration of server based web applications to Linux depend on the nature of the web application technology. The Oracle Application Server provides a complete solution for deploying web-based applications on Linux.

Java/JSP/Servlet Applications

Migration of Java-based server applications to Linux is a straightforward process. The JDK required to run Java on Linux is readily available, and will need to be downloaded and installed on the Linux application servers in question. The platform independent nature of compiled Java class files already allows them to be compiled on one platform and deployed to another, so the migration of Java application code across platforms does not generally have a large impact.

In the case where Java-based Web applications are moving non-Oracle systems to Oracle on Linux, connectivity to the Oracle database needs to be considered. Oracle supplies a set of JDBC drivers and documentation for the development of Java based Oracle applications.

IIS/ASP Applications

ASP applications can be migrated to Java with the use of the Oracle9*i*AS Migration Kit for ASP. This is a free utility that migrates your proprietary ASP applications to industry standard Java code that is compatible with the Oracle Application Server and can be run on any platform with JDK support, such as Linux. Detailed

information on the Migration Kit can be obtained from the Oracle Technology Network at http://otn.oracle.com/tech/migration/asp/content.html.

DATABASE MIGRATION

By default, features and functionality provided by the Oracle database are platform generic, so there is no issue or loss of functionality when migrating platforms. Data is migrated using standard, well-known functionality of the Oracle database.

Migration of a database platform to Oracle on Linux requires, in addition to the platform migration areas mentioned above, consideration of a few additional aspects such as:

- Performance Testing

- Data Migration

- Migrating to a new release: Taking advantage of new features

- Tuning on Linux

- Real Application Clusters

Performance Assessment and Testing

In order to assess and test the performance of a database application once it has been migrated to Linux, it is important to understand and quantify its workload and performance characteristics on the existing platform. If these factors are not well understood and quantifiable, it will be difficult to size hardware and manage the migrated application on Linux. With a realistic understanding of what is to be evaluated, an analysis of the performance of the Linux-based solution can be undertaken. There exist a variety of commercial applications available that can be used to generate a database workload and record throughput for tests of concurrency. For tests of batch process or single user query performance, simple shell scripts are generally sufficient.

Data Migration

For migration of Oracle Databases across platforms, standard full database export import procedures are the most straightforward way to accomplish the task. It is important to take into consideration the time that will be required to migrate the data, as this will impact overall time required for the production conversion. In the case of a very large database, it may be beneficial to create a number of smaller export files from the original database, by schema owner or even object, and then perform multiple imports into the target database in parallel.

Migrating To A New Release: Taking Advantage Of New Features

As a database platform migration project creates a change to the existing infrastructure and some level of testing activity, many customers take this opportunity to upgrade to the most recent Oracle Database as part of their migration project. Combining the platform migration with a database upgrade can save considerable time and testing effort versus separate efforts in serial, as regression and performance testing need only be performed once. The impact to the clients of the database is minimized as well as there is only one production cutover, rather than two for a migration followed by an upgrade.

In addition, there may be new features of the Database that can be taken advantage of easily within the scope of the migration that can provide immediate, benefits for user and administrators. For example, migrating from an earlier Oracle release to Oracle9*i* Release 2 would allow a customer to take advantage of improvements in the areas of indexing, partitioning and performance management with little effort. Once migrated to the Oracle9*i* Database on Linux platform, the wealth of functionality of the Oracle9*i* database can then be leveraged, areas such as OLAP Services, Oracle Streams, XML DB, and Real Application Clusters to name a few.

Real Application Clusters

Oracle Real Application Clusters is the enabling technology that allows for scalability, flexibility, and high availability of Oracle Databases on Linux. Real Application Clusters allow you to access a single physical database using multiple instances of the Oracle Database on clusters of Linux on Intel-based servers. Adding low cost Intel/Linux nodes to the cluster, rather than investing in larger SMP hardware achieves horizontal scalability and fault tolerance. The benefits of Real Application Clusters are significant and many of our customers have chosen to utilize it as a standard part of their Oracle on Linux strategy. More information on Real Application Clusters can be obtained at http://www.oracle.com.

SUMMARY

Lower total cost of ownership, performance, flexibility and scalability are attainable in an infrastructure built on Linux that employs Oracle software, such as Real Application Clusters and Oracle Application Server as the enabling technology. Oracle is committed to furthering the goal of our customers to run mission-critical applications at the lowest cost. Future releases of the Oracle Database and Application Server will continue to support Linux with enhancements in the areas manageability and scalability.

RESOURCES

Available on the Web:

- Oracle on Linux: http://www.oracle.com/linux

- Oracle Technology Network Linux Center: Technical white papers and documentation: http://otn.oracle.com/linux

- Oracle Technology Network Migration Center: http://otn.oracle.com/tech/migration/content.html.

- Metalink: Oracle Support Online: http://metalink.oracle.com

- Oracle on Red Hat: http://www.redhat.com/solutions/partners/oracle/

- Oracle E-Business Suite on Linux: http://www.oracle.com/appsnet/technology/linux.html

- Red Hat Errata: http://www.redhat.com/support/errata/rhel/

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