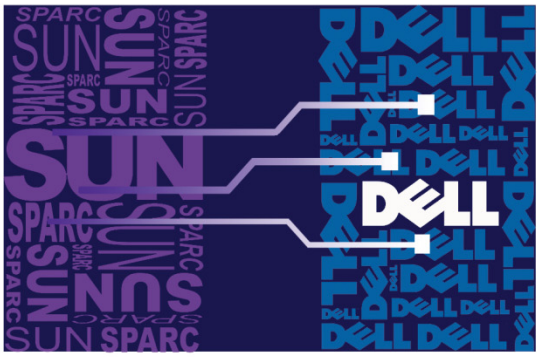
MOVING TO DELL



PLANNING THE TRANSITION

Principled Technologies®

PLANNING TO MIGRATE TO
RED HAT ENTERPRISE LINUX 5.4 ON DELL POWEREDGE R910 WITH ORACLE 11*g* ENTERPRISE EDITION

FROM
SOLARIS 10 ENTERPRISE ON A SPARC-BASED SERVER WITH ORACLE 10*g* ENTERPRISE EDITION

Planning the transition from a Sun SPARC Solaris server to a newer and faster Intel-based Dell PowerEdge server running Red Hat Enterprise Linux is an important step in the migration process. This guide discusses key topics that any migration plan should address.

This guide is part of a package of materials that covers both planning and implementing such a migration. Other materials include a set of performance comparison reports, a TCO analysis, a migration process guide, and summary planning and migration videos.

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Introduction

Dell PowerEdge R910

Performing a cross-platform operating system migration can be intimidating. There are many factors to keep in mind technologically, practically, and financially. The best way to prepare for such a migration is careful planning. This Planning Guide details the approach suggested by Principled Technologies (PT) and Dell Inc. (Dell) for migrating from a SPARC®-based Solaris™ system to an Intel® Nehalem-EX-based Red Hat® Dell™ PowerEdge™ R910 Server.

PT has performed hands-on research and drawn on real-world experiences to document best practices and help systems administrators plan for a migration from Solaris 10 Enterprise Edition to Red Hat Enterprise Linux® 5.4.

Scope of this Guide

This Planning Guide reviews the approach that PT and Dell recommend for preparing to migrate from a Solaris operating system for SPARC-based systems (64-bit) (Solaris 10) to Red Hat Enterprise Linux for x86-64 on a Dell PowerEdge R910 Server. We cover reasons for migrating as well as planning ideas and concepts that may help in your upcoming migration from Solaris to Red Hat Enterprise Linux.

Appendix A gives an Oracle® database-based example approach to working through this planning guide. Detailed step-by-step instructions for executing this migration appear in our corresponding Migration Guide [Note: We will provide hyperlink once the Migration Guide is on our site.]

Deciding to migrate from SPARC to Intel Nehalem-EX based systems

Pat Gelsinger, general manager of Intel's Digital Enterprise Group, speaking of the initial Nehalem processor, summed up the best argument for migrating to Nehalem systems this way: "We're less than half the cost and 1.7 times the performance of SPARC."[1] The advent of the Nehalem-EX processor increases that performance gap.

[1] http://www.internetnews.com/hardware/article.php/3812831/Can+Intels+Nehalem+Transform+the+Datacenter.ht

Below, we present the reasons to move from SPARC to Nehalem-EX:

Performance

Nehalem's performance advantage over existing SPARC systems is well known. In the companion report to this Guide, [Note: We will provide a hyperlink once our performance reports are on our site.] we quantify some of the performance advantages you can expect from the new Nehalem-EX processors.

Lower server hardware costs

Increased prices for SPARC-based systems can negatively affect your budget. IDC reported that sales of SPARC-based servers declined 14 percent between 2006 and 2007 while revenues from those sales actually held steady.[2] Additionally, a study by Red Hat shows that an Intel Xeon® processor-based Dell PowerEdge server capable of running a large enterprise-class Oracle database costs only about 28 percent of what comparable RISC hardware would cost.[3]

Decreased power and facilities expenses

The same Red Hat study showed that, because of the energy efficiencies enabled by the Intel Xeon processors, moving to Dell PowerEdge servers running Red Hat Enterprise Linux can cut power and facilities costs by nearly one-third.[4]

Flexibility

Intel Xeon-based systems give you a choice of the following operating systems: Linux, Windows, and Solaris. SPARC-based systems run Solaris, but do not run Windows or Linux natively.

Staffing

IT professionals skilled in maintaining RISC-based systems are increasingly hard to find. IT professionals experienced with Intel-based systems are readily available and less expensive to hire.[5] Additionally, many existing RISC administrators have some experience with Intel-based systems, so hiring new employees may not be necessary.

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[2] IDC Worldwide Quarterly Server Tracker, February 2009
[3] http://i.dell.com/sites/content/business/solutions/operating-systems/en/Documents/red-hat-oracle-on-red-hat.pdf
[4] Ibid.
[5] "Migration from UNIX/RISC to x86"; Burton Group Research Assessment by Richard Jones; Oct. 8, 2009

Deciding to migrate to Red Hat Enterprise Linux

Red Hat provides guidance for migration planning in its "Solaris to Red Hat Enterprise Linux: Strategic Migration Planning Guide,"[6] which reviews organizational motivations for migration and discusses specific migration and deployment scenarios. Red Hat also provides a paper that discusses the migration decision, "5 Reasons to choose Red Hat Enterprise Linux over Sun Solaris."[7] The rest of this section pulls from those and other sources, outlining some of the factors that might influence the migration decision.

Reasons to migrate to Linux

- Enterprises are moving from UNIX to Linux in volume. IDC projects that Linux-related software growth will lead the industry during the post-recession recovery period.[8]
- According to eWEEK, over three-quarters of the IT executives interviewed for one survey were either "actively evaluating" or "accelerating adoption" of Linux for servers.[9]
- IDC sees Linux as being "highly compatible with two of the hottest trends in the industry: virtualization and cloud computing."[10]

Reasons to migrate to Red Hat Enterprise Linux

- Red Hat is the leading vendor of open-source software and has been ranked as one of the top vendors delivering value in Enterprise Software for six consecutive years by the CIO Insight Magazine Vendor Value survey.[11]
- Red Hat Enterprise Linux is a robust, standards-based, open-source platform that leverages the innovation of the open-source development community.
- Red Hat Enterprise Linux supports a range of systems and provides interoperability with UNIX and Microsoft® Windows® systems.
- Red Hat Enterprise Linux was developed specifically to run on x86-64 hardware and provides freedom from vendor

[6] Planning guide written in 2009. http://www.redhat.com/f/pdf/RH_StrategicMigrationPlanningSolaris.pdf
[7] http://www.redhat.com/f/pdf/RH_Ecosystems.pdf
[8] http://www.linuxfoundation.org/sites/main/files/publications/Linux_in_New_Economy.pdf
[9] http://www.desktoplinux.com/news/NS6982786934.html
[10] "The opportunities for Linux in the new economy" http://www.linuxfoundation.org/sites/main/files/publications/Linux_in_New_Economy.pdf
[11] http://www.cioinsight-digital.com/cio/200910/

lock-in. Red Hat Enterprise Linux runs on a wide range of certified hardware systems from the world's leading hardware vendors, and also boasts a robust ecosystem of certified software.

- Red Hat Enterprise Linux scales well on multi-core Intel Xeon-based servers.[12] Choosing a system with high performance per core, virtualization and consolidation potential reduces hardware costs, software licensing costs, maintenance costs, datacenter costs, and management costs.
- Benchmark results confirm that Red Hat Enterprise Linux delivers high performance. [13]

Pre-migration considerations

This section reviews some of the topics you should consider prior to migrating your databases.

Understanding your migration

There are several different purposes for a migration. We discuss the basics in the Why Migrate? section, but understanding the migration method that best fits your company will help save time and money. Whether you're doing a one-to-one server replacement, consolidation of multiple servers down to one more powerful server, or any other option, you need to understand the advantages and disadvantages of your migration before starting the process.

One-to-one server replacement

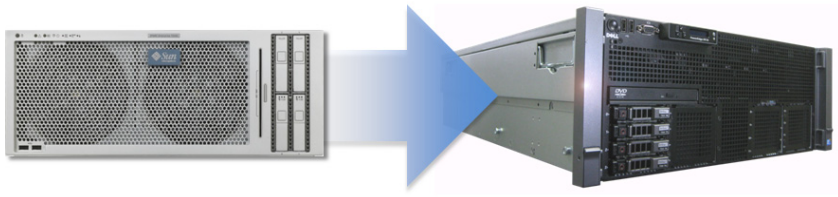

Figure 1. A one-to-one server replacement switching out an existing server for a new, more powerful server.

[12]Benchmark results available at RHEL Benchmark Reports are located in Red Hat's Reference Architecture Repository (to access you must fill out a registration form): http://www.redhat.com/rhel/resource_center/reference_architecture.html
[13]Ibid.

In some migration situations, a company may be looking to replace a few servers. A one-to-one server replacement (see Figure 1) from SPARC to an Intel Nehalem-EX-based Red Hat Enterprise Linux server provides the following advantages:

- The main advantage to doing a one-to-one server replacement is increased server performance. Newer Intel Nehalem-EX processors and the Intel processor-based Enterprise Linux optimizations lead to greater performance.
- Newer Intel Nehalem-EX-based Dell servers are able to utilize new power-efficient processors and RAM, which can lead to long-term financial savings. Sometimes servers need to be isolated due to regulatory or security reasons. If you have a server that needs to be isolated, for example, because it carries confidential HIPAA data, a one-to-one server migration is what you need.

Consolidation

Figure 2. A consolidation of many servers onto one more powerful server.

Many companies have cluttered and underutilized datacenters, a result of simply adding servers when a need arose. These companies can save space and money by consolidating those many servers down to a single, more powerful server (see Figure 2). Companies can also consider using virtualization as an even more powerful tool for consolidation. Virtualization is becoming more popular as power costs related to running servers increase and as virtualization technology continues to improve. Consolidating multiple existing servers offers the following advantages:

- Consolidation saves power draw, which has long-term financial advantages.

- Consolidation helps reduce workspace clutter, which can lead to a more efficient workspace.
- Consolidation helps reduce hardware maintenance and support costs, which also helps with long-term financial costs.
- Consolidation can help save overall money spent on software licensing, though that depends on the applications your company chooses to use.

Assessing costs and organizational moves

After determining your most likely migration scenario, the next planning step is to assess the costs and organizational moves involved in migration. Understanding these costs and moves can help with budgeting and migration preparation (see Figure 3).

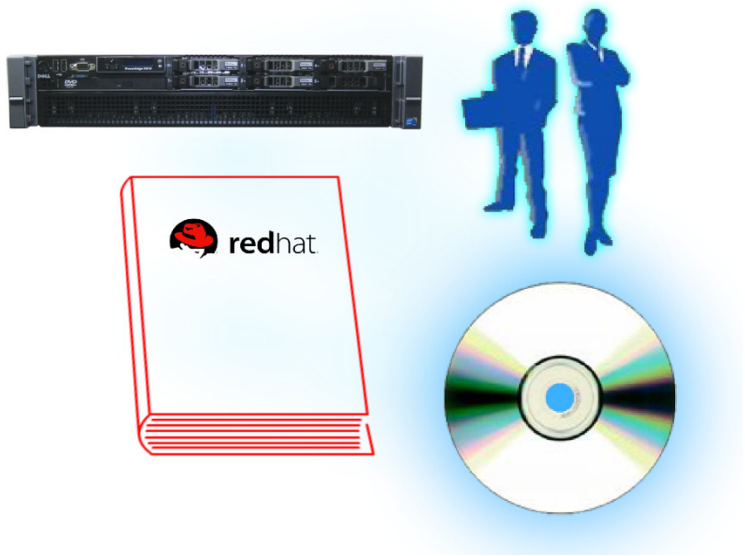

Figure 3. Migration involves a variety of short and long-term costs such as hardware, personnel, training, and software.

Short-term costs

Short-term costs will depend on which migration best fits your company's needs. Among the short-term costs that might arise are the following:

- Hardware costs
- Software costs
- Training or new hires

Long-term costs

Long-term costs exist whether you migrate or continue using current hardware. An analysis of your current long-term costs and the long-term costs that come with migration can help you understand what potential costs you will encounter as well as the potential savings that you might receive from migrating. Some long-term costs to factor in from migrating are the following:

- **Power.** Going green gained popularity due to its positive effects on the environment. However, green awareness has quickly shifted to a monetary focus as studies have shown electric bills to be a considerable expense. A consolidation migration can lead to enormous long-term savings due to lower overall power usage.

NOTE: Newer Dell servers like the Dell PowerEdge R910 and Intel Nehalem-EX processors have optimizations for better power efficiency. These save power in addition to the overall power savings that result from reducing your number of servers.

- **Maintenance and support.** The consolidation migration method will save long-term maintenance and support costs as you reduce the number of physical servers that you must maintain.
- **Cooling and datacenter space.** These costs function similarly to power costs. Consolidation means fewer servers, which means you need less space and less air conditioning. Consolidation can lead to significant saving on cooling and space.
- **Regulatory compliance savings.** With fewer physical devices storing data and more uniform management practices, a consolidated environment can make the process of complying with regulatory requirements, such as Sarbanes-Oxley and the Health Insurance Portability and Accountability Act (HIPAA), less expensive, easier, and more secure.

Organization assessment

Changing technologies involves a learning curve. It is best to make sure your organization is prepared for that change. Taking the following planning steps should help make the migration process smoother and add to productivity in the long run.

- **Assess the level of Linux and x86-64 RISC expertise among existing server administrators.** Your company may be able to avoid extra training costs if your current Solaris administrators have pre-existing experience.
- **Assess what applications you plan to port over from the original server.** Understanding which applications you are planning to move will help you know which programs you can simply port over and which will require more work.
- **Assess the level of strain on existing servers.** If you are doing a consolidation migration, understanding the amount of strain on your current servers will help you understand the exact specs you will need on the new server you are purchasing.

Moving your applications

Applications are the pieces that make a corporation run. From large enterprise applications such as Oracle or SAP® to smaller built-in applications like Sendmail and Apache, they are what move productivity forward. You will have to migrate all of these applications in some form or another. Note that during a migration, some applications transfer over with minimal effort while others take a little more work (see Figure 4).

Whether an application is one you have developed in house or one you purchased, you have several choices when moving it from Solaris 10 on SPARC-based systems to Red Hat Enterprise Linux 5.4 on x86 (64-bit) systems.

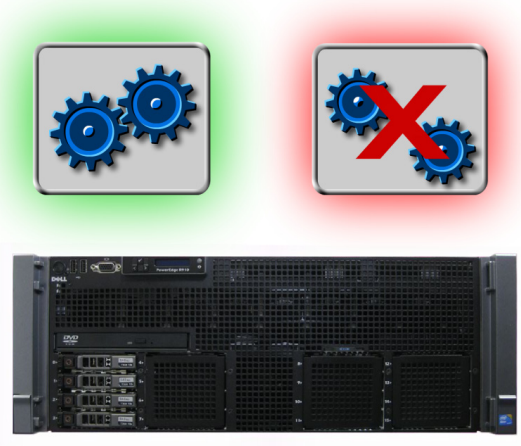

Figure 4. Applications come in a variety of shapes and sizes, with some easier to migrate than others.

Java-based applications

These applications should run as is in the new Red Hat Enterprise Linux 5.4 x86 (64-bit) environment. Sun developed the original Java language in the 1990s and has maintained a strong commitment to Java ever since. Because Java applications run in a Java Virtual Machine, they are largely machine-independent.

Built-in applications

Red Hat Enterprise Linux has the advantage that quite a few of the built-in Solaris applications are built into Red Hat Enterprise Linux as well. You should be able to run these programs the same way in Red Hat as you did while using Solaris.

NOTE: Be sure to register with Red Hat Network (RHN) during the Red Hat Enterprise Linux install process to ensure you keep your system up to date.

When you have the source code for the application

Frequently, applications for which you have source code are those your organization developed. Porting an application from Solaris to Linux requires less work than other migrations, such as to Microsoft Windows. One big advantage is the availability of the GNU tool set on both Solaris and Linux. If the developer built your application using the Solaris versions of the GNU Compiler Collection (GCC) tools, you will not encounter language issues when you port. However, you may have to contend with differences in the system application programming interfaces (APIs).

When you do not have the source code for the application

You will not typically have the source for an application you purchased. If such an application is available in an x86 (64-bit) version, you have the option of moving to the native version.

Oracle is a prime example of an application that both Solaris 10 (SPARC) and Red Hat Enterprise Linux 5.4 (x86 64-bit) support. The bulk of the Migration Guide focuses on how to migrate an Oracle installation from the Solaris 10 SPARC environment to the Red Hat Enterprise Linux 5.4 x86 (64-bit) environment.

A note about application data

You should never simply copy the raw data files from one system to another system of a different architecture. The data formats that applications write to disk are not generally portable. Bit orders, padding, and alignment are examples of elements that can differ as

you move from one system to another. Most applications, however, provide some ability to back up or export data to portable formats.

Minimum requirements

Be sure to thoroughly research the basic requirements and allow adequate headroom for growth for each of your applications before setting up your new operating system. Understanding your applications' software and hardware requirements can save you time as well as money.

Planning around a busy company

While executing a carefully designed, step-by-step migration plan simplifies the migration process, no plan can live up to end users' expectations that servers remain up and running 100 percent of the time. The best way to minimize the downtime that end users experience is to plan when and how you will do your migration (see Figure 5).

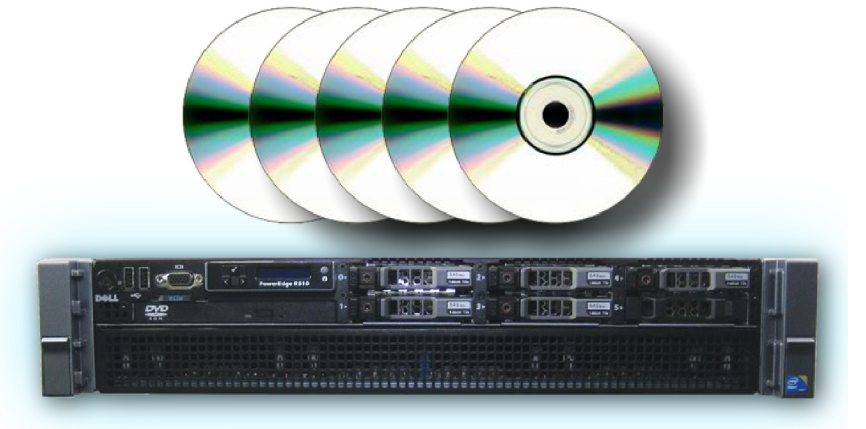

Figure 5. Time is at a premium when migrating. Ensuring you have all necessary software can help minimize downtime.

Ensure you have all necessary files before you start the migration process

Applications can require as few as one setup file or as many as dozens. Missing pieces of software can prolong a very time-sensitive process. Making sure that you have all necessary components at hand will save critical time and shorten the migration process.

Time your migration to affect the fewest people

Servers generally see less traffic outside normal business hours, i.e., nights, early mornings, and weekends. The amount of downtime for your migration will depend on the number and complexity of applications that you are planning to migrate. Planning your migration for a time that will affect the fewest users minimizes end-user downtime and has minimal impact on productivity.

Plan your workspace to incorporate new hardware

An aspect that may seem obvious but remains important is the physical aspect of a migration. Planning the layout of your datacenter will reduce overall downtime and lead to better productivity.

Summing up

Red Hat Enterprise Linux 5.4 and new Intel Nehalem-EX processors introduce many new features and enhancements. As this Guide has explained, preparing to deploy these products on a Dell PowerEdge R910 server and to migrate your Sun Solaris servers to a new Red Hat Enterprise Linux environment can help you avoid potential problems during your migration.

Appendix A. Methodology: Oracle planning

One-to-one migration

We chose a one-to-one migration for our simulated migration. Database applications utilize the disks and processors heavily, so migration to a new Intel Nehalem-EX-based Dell PowerEdge R910 server using Red Hat Enterprise Linux made sense. Migrating to a newer, faster Enterprise Linux server will help avoid future bottlenecks.

Assessing costs

Moving to a new server and operating system presents short-term costs, long-term costs, and basic organizational costs. Here are some of the costs that we might encounter while preparing to migrate an Oracle database from Solaris to Red Hat.

Short-term costs

- Cost of the server
- Cost of the Oracle software and licenses
- Training

NOTE: In our case, it is doubtful that we would need to hire a new administrator or do excessive training as Oracle is very similar between operating systems.

Long-term costs

- Space and power should not be issues as there should not be a major increase or decrease in either with a one-to-one server migration.
- Maintenance costs should be low as well due to the Nehalem-EX's new error-checking abilities. This should increase stability and lead to fewer problems overall.

Organization assessment

- In our example, we focus more on the actual migration process. Therefore, we will assume that the current server administrator has experience in both Red Hat and Solaris and does not require additional training. You can find additional information on Red Hat Training at http://www.redhat.com/training and you can find additional information on specific courses for migration from Solaris to Linux in Appendix B.

- In our case, the main application we are transferring is Oracle. However, the Oracle version on the SPARC-based server that we are using is older so we are adding some new elements in Red Hat. For example, we just created a basic database on the SPARC-based Solaris system. However, on the Red Hat server, we set up ASM-based storage using Oracle Grid Infrastructure. Research and planning helped us know the best process for planning that storage change.
- The high level of workload stress on our original server was the reason for our migration. Because we are doing a one-to-one migration, it is most important to analyze stress on our SPARC-based Solaris system when it is starting to become overwhelmed. The newer Intel Nehalem EX-based Dell Red Hat system that we move to (the Dell PowerEdge R910) should be able to handle heavier workloads with ease.

Planning your Oracle 11*g* setup

Many different options exist for installing an application such as Oracle. We recommend looking through documentation at http://download.oracle.com/docs/cd/E11882_01/install.112/e10840/toc.htm and planning which features you intend to use. Doing so will affect not only the way you set up your software but also how you lay out your system. Below are some of the planning decisions we faced in our Oracle setup.

Planning for hardware and software requirements

Oracle has a variety of requirements for hardware and software. While our Dell PowerEdge R910 easily met the hardware requirements, some software requirements required us to make adjustments. For example, Oracle requires more swap space than Red Hat Enterprise Linux 5.4 allocates by default. In our pre-installation research, we learned that for servers running with 16 GB of RAM, you should use at least 16 GB of swap space. In our install, we encountered that did not meet this minimum, and adjusted accordingly.

NOTE: Hardware and software requirements for an install of Oracle Database 11*g* R2 on Linux can be found at the following link: http://download.oracle.com/docs/cd/E11882_01/install.112/e10840/pre_install.htm#BABFDGHJ

Determining whether to use Automatic Storage Management (ASM) for Oracle storage

ASM gives the Oracle administrator a simple interface to use for managing all data. However, if you use ASM with certain hard drives, you will be able to use those hard drives **only** for ASM. We decided to use ASM in our migration for security and performance reasons. ASM can also act as a basic RAID controller, so you should decide if you would rather use the built-in RAID or ASM for those purposes. We used the built-in RAID controller for our migration.

Determining whether to use clustering for your Oracle setup

Like many Enterprise applications, Oracle allows you to install Oracle 11*g* Database in a cluster. Doing so allows multiple servers to work together to host one database while giving additional protection against data loss due to unexpected outages. However, using a cluster requires a good deal more setup time than a typical stand-alone setup. Because our example migration is only a one-to-one server migration, we did not use clustering. However, most organizations choose to use clustering for the added data security. You can find more information on planning for a clustered setup of Oracle 11*g* at the following link http://download.oracle.com/docs/cd/E11882_01/install.112/e10813/toc.htm

Determining your Oracle install's endianness

Different processors have different endian capabilities. Some are restricted to big-endian, some are restricted to little-endian, and some can do both. Endianness is a way of describing how certain programs store data in external memory. If your endianness is different between your destination and source platforms (as is the case with Linux and Solaris), then you will have to perform a conversion on your database files to migrate them successfully. We determined before our migration that we would have to convert our database datafiles using the rman utility.

Selecting your Oracle migration method

In this example Oracle database migration, we discuss planning a migration that crosses different processor architectures, different operating systems, and different versions of the database software. Two methods are available for migrating Oracle from one system to another: the export-and-import method and the data pump/ tablespaces method.

Export-and-import method

The export-and-import migration method has taken a back seat to the newer data pump/tablespaces method, but is still useful for migrating older versions of Oracle. The newer method of data migration, pump/tablespaces (mentioned below), speeds up the migration process considerably, so we chose to use that. If you are attempting an Oracle upgrade using versions much older than those we reference in the Migration Guide, make sure that your current version can migrate to the new version you have purchased by checking the Backward Compatibility Support for Export/Import table at http://download.oracle.com/docs/cd/B10501_01/server.920/a96530/expimp.htm

Data pump/tablespaces

The data pump/tablespaces method is now the most commonly used Oracle migration method. This method involves using built-in functionality found in later versions of Oracle. The data pump creates a dump file that can use a large amount of space depending on the size of your database. Planning where you want that dump file while preparing your RAID setup can prevent problems later. For our situation, our database was small enough to not need extra storage for the dump file. However, many enterprise databases are quite large and can require a lot of space.

Timing and workspace planning

Because our example Oracle migration used a very small database, it did not require a great deal of time. Larger Oracle databases can require hours or even days to migrate. It is important to be prepared and select a time for migration that best fits your specific circumstance. Making a few preparations for our Oracle migration prevented extra downtime.

Acquiring necessary files

The Oracle setup we used as part of our Migration Guide required several Red Hat Package Manager (RPM) packages as well as installation packages for both Oracle Database and Oracle Grid Infrastructure. The latter two packages are larger than 1 GB each and thus take some time to download. Making sure you have all your materials ready to go helps streamline the migration process.

Timing

Because we used a 1 GB database for our example migration, we were able to do this migration over a few hours. Using an early weekend morning helped us avoid unnecessary downtime.

Workspace planning

Because we performed a one-to-one migration, space was not an issue. We were able to rack our Dell PowerEdge R910 server in the same rack as our original SPARC-based Solaris server. Doing so helped avoid clutter and simplified the process of moving the necessary network connections to our new Oracle server.

Appendix B. Red Hat Training courses

Red Hat provides a variety of different Red Hat Training courses for people trying to gain more knowledge about Red Hat Enterprise Linux. The following courses are courses that would specifically help with migrating from Solaris to Red Hat:

Course code	**Title**
RH033	Red Hat Linux Essentials
RH131	Red Hat Linux System Administration
RH133	Red Hat Linux System Administration (and RHCT Exam)
RH142	Linux Troubleshooting Techniques and Tools
RH145	Red Hat Directory Server Administration
RH184	Red Hat Enterprise Linux Virtualization
RH253	Red Hat Linux Networking and Security Administration
RH300	RHCE Rapid Track Course (and RHCE Exam)
RH301	Red Hat Linux Rapid Track Course
RHS333	Red Hat Enterprise Security: Network Services
RH320	Red Hat Apache and Secure Web Server Administration
RH401	Red Hat Enterprise Deployment, Virtualization, and Systems Management
RH423	Red Hat Enterprise Directory Services and Authentication
RHS429	Red Hat Enterprise SELinux Policy Administration
RHS435	Red Hat Enterprise Certificate Management
RH436	Red Hat Enterprise Clustering and Storage Management
RH442	Red Hat Enterprise System Monitoring and Performance Tuning
RHD143	Red Hat Linux Programming Essentials
RHD221	Red Hat Linux Device Drivers
RHD236	Red Hat Linux Kernel Internals

Check https://www.redhat.com/courses/ for more information on available Red Hat Training courses.

About Principled Technologies

We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help you assess how it will fare against its competition, its performance, whether it's ready to go to market, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.

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