



WHITEPAPER

STRATEGIC MIGRATION PLANNING GUIDE

MIGRATING FROM SOLARIS TO RED HAT ENTERPRISE LINUX IN VERITAS STORAGE FOUNDATION ENVIRONMENTS

EXECUTIVE SUMMARY

This document is geared towards helping customers understand best practices on how to migrate their Veritas Storage Foundation environment with associated data from Sun Solaris to Red Hat® Enterprise Linux®. It includes the planning steps that should be taken when preparing for such a migration as well as common implementation and training standards and best practices. Is your IT ecosystem in danger of becoming too dependent on a single vendor? The Oracle-Sun merger is being touted as an industry-changing event. Proponents see it as delivering a single-stack offering that includes hardware, operating system, and applications, a more diversified corporate portfolio, and a much more credible offering in the market. But what does this merger mean for you, the customer? For many, the reality of this situation is one of the things keeping you up at night. With the merger, one vendor now has a disproportionately large stake in your enterprise technologies. This puts you at a huge disadvantage, making you increasingly vulnerable to cost increases and limiting your options to do what is best for your business environment. Migrating from a proprietary Sun Solaris environment to Red Hat Enterprise Linux, which is based on free industry-wide standards, will not only help you carve out IT costs, but will also help scale your IT ecosystem for superior choice and value. Strategic migration planning from Symantec and Red Hat provides you with the roadmap to execute migrations safely and efficiently. Red Hat and Symantec are working together to make sure that your decision to migrate infrastructure and data from Solaris to Red Hat Enterprise Linux can be conducted in a manner that removes risk and disruption to your business. Many of the principles in this document have been developed by Red Hat's global team of architects and enterprise consultants and provides you with the tools, insights, and proven processes you need for a smooth migration of your operating environment. These steps and best practices are further complemented by the Portable Data Containers feature of Veritas Storage Foundation, which helps you move large storage datasets in a short period of time with maximum efficiency. With Portable Data Containers you can now migrate data to the Red Hat Enterprise Linux platform in three easy steps:

1. Convert the file system.
2. Extract the snapshot volume and deport it to the new disk group.
3. Use Veritas Volume Manager to import the new disk group to the Red Hat Enterprise Linux environment.

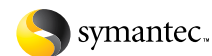


TABLE OF CONTENTS	3 Migration consideration	36 Successfully migrated customers
	10 The strategic migration process	40 Summary
	30 Enterprise services	

Benefits

- Lower costs. You will maximize your cost savings by lowering your hardware, software, and operational costs.
- Improved choice and avoid vendor lock-in. By migrating your infrastructure and data to Red Hat Enterprise Linux, you will gain access to an extremely rich ecosystem of hardware and software vendors that are certified on Red Hat Enterprise Linux.
- IT modernization. With this migration you will modernize your IT infrastructure and protect your future with support for physical, virtual, and cloud environments at a pace that works for you. With the SmartMove feature of Veritas Storage Foundation, you can migrate your data to thin provisioned storage for even greater storage efficiency.
- Data migration efficiency. Veritas Storage Foundation’s Portable Data Containers feature enables data to stay on its current storage hardware, dramatically reducing the time to migrate and alleviating the requirement to temporarily double storage during a migration.
- Consistent datacenter operations. Continued use of Veritas Storage Foundation provides you with the consistency in operations and root cause analyses to which you have become accustomed. Business procedures in the datacenter are the same even as you move to a new operating platform, such as Red Hat Enterprise Linux.
- Low risk migration. Red Hat and Symantec are very experienced in conducting migrations. This experience has resulted in best practices that are embodied in this document, along with the skills and expertise of our personnel. You can be sure that any migration you consider will come with a well-prepared plan and knowledge transfer with minimal disruption and cost to your business.

Pre-planning

A thorough understanding of your migration environment is the critical first step to ensure faster time-to-value. Your organization’s motivations for undertaking an operating system (OS) and data migration should be carefully considered, as these may influence choices, opportunities, and trade-offs. Likewise, understanding your potential deployment scenarios will help you proactively identify any roadblocks and anticipate future needs.

The Solaris to Red Hat Enterprise Linux migration planning process

Red Hat has established a proven five-step process designed to identify Solaris to Red Hat Enterprise Linux migration opportunities, examine the risks associated with various migration scenarios, create a standard enterprise build, and develop a comprehensive strategic migration plan for the enterprise. These principles directly apply to helping customers most effectively migrate their Solaris environments and related data from Solaris to Red Hat Enterprise Linux using the capabilities of the Veritas Storage Foundation product suite. Using the Storage



Foundation online migration capability, data can be migrated from the native stack to Veritas Storage Foundation on the Solaris platform, and eventually to Red Hat Enterprise Linux. This ensures minimum planned application downtime during the data migration. Through this process, your organization will:

- Examine the existing Solaris architecture and determine the equivalent capabilities in the Red Hat Enterprise Linux ecosystem.
- Examine third-party functional and business applications and determine the equivalent or enhanced capabilities in the Red Hat Enterprise Linux ecosystem.
- Measure organizational readiness and overall migration risk.
- Develop a strategic Solaris to Red Hat Enterprise Linux migration plan, including a detailed roadmap and cost estimate.
- Implement the strategic migration plan and employ implementation support strategies.

The details that follow are intended to provide insight into the considerations and processes required to use Veritas Storage Foundation to move your existing Solaris environment to Red Hat Enterprise Linux. We encourage you to share this with your team as you embark on your migration planning. Through these insights, we hope to arm you with the knowledge to successfully plan and execute your migration.

2. MIGRATION CONSIDERATIONS

An organization considering an OS migration should carefully examine the motivation or combination of motivations behind the decision. These motivations have a potential impact on the strategic migration planning process because they can influence migration opportunities, choices, and the inevitable trade-offs that must be made in the process of migration. It is also important to understand both the types of migrations that are possible as well as the potential deployment scenarios, as these serve as foundational drivers and knowledge for the entire migration planning process. Customers should consider the complexity of their migration. Application migration is the most complex work. It depends on the CPU architecture, programming language, its own design, application usage, and so on. Especially when the CPU architecture is different, you will need to consider recompiling the application and endianness (byte order) in some cases. File migration differs with the type of file. The plain ASCII text file is inherently portable, but other files, such as binary, are not. To migrate an application binary file (executable) properly, you should recompile it for the Red Hat Enterprise Linux operating environment. For these reasons and more, you should consider your migration requirements very carefully. This section examines the organizational motivations for migration as well as the high-level migration and deployment scenarios that are typically associated with operating system migrations.



2.1 Migration drivers

There are key reasons that organizations choose to move from an environment with Veritas Storage Foundation running on Solaris to one running on Red Hat Enterprise Linux. These reasons may include:

- Cost reduction in multiple areas, including:
 - Hardware acquisition and maintenance costs
 - Software license and maintenance costs
 - OS support and systems administration costs
 - Power and cooling costs
- End of server lease
- Expanding business requirements with existing budget constraints
- Corporate mergers and acquisitions
- Replacement of retiring or discontinued software
- Server and storage consolidation
- Application consolidation
- Datacenter consolidation
- Leveraging new technologies (such as virtualization)
- Performance
- Stability
- Ease of migration
- Ability to run infrastructure and application software equally or more efficiently
- Continued use of familiar Symantec tools (administration and management)
- The need to deploy your applications and data on an operating environment platform from a trustworthy vendor that has a more reliable future and can help your company modernize your IT infrastructure

In many cases, a combination of motivations drive strategic migrations. Whereas no single motivation may be sufficient to warrant the cost, the sum of the business objectives may be enough to justify the migration. In other cases, a single driver (such as cost savings) is greatly desired (or required), and sufficient to justify the migration.

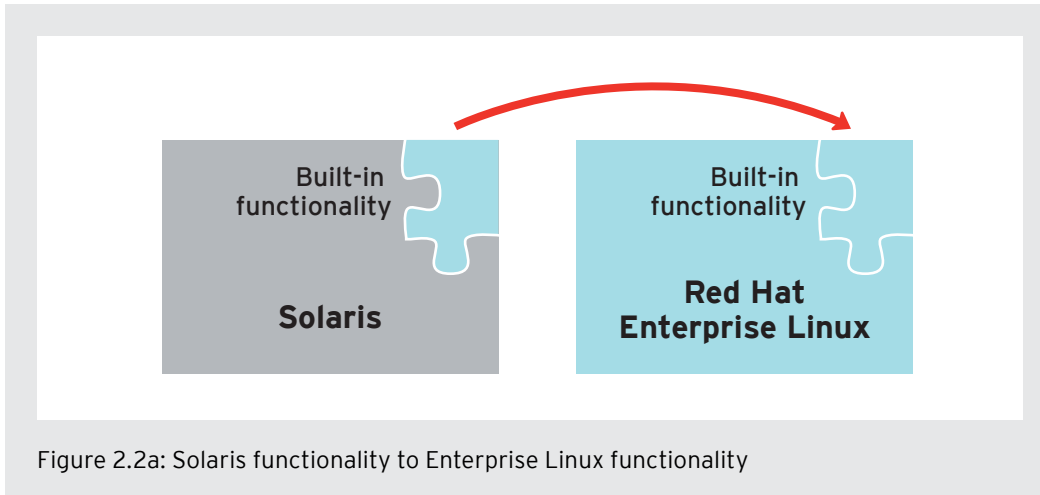
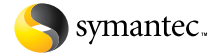


Figure 2.2a: Solaris functionality to Enterprise Linux functionality

2.2 Potential migration scenarios

In any migration from one operating system to another, there are four primary migration scenarios that must be closely examined in order to create a plan and conduct a successful operating environment migration implementation. In each of these scenarios, beyond the issues associated with migrating the operating system and applications, there may be significant data migration challenges to

overcome, however by partnering with a strategic ISV like Symantec, this risk can be mitigated. This section gives a high-level overview of these primary scenarios. More detailed versions of each of these scenarios are available in Appendix A of this document.

Scenario one: Built-in functionality to built-in functionality

In this scenario, functionality built into Solaris is the same or similar to functions that are built into Red Hat Enterprise Linux (see Figure 2.2a). When functionality is part of both operating systems and works identically (e.g. Apache or Sendmail), there are few challenges to migration.

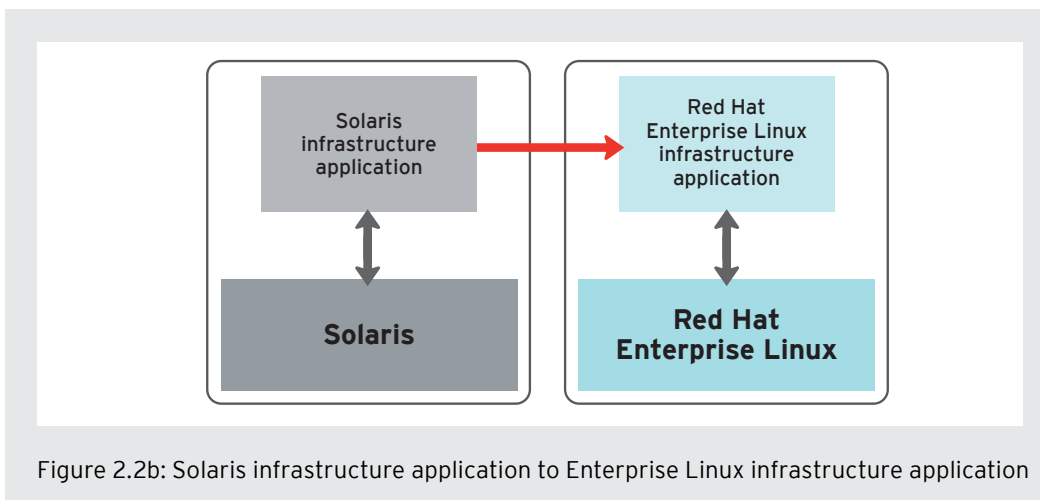


Figure 2.2b: Solaris infrastructure application to Enterprise Linux infrastructure application

Scenario two: Solaris infrastructure application to Red Hat Enterprise Linux infrastructure application

This is an assumed scenario described as part of the scope of this document. It is assumed that the customer has Veritas Storage Foundation or Symantec NetBackup infrastructure applications running on Solaris today and wants to continue to run these applications after the migration

to Red Hat Enterprise Linux. The customer may also have other non-Symantec infrastructure applications that they want to continue to run in a Red Hat Enterprise Linux environment. This requires a change in the operating system used and a migration of the underlying data associated with the customer's existing environment. (see Figure 2.2b).

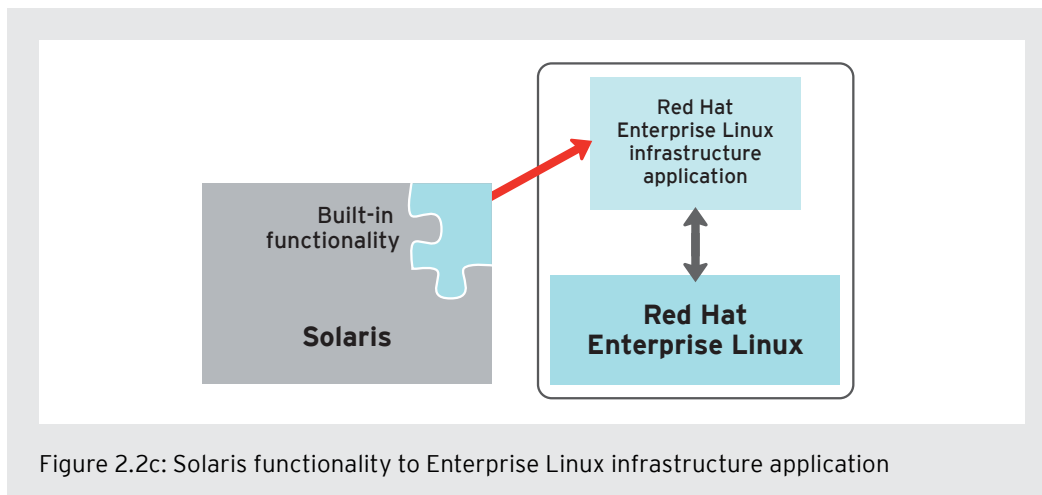
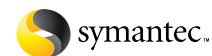


Figure 2.2c: Solaris functionality to Enterprise Linux infrastructure application

Scenario three: Solaris functionality to infrastructure application

In a small number of circumstances, Solaris has built-in functionality that Red Hat Enterprise Linux does not (see Figure 2.2c). For instance, to achieve the functionality of a flash archive in Solaris, an application such as Altiris Deployment Solution would be used. An additional infrastructure application may be necessary in this scenario to achieve the same functionality in a Red Hat Enterprise Linux environment.

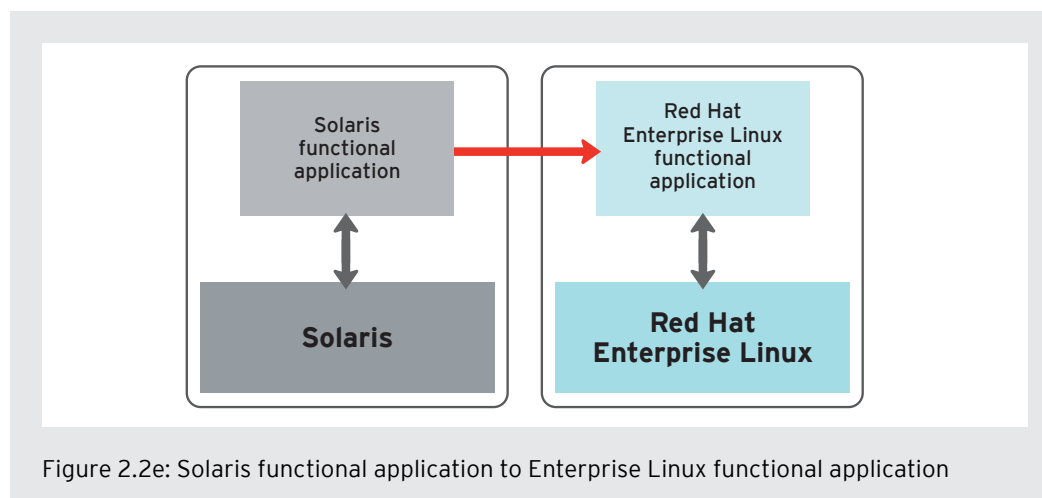


Figure 2.2e: Solaris functional application to Enterprise Linux functional application

Scenario four: Functional application to functional application

This scenario involves moving from one functional application on Solaris to the same or similar application on Red Hat Enterprise Linux (Figure 2.2e). This type of scenario often occurs with two application subtypes: ISV functional applications and custom functional applications.

The migration of an ISV functional application is very similar to Scenario 2, Solaris infrastructure application to Red Hat Enterprise Linux infrastructure application, discussed earlier in this document. The migration usually revolves around availability of, and version issues associated with, the ISV application in question. Custom functional applications usually present a more challenging situation unless exceptional care was taken to ensure cross-platform compatibility during their development phase. A methodology for examining the readiness of these applications for migration is outlined in Section 3.3 of this document.



2.3 Migration deployment scenarios

When considering operating system platform migrations, it is important to understand the possible deployment scenarios of the server workloads. This helps to develop the best enterprise architecture for your environment—which is what ultimately drives a large portion of the capital cost savings the migration allows. There are four primary deployment scenarios that are common to migrations: consolidation, dispersion, aggregation, and cloud migration. These scenarios are not mutually exclusive and can be combined in a large-scale migration to achieve the right balance of functional and operational characteristics for specific workloads. When migrating data to Red Hat Enterprise Linux, IT must take the following considerations into account:

- Differing file formats
- Data locality
- Access service levels
- Data utilization efficiency
- Appropriate storage usage

Many of these considerations can be properly managed with the use of Veritas Storage Foundation and Veritas Operations Manager (VOM) during migration. Key features like Portal Data Containers can seamlessly convert file system layouts, making many file formats quickly available on Red Hat Enterprise Linux. Some application data files that have specific binary structures inside them, however, may need additional proprietary conversion using tools provided by the application vendor. Veritas Operations Manager and the SmartTier feature of Storage Foundation make it possible to automate storage tiering, optimize storage usage, manage data locality, and access service levels.

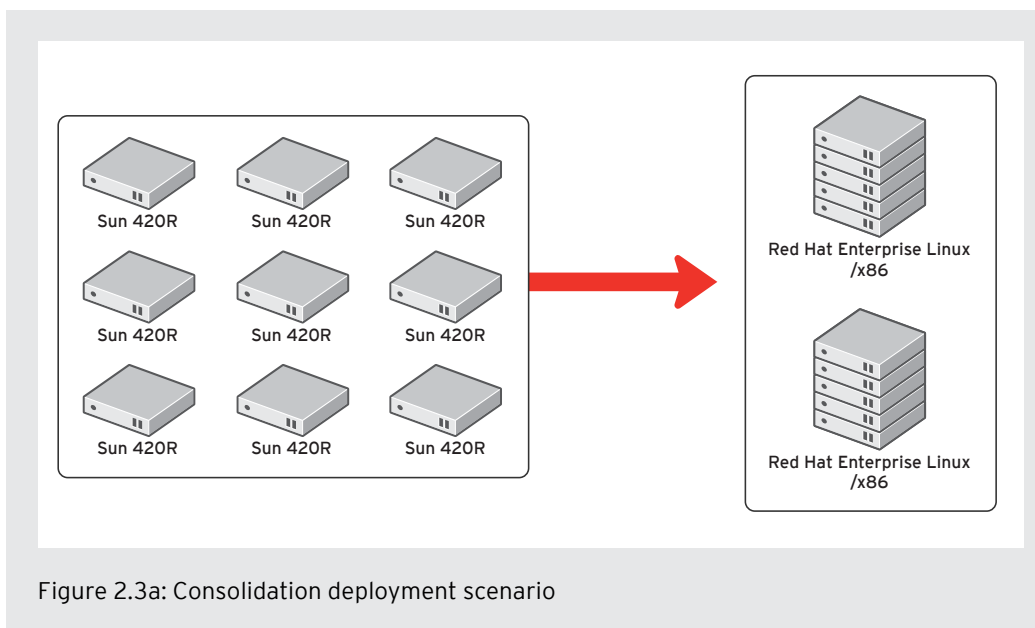


Figure 2.3a: Consolidation deployment scenario

Consolidation

In the consolidation scenario, workloads on a large number of under-utilized SPARC systems are consolidated onto fewer systems. These new systems may use virtual machines running Red Hat Enterprise Linux to contain each workload (see Figure 2.3a). This type of scenario is common in environments where customers have made virtualization of systems a strategic directive. In this scenario, the customer utilizes the chosen virtualization technology to control access to system resources.



Advantages:

- Reduced hardware operational costs
- Reduced datacenter footprint
- Greater return on investment (ROI) from the chosen virtualization strategy

Disadvantages:

- Proprietary virtualization technologies can increase capital costs and create a new kind of vendor lock-in for the customer.

Dispersion

In the dispersion scenario, workloads on one or more large SPARC systems are distributed among a number of smaller x86-based systems running Red Hat Enterprise Linux (see Figure 2.3b). This type of scenario is common in environments where Red Hat Enterprise Linux has a growing footprint. Customers can distribute and scale hardware resources in smaller units across multiple datacenters. While 1U to 4U individual rackmount systems have traditionally been common in this scenario, the use of blades has been growing in recent years. Blade servers provide the customer similar advantages with lower operational costs.

Advantages:

- Higher performance from newer x86 hardware technologies
- Lower capital cost to scale hardware resources
- Higher flexibility with (re)deployment of resources

Disadvantages:

- When not properly planned, this scenario can result in higher operational costs.

Aggregation

In the aggregation scenario, workloads for a large number of SPARC systems of various sizes are migrated into a single large fault-tolerant hardware platform where Red Hat Enterprise Linux can be run (see Figure 2.3c). This type of scenario is common in environments where the customer already has a high investment in the specific hardware platform and wishes to further leverage the platform to aggregate legacy SPARC platforms

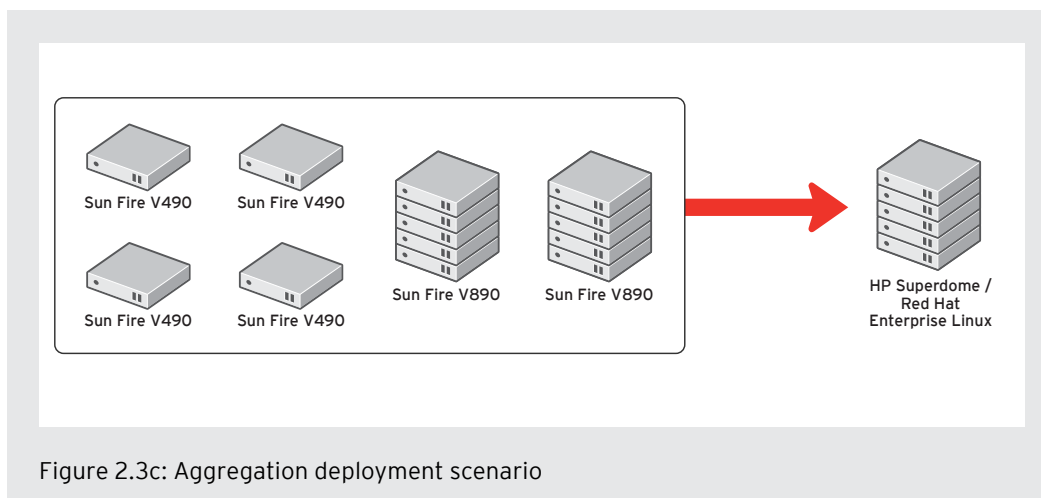


Figure 2.3c: Aggregation deployment scenario

using Red Hat Enterprise Linux. Customers have a choice of using hardware (LPARs, partitioning) or software (zVM, Xen, or KVM virtualization) to control access to system resources.



Examples of these platforms include:

- IBM System z using Integrated Facilities for Linux (IFL) central processors
- HP Superdome (Intel Itanium-based)
- Fujitsu Primequest (Intel Itanium-based)

Advantages:

- Reduced hardware operational costs
- Reduced datacenter footprint
- Greater ROI derived from existing hardware platform

Disadvantages:

- Without prior investment in the platform, a customer will incur a high capital hardware cost.

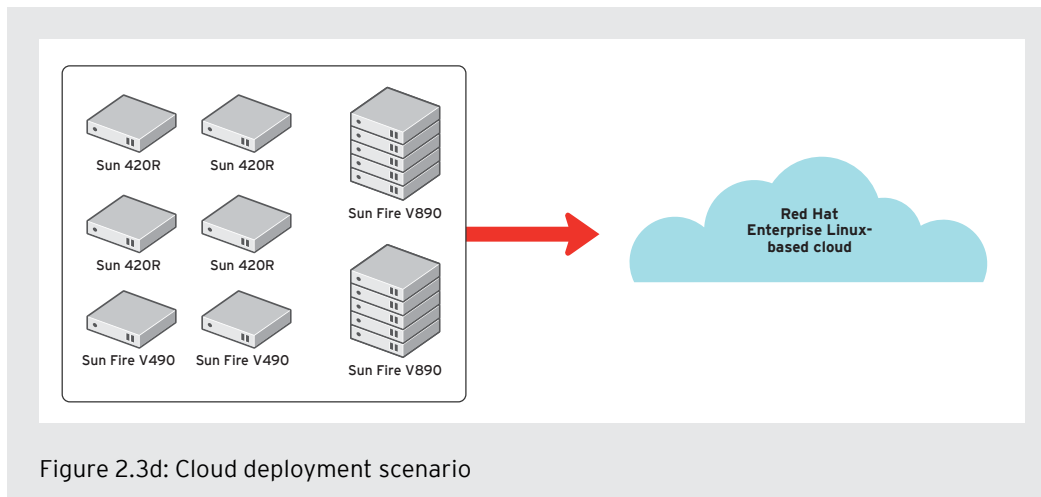


Figure 2.3d: Cloud deployment scenario

Migration to cloud

In the cloud migration scenario, workloads on any number of SPARC systems are migrated to run on Red Hat Enterprise Linux in a cloud computing environment (see Figure 2.3d). This may be an internal, or private, cloud created by the customer, or an external, or public, cloud like those offered from Amazon

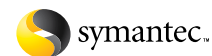
or Rackspace. This type of scenario is very new to most customers, though a small number of customers are moving or have moved their entire operations into a cloud computing environment. Within the cloud, customers have a very high level of control over resources provided to individual workloads.

Advantages:

- Resources can be easily scaled up or down as needed for each workload.
- Zero hardware costs (using a public cloud)
- Low investment cost results in fast ROI (using a public cloud).
- Higher hardware utilization provides better hardware ROI.
- Simplified cloud environment provides for a lower operational cost.

Disadvantages:

- Severe outage of cloud or connectivity can cause total loss of access to the operating environment (using a public cloud).
- Critical data is stored and processed on systems not owned by the customer, so issues of compliance and record-keeping are concerns (using a public cloud).



3. THE STRATEGIC MIGRATION PROCESS

This section describes a holistic, five-step process designed to identify data, operating system, and application migration opportunities, examine the risks associated with various migration scenarios, create a standard enterprise build, and develop a comprehensive strategic migration roadmap for the enterprise. The following table gives a high-level overview of the phases, deliverables, and durations involved in the migration planning process.

TABLE 3.1A OVERVIEW OF MIGRATION PLANNING PROCESS

PHASE	DESCRIPTION	DELIVERABLES	TYPICAL DURATION
I: Infrastructure Applications Analysis and Standard Build	This phase examines existing Solaris infrastructure, administrative functionality, and applications (the “as is” architecture) to make recommendations for their equivalent capabilities in an Enterprise Linux ecosystem. During this phase a standard operating environment build of Enterprise Linux is created as a baseline “to be” architecture.	Infrastructure applications recommendations report Standard operating environment build High-level infrastructure	3 - 5 weeks
II: Functional Applications Analysis	This phase examines third party functional or business applications (SAP, Oracle, custom applications, etc.) and makes recommendations for their equivalent capabilities in the Enterprise Linux ecosystem.	Functional applications recommendations report High-level applications migration cost estimate	2 - 8 weeks (highly variable, depending on # and complexity of applications)
III: Readiness and Risk Analysis	This phase looks at additional technical and business details such as server sizing, service level agreements (SLAs), server refresh cycles, skills gaps, training, IT processes and practices, IT governance, etc. to measure organizational readiness and overall migration risk.	Migration risk analysis report Organizational readiness report	3 - 5 weeks
IV: Strategic Migration Planning	The final phase combines the results of Phases I - III and uses that information to produce a detailed migration roadmap, scope of activities needed, as well as a detailed migration cost estimate for the entire migration project.	Overall migration cost estimate Strategic migration roadmap	3 - 5 weeks
V: Migration Implementation	Red Hat Consulting offers a wide variety of workshops, training, and service offerings designed to help customers implement their Strategic Migration Plan.	Server migration	TBD

3.2 Phase I: Infrastructure applications analysis and build

In this phase, the current infrastructure is examined and recommendations for a standard build and equivalent functionality in Red Hat Enterprise Linux are presented. In most cases, Red Hat Enterprise Linux provides the same or similar functionality through its very broad ecosystem of certified third-party software vendors. This document assumes that customers will be retaining the use of Symantec’s broad portfolio of products that enable storage optimization and mobility



during migrations. As the following paragraphs indicate, customers may have other infrastructure applications that they wish to carry onto the Red Hat Enterprise Linux platform from a functionality perspective.

Infrastructure application analysis

The first step in this process is to identify the existing infrastructure applications. These applications include services that do not perform a business role, but are required for proper functionality in a customer's environment. Examples include DNS, mail, provisioning, infrastructure software for advanced storage management such as Veritas Storage Foundation, backup software such as Symantec NetBackup, and high availability and disaster recovery solutions like Veritas Cluster Server. The analysis is conducted by working very closely with IT staff –reviewing installation methods, network topology, authentication procedures, and any existing documentation for third-party software. This process will most likely require a software inventory of all infrastructure applications.

Infrastructure ecosystem mapping

In this step, a customer's existing infrastructure applications will be mapped to their Red Hat Enterprise Linux equivalent. These applications will fall into one of the following categories, as detailed in section 2.2:

- Built-in functionality in Solaris to built-in functionality in Red Hat Enterprise Linux (i.e. Sendmail, bind, Apache)
- Third-party ISV certified application on Solaris to third-party ISV certified application on Red Hat Enterprise Linux
- Symantec products as a rule are already certified on Red Hat Enterprise Linux and typically are certified to run on Red Hat Enterprise Linux within 90 days of any new major release of this operating system.
- Solaris built-in functionality to third-party ISV certified application on Red Hat Enterprise Linux (i.e. Flash Archive)
- Built-in functionality in Solaris to alternative functionality in Red Hat Enterprise Linux (i.e. dtrace to systemtap)

Some applications will be directly portable to their Red Hat Enterprise Linux equivalent, while others may need to be reimplemented in an alternative application, or with third-party ISV certified software. Once all of the existing infrastructure applications are identified, a mapping can be created to pave the way for the migration. Table 3.2a represents an ecosystem mapping for some common infrastructure applications when moving from Solaris to Red Hat Enterprise Linux, though it is not a comprehensive listing.



Data migration analysis and plan formation

The time it takes to migrate data is generally one of the biggest challenges for a successful migration. As most computing environments today are 24x7, shutting down servers for a few hours or even days to migrate data can be very costly and is sometimes even impossible. Veritas Storage Foundation's Portable Data Containers functionality addresses the need for simplified data movement. Portable Data Containers offer end-user applications access to storage independent of the operating system. By enabling application data storage to be used by any processing platform, Portable Data Containers give IT managers greater leverage over the heterogeneous computing resources in their inventory.

Successfully exchanging data between Solaris and Red Hat Enterprise Linux requires attention since the endianness differs between the two operating system environments. With Portable Data Containers, moving from Solaris to Red Hat Enterprise Linux may only require conversion of the file system metadata as opposed to needing to convert the actual data. Proprietary application data or data files with internal binary structures may need an additional utility to reorder internal structures. If no proprietary data files are being converted or the proprietary data have been prepared for a switch in endianness, the time to convert the file system is proportional to the number of files in the file system and the fragmentation of the file system rather than the overall size of the file system. The Veritas File System has a utility to allow for defragmentation that would help improve the conversion time.

If you have large amounts of file system data to be migrated, you may want to consider introducing Storage Foundation into your legacy environment to alleviate this problem and using Portable Data Containers to expedite this migration. This would reduce downtime significantly during migrations. As a comparison, copying multiple terabytes of data from a legacy Solaris platform to a newly built Red Hat Enterprise Linux platform could take days or even weeks if done over a slow network connection. The time it takes to transfer the data becomes directly dependent on how much data is being transferred. By contrast, the time it takes to convert data with Portable Data Containers is a factor of how much metadata is in the file system, which is generally multiple orders of magnitude less than the actual file system size. As an example, a 20 terabyte file system containing only one terabyte files would take almost no time to convert with Portable Data Containers since only 12 meta data entries need to be processed and imported on the Red Hat Enterprise Linux server. Typically this would take only a few minutes as compared to a network-based copy, which would take hours to days. For large databases there are common examples (see case studies at end of paper) of platform migration in a few hours or less, as compared to the days that would be required with traditional migration techniques.

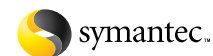


TABLE 3.2A COMMON INFRASTRUCTURE APPLICATION MAPPING

INFRASTRUCTURE COMPONENT	AS-IS SOLARIS	TO-BE RED HAT ENTERPRISE LINUX
Provisioning	Jumpstart	Kickstart, Red Hat Network/Satellite
Network File Systems (NFS)	NFS/NFSv4	NFS/NFSv4
Drive/Directory mounting	Autofs	Autofs
Package management	SyS V packages/pkgadm	RPM/YUM
Systems management	Sun xVM Ops Center	Red Hat Network/Satellite
Monitoring	Sun Management Center	Red Hat Network/Satellite
Troubleshooting	Dtrace	Systemtap
Packet filtering firewall	IPfilter	Netfilter/IPtables
Intrusion detection	BART	AIDE
Identity management	Sun Java System Directory Server Sun Java System Identity Server	Red Hat Directory Server Red Hat Certificate System
File systems	UFS, ZFS, QFS, SAMFS, Veritas File System	Ext3/4, LVM, GFS, XFS, Veritas File System
Virtualization	Containers, Zones, Ldoms, Sunfire Dynamic System Domains, xVM	Red Hat Enterprise Linux Virtualization (Xen, KVM), Red Hat Enterprise Virtualization
Storage multipath	MpxIO, Veritas Dynamic Multi-Pathing	Device-Mapper-Multipath, Veritas Dynamic Multi-Pathing
Job scheduling	Sun Grid Engine	Red Hat Enterprise MRG
Clustering	Sun Cluster, Veritas Cluster Server, Veritas Cluster File System	Red Hat Clustering, Veritas Cluster Server, Veritas Cluster File System
Bare-metal recovery	Flash Archive	Kickstart, Red Hat Network/Satellite

Standard Operating Environment (SOE) build

Standard Operating Environment (SOE) is an organization's standard implementation of the core operating system. It can include the base operating system, a custom configuration, standard applications used within an organization, software updates, and service packs. Once an application set has been identified, a standardized build based on an SOE approach will be created for rapid and consistent deployment. An SOE build consists of a set of tested hardware, tested software, and configurations deployed on top of Red Hat Enterprise Linux. The SOE build will be fully aligned to your technical and business requirements, dramatically reduce deployment time, simplify maintenance, increase stability, and reduce support and management costs.

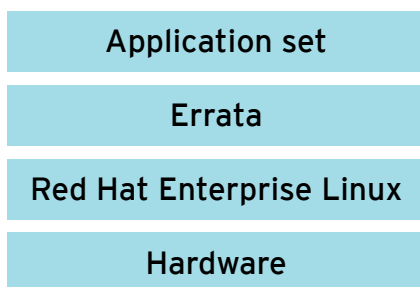
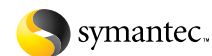


Figure 3.2b Standard operating environment build

If standard hardware is not yet defined, the SOE build will be built on your current corporate standard hardware. Provisioning systems from bare-metal to the fully configured SOE build is accomplished through the Red Hat Network Satellite provisioning feature. Symantec has one of the broadest hardware compatibility lists (HCL) in the industry with respect to storage devices, so the SOE on any hardware is typically able to provision a large number of configurations, giving

customers the ability to maximize storage utilization. Provisioning is composed of the following components:

Provisioning configuration

- Installation methodologies
- Software packages
- Configurations according to security, authentication, storage, and other requirements

Testing

- Provisioning server and storage setup
- Deployment testing
- Adherence to policy and configuration
- Delivery and training
- Customer's IT staff trained to deploy and modify SOE build
- Any remaining customer needs addressed
- Additional training recommendations

Results

- SOE build satisfying customer requirements
- Documentation
- Detailing work performed
- Specific procedures



- Recommendations for future enhancements or growth
- Links to product-specific manuals
- Fully tested provisioning server and provisioning configuration files(s)
- Time-tested and precise methodology, freeing up resources

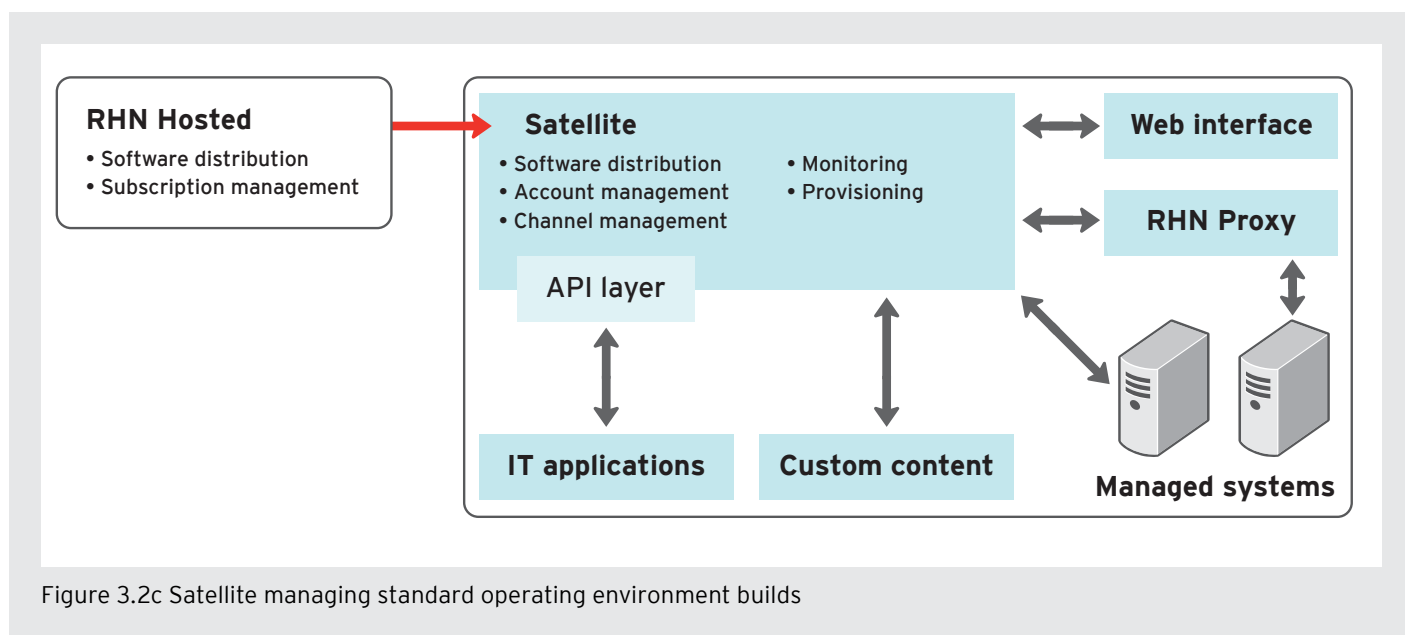


Figure 3.2c Satellite managing standard operating environment builds

3.3 Phase II: Functional applications analysis

Phase II of the strategic migration planning process focuses on examining functional workloads to determine the feasibility and amount of effort required to migrate them from Solaris to Red Hat Enterprise Linux. Complexity of such migrations can range from trivial to highly challenging. Understanding this level of complexity is extremely important in order to be able to accurately determine migration costs.



Step one: Application information gathering

The first step in functional application analysis is to gather as much relevant data as possible about the applications themselves. This usually involves capturing data, as applicable, by examining existing documentation and conducting interviews with various IT and business stakeholders. This sort of data may include:

- Application Service Level Agreements (SLAs)
- Existing hardware characteristics for production, staging, testing, and development environments:
 - Number of hosts / CPUs per host
 - Memory requirements
 - Storage and file system requirements
 - Network bandwidth and latency requirements
 - Horizontal scalability requirements and limitations
 - Vertical scalability requirements and limitations
 - Hardware utilization rates
- Security requirements
- Data requirements
- Authentication and authorization
- Versions and ISV support levels
- Specific software dependencies
- Development languages and platforms
- External integration points
- Developer knowledge and availability
- Level of documentation available
- Virtualization restrictions
- Performance
- Stability

Step two: Macro-level difficulty analysis

The second step in this process is to divide the functional applications into ISV applications (i.e. applications developed and written by an external software company) and custom applications (i.e. applications developed in-house or by a contracted third-party). Once this is done, then we can categorize the complexity of the migration effort for each application at a macro level. We will classify the effort as either low, moderate, or high based on the data we gathered in step one. This can also be done to categorize the complexity of the data migration effort. The general characteristics for this data and application migration complexity is shown in table 3.3a below.

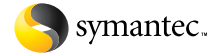


TABLE 3.3A: MIGRATION DIFFICULTY ANALYSIS

	LOW	MEDIUM	HIGH
ISV software migration	Third-party application installed on the host is certified on Red Hat Enterprise Linux at the same version levels. Small number of external integration points.	Third-party applications installed on the host are certified on Red Hat Enterprise Linux but at a different version level. Moderate number of external integration points.	Third-party application installed on the host is not available on Red Hat Enterprise Linux. Large number of complex external integration points.
Application porting	Highly portable, with well-established porting methods, clean code and few dependencies; e.g. pure Java application which should move over and work with minimal changes. Large percentage of original developers and developers with high level of mindshare are still available. Small number of external integration points.	Generally clean and independent; relies upon a few oddities such as moderate OS-specific calls, libraries to replace. Some amount of mindshare has been lost to departed developers. Moderate number of external integration points.	Large amount of code will need to be rewritten to work or be efficient in the new environment; unavailability of third-party libraries may require custom library building; cost prohibitive and/or impractical for technical or business reasons. Due to the enormous number of issues and lack of resources (persons, libraries, hardware) it is highly difficult to perform a port of this application. The cost of porting the existing application is more expensive than writing a new application from scratch. Large number of complex external integration points.
Data Migration	Text and non-binary file formats	Structured data typically requires a conversation step to change the data structures inside a file	Structured data for ISV apps that do not have endianness converters

Once the complexity rating has been established, the size of the application and amount of data to be migrated must be taken into account, particularly for custom-written applications and very large data sets. This allows for better judgments about application and data migration costs. When plotting application and data complexity vs. application and data size on a chart (Figure 3.3b), relative migration cost is easily seen. While this information is very coarsely grained (i.e. only nine levels of cost categorization), it provides enough information to create a high-level estimate of one of the factors in application and data migration costs.

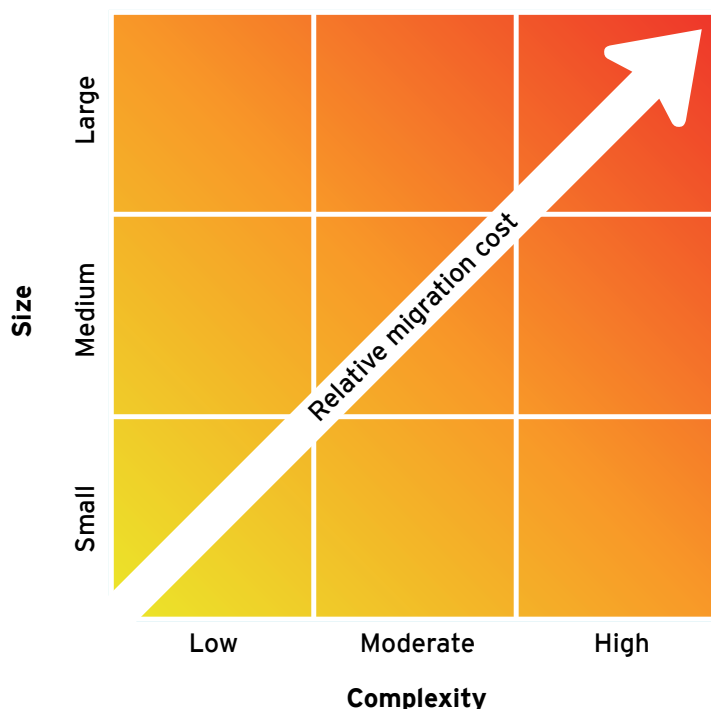
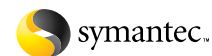


Figure 3.3b: Application complexity vs. application size

Step three: ISV application mapping

For ISV applications that are not able to be migrated due to the application or appropriate version not being available on Red Hat Enterprise Linux, a mapping exercise must be undertaken in order to replace their functionality. This step in the process is focused on examining the features and functions of the existing ISV application and then performing a comparison with other ISV or open source options available on the market. Key stakeholders and users should be consulted to generate a list of key features, and these features should be ranked in terms of priority (i.e. “must have,” “nice to have,” etc.) Finally, the available options should be compared based on features and priorities in order to determine the final product selection for the Red Hat Enterprise Linux environment.

Step four: Application and data dependency mapping

An important aspect of application migration is understanding the relationships and dependencies between various applications. This information can have a great deal of impact on many decision-making situations as well as in overall cost estimation. In this step an application dependency graph is created that visually shows which applications depend on other applications from a migration standpoint (Figure 3.3c). Or, put another way, which applications require other applications to be migrated if they are migrated. It is also important to map the service levels, media types, and underlying characteristics (replicated/cloned/thin) of storage to the application being migrated. Again, Veritas Storage Foundation can assist customers in ensuring policy compliance if mapped appropriately. Veritas Operations Manager simplifies storage provisioning and management with an easy-to-use interface that expedites migrations by automating the process of choosing appropriate storage for different applications based on parameters such as media type, rotation speed, cloning, and replication as predefined by templates for a given workload.

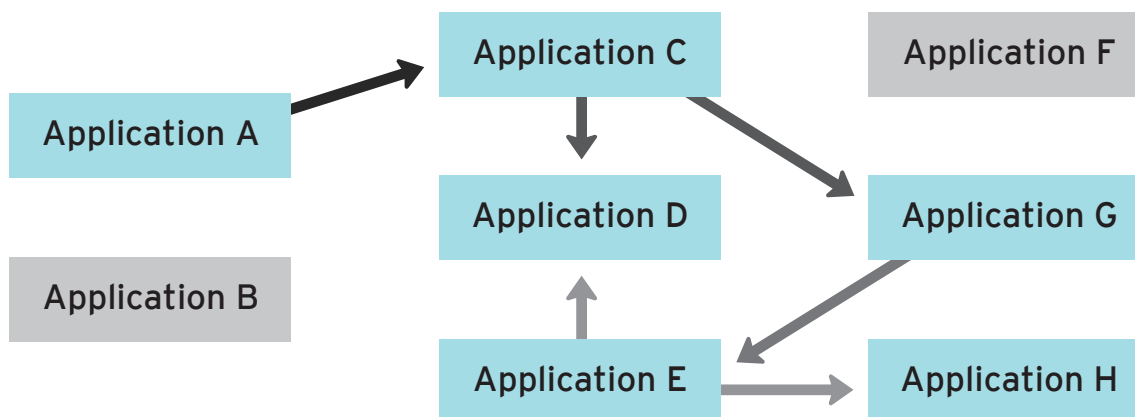


Figure 3.3c: Sample application dependency graph

This process can be done manually and with the help of automated discovery tools available from various software vendors including Symantec, IBM, CA, and EMC. However, automated tools show dependencies from an interaction point of view, not necessarily from a migration point of view. Thus, manual analysis may still be required to get a full picture of migration dependencies between applications. This information is used in the next step as well as in Phase IV of the strategic migration planning process.

Step five: Individual deployment scenario analysis

Conduct analysis to look at possible deployment scenarios for each application with its associated datasets and testing and staging environments based on the four generic deployment patterns that were discussed in Section 2.3 of this document:

- **Consolidation.** Workloads on a large number of SPARC systems and/or Solaris on x86 systems with low utilization are consolidated onto fewer systems, potentially using virtual machines running Red Hat Enterprise Linux to contain each workload.
- **Dispersion.** Workloads on one or more large SPARC systems are distributed among a number of smaller x86-based systems running Red Hat Enterprise Linux.
- **Aggregation.** Workloads for a large number of SPARC systems of various sizes are migrated into a single, large, fault-tolerant hardware platform where Red Hat Enterprise Linux can run. (i.e. IBM zSeries mainframe, HP Superdome (Itanium), etc.).
- **Cloud migration.** Workloads on any number of SPARC systems and/or Solaris on x86 systems are migrated to run on Red Hat Enterprise Linux in a cloud computing environment.

These deployment scenarios are often influenced by the application and data dependency information that was obtained in step four. Once the deployment scenarios are mapped, it is easier to then estimate the actual hardware that they would map to. The next thing to do is examine each scenario and determine the approximate hardware that would be required to fulfill the scenario. This process is usually very specific to the corporate hardware standards that have been established at the migrating company. Thus, it is difficult to give hardware sizing and mapping



guidance in this document, but it is possible to work with specific hardware vendors on appropriate sizing. Performance comparison information for a wide variety of standard workloads is also available at www.spec.org. At this point, there is usually no way of making final deployment or hardware decisions for each application. The process of analyzing possible and preferred deployment scenarios—as well as the potential hardware sizing scenarios—gives us valuable input for phase IV of the migration planning process. This will give us a better idea of overall migration costs.

Step six: High-level application and data migration cost estimation

In the final step of this phase, the data gathered in steps one through five is analyzed to create a high-level migration cost estimate as well as a list of candidates for early migration pilots.

Storage management solutions with Veritas Storage Foundation

One way organizations can improve storage utilization and reduce storage spend is by utilizing thin provisioned storage. With thin provisioning, the storage capacity in a LUN is assigned from a storage pool as application writes are received in the array. Customers that deploy thin provisioned storage should reclaim misused storage before migration. Using the Veritas Storage Foundation's SmartMove technology, online reclamation occurs during online migrations from legacy storage to thin storage. This means that only the used blocks are migrated to the new storage array. Storage Foundation also includes an automated storage reclamation capability using a Thin Reclamation API that provides for true thin storage optimization by enabling IT organizations to place unused storage back into the thin pool for redistribution. The amount of data being stored is growing so much faster than the annual decline in storage prices that it is putting pressure on the budgets of datacenter administrators. Historically, datacenter administrators have taken a one size fits all approach to data, using a single tier of storage that meets all application needs throughout. This was done because the task of determining what data to move where and when is difficult. Without an automated data classification and placement technology, manually moving data between tiers is too operationally expensive. This poses a problem since the data growing the fastest is the data that doesn't require the most expensive and high-performance disks, creating a need for data classification, cost control, and performance optimization. Data classification automates the process of identifying and moving data to the appropriate tier based on policies allowing administrators to adopt a multi-tiered storage strategy. Data migration between the tiers should be automatic and policy-driven. Most importantly it should be done seamlessly to the applications that consume it. Symantec's SmartTier capability fulfills each of the above needs for your migration planning.

3.4 Phase III: Readiness and risk analysis

A large-scale migration can be a challenging endeavor from both an organizational readiness standpoint and a risk standpoint. Successfully identifying and mitigating both technical and organization risks is a critical factor for success in any migration. This phase is focused on analyzing technical and organizational risks by using tools such as a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis. Creating a comprehensive risk mitigation strategy outlining both preventative and compensatory actions helps avoid future migration problems.



Technical readiness analysis

In this step of the analysis, the various technical risks inherent in a migration will be identified and analyzed. This is accomplished by collaborating with key decision-makers within the IT organization to ensure that all risks are identified. Technical risks can include:

- Workload factors (performance requirements, portability)
 - Cost factors
 - Software (licensing, code portability, ISV applications)
 - Hardware (server sizing, storage sizing, existing maintenance)
 - Indirect costs (physical floor space, power, cooling)
- Expertise factors (historical experiences, familiarity, hidden skills)

Organizational readiness analysis

Technical factors are usually relatively easy to identify. However, organizational challenges are generally more difficult to identify and are often overlooked when doing migration planning. Technical challenges rarely derail a project, but organizational readiness can pose seemingly small challenges that have the potential to undermine even the most well thought-out migration plans. Organizational readiness factors can include:

- Workload factors (effects on customer SLAs, maintenance windows, project schedules)
- Training factors (skill gaps, new technologies, new staff)
- Acceptance factors (political, governance)

In order to effectively identify organizational risks and their potential impacts on a migration it is important to first perform an organizational readiness analysis. This provides a roadmap to focus on areas that need the most attention and helps an organization take advantage of areas of strength that may offset these risks. There are many ways to conduct an organizational readiness analysis, but experience has shown that starting with a SWOT analysis is useful in order to see organizational challenges from a holistic perspective. To illustrate this process, let's examine two hypothetical companies, Company A and Company B, with very different migration risk profiles. Consider the speed at which the migration will occur in Company A's situation. It is an all-Solaris shop with Symantec's storage management suite, and has decided to replace end-of-life hardware with x86 hardware running Red Hat Enterprise Linux. This scenario allows Company A to slowly close any skill gaps and approach workload migrations at a pace that it is comfortable with. A SWOT analysis for this migration might look something like Table 3.4a.

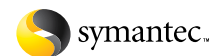


TABLE 3.4A: SWOT ANALYSIS FOR COMPANY A

<p>STRENGTHS</p> <ol style="list-style-type: none"> 1. The IT staff has been growing their Linux skills 2. Many of the same tools used to manage their Solaris environment are similar on Enterprise Linux 3. Applications running in Java also run on Enterprise Linux 	<p>WEAKNESSES</p> <ol style="list-style-type: none"> 1. Reduced budget 2. The slow speed of migration may mask cost savings 3. Some IT staff members prefer the familiar legacy Solaris toolsets for provisioning
<p>OPPORTUNITIES</p> <ol style="list-style-type: none"> 1. Majority of the older equipment is end-of-life (EOL) 2. Recent budget constraints are forcing management to explore new options 3. More applications in use are being certified on Enterprise Linux 4. Power and cooling costs in the datacenter have increased, prompting research into more dense hardware and virtualization options 	<p>THREATS</p> <ol style="list-style-type: none"> 1. A previous migration attempt to Linux without vendor assistance was halted 2. Existing server hardware contracts are staggered, making full refreshes more difficult 3. Training may not be possible due to budget constraints 4. A competitor is offering Linux support at a lower cost

In contrast, Company B is planning to execute a major initiative to migrate from Solaris to Red Hat Enterprise Linux again using Symantec’s storage management suite to optimize its data migration. The company has several thousand SPARC systems located throughout the world. There are many driving reasons to push for a migration, but it was decided that all new projects would be built on x86 hardware and Red Hat Enterprise Linux. The cost of x86 hardware is an order of magnitude less expensive to purchase and maintain than existing SPARC hardware, while still supporting the same level of performance and, in many cases, higher levels of performance. One of the biggest incentives to migrate is third-party application support. Many of the development tools and applications in use have changed to using Linux as their initial development platform. Organizations that wish to use the latest development tools and more cutting-edge technologies migrate to Linux. However, IT staff needs to quickly fill skill gaps to support the new environment. When compared to Company A, this is a much different migration with a different set of risk factors. A hypothetical SWOT analysis for Company B is shown in Table 3.4b.

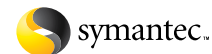


TABLE 3.4B: SWOT ANALYSIS FOR COMPANY B

<p>STRENGTHS</p> <ol style="list-style-type: none"> 1. Company has chosen a decisive strategic direction to move to Red Hat, supported by senior IT management 2. Most of the developers have Linux experience due to interactions with third-parties 3. Most of the company's development tools have already migrated to Red Hat, providing support for the migration 	<p>WEAKNESSES</p> <ol style="list-style-type: none"> 1. Linux knowledge is not pervasive within the IT operations staff 2. Operations staff does not have the tools to support the new projects in the short term 3. Developers are self-supported using non-commercial open source tools 4. Some custom functional applications cannot be easily ported to Enterprise Linux
<p>OPPORTUNITIES</p> <ol style="list-style-type: none"> 1. Need for cutting edge technology and development toolsets driving customer to adopt open source 2. The company needs to become a more nimble player in their industry while simultaneously cutting costs 3. Many of the third-party applications and tools used have equivalent functionality in Enterprise Linux and other open source products, providing substantial software licensing cost savings 	<p>THREATS</p> <ol style="list-style-type: none"> 1. Some parts of the IT organization are uncomfortable with the changes posed by the migration 2. IT management is concerned that operational costs will grow due to the speed of migration and knowledge gaps 3. Non-commercial open source development platforms may spill over into the production environment

Risk mitigation strategy

After carefully analyzing a company's unique environment and considering all possible risks, each risk factor will need to be addressed and a migration risk mitigation report created. Each major risk will be listed, and include recommendations on how to mitigate or avoid the risk altogether. Some or all of the risk factors may affect your decision. Take Company A, for example. If, like this company, your environment consists of many workloads in Java™, and your staff has previous experience or hidden skills with respect to Linux, your organizational readiness would be very high, so many of the risk factors listed would be low. Some risks such as workload porting and skill gaps may not even apply.

Conversely, consider Company B's environment. If you have custom software that depends on specific Solaris library calls that need to be rewritten and a staff with little Linux experience, these factors would weigh more heavily. Red Hat can assist in mitigating or overcoming many of these risks. For example, Red Hat has a rich portfolio of world-class training courses to help address skill gaps. Custom workshops to quick-start your staff in different technologies are also available. Symantec software can also help mitigate risk by simplifying some of the basic challenges of making data accessible (using the Portable Data Containers feature of Storage Foundation) on multiple platforms so that copy-based migrations between file systems are not required. In addition, the way you manage your file system, volume manager, and high availability solution is the same on Red Hat Enterprise Linux as it is on Solaris, meaning less impact on your administrator staff.

Once all of these factors have been identified, a risk migration strategy is created to aid in the overall migration planning. An excerpt from a risk migration report for Company A might appear like the one in Table 3.4c.

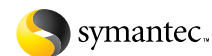


TABLE 3.4C: EXCERPT FROM A RISK MIGRATION REPORT FOR COMPANY A

RISK	LIKELIHOOD OF OCCURRENCE	POTENTIAL IMPACT	STRATEGY
Training budget low	High	High	Virtual training greatly reduces cost and allows staff to schedule instruction at their own pace.
Provisioning skill gaps	High	Medium	A consultant works with staff to deploy an enterprise core build that can be managed with new skills gained from virtual training.
Previous migration project failed	Low	High	Team up with Red Hat Consulting to establish a clear strategy and contingency plan.
Budget constraints may lead to using unsupported software	Low	High	The Enterprise Linux subscription model and errata life-cycle is unmatched, and the customer does not want to be left in a mission-critical situation unsupported.

Company A provided its system administrators with virtual Red Hat Training opportunities where they learned about kickstart and Red Hat Network Satellite without incurring travel costs. They also were able to work with an expert from Red Hat Consulting on-site to quickly deploy new systems, building the organization’s confidence and allowing it to increase the pace of the migration. The company was also able to determine that the replacement x86 hardware was more efficient, dramatically lowering its TCO after analyzing its hardware acquisition costs and power and cooling data.

Company B’s risk migration strategy might contain the following:

TABLE 3.4D: EXCERPT FROM A RISK MIGRATION REPORT FOR COMPANY B

RISK	LIKELIHOOD OF OCCURRENCE	POTENTIAL IMPACT	STRATEGY
Linux skill gaps exist	High	High	On-site training and workshops provide quicker knowledge transfer while limiting travel spend.
IT staff is not able to fully support new projects in the short term	Medium	Medium	A Red Hat Dedicated Enterprise Engineer (DEE) will see the project to its end, ensuring timelines and goals are met.
Unsupported tools are in use	Low	Medium	SOE ensures supported tools are in place across the environment. Satellite is used to deploy additional tools that address the need for consistency throughout the environment.
Custom application portability is difficult	High	High	Developers work closely with consultants to re-write code as needed.
IT staff is apprehensive	Medium	Low	Training and mentoring from a Red Hat DEE will ease concerns while increasing staff productivity by providing real-time guidance and recommendations.



For Company B, a mentoring approach was recommended, allowing the organization to leverage and motivate its existing IT staff. The migration speed was also balanced by having an on-site Red Hat Technical Account Manager (TAM) and several consultants working side-by-side with existing staff to guide it, increasing the speed of the migration and reducing risk. Red Hat Network Satellite was used to deploy an enterprise standard build, which required a significantly lower ratio of administrators to systems, freeing up some administrators to work on higher-value projects for the company. This resulted in additional cost savings.

3.5 Phase IV: Strategic migration plan formation

Phase IV of the strategic migration planning process focuses on bringing together all of the information gathered and analyzed in phases I-III into a comprehensive strategic planning roadmap. This document will serve as the foundation for the migration implementation phase and subsequent migration discussions. Creating the strategic planning roadmap requires eight primary objectives:

- Detailed analysis of existing hardware and data
- Consolidated deployment scenario and virtualization analysis
- High-level hardware redeployment analysis
- Consolidated risk analysis and risk mitigation plan creation
- Training plan creation
- Deep-dive analysis of large, high-complexity applications (optional)
- Detailed cost estimation
- Master migration roadmap creation

Step one: Consolidated analysis of existing hardware and data

The first step in generating the strategic migration roadmap is to perform a detailed analysis of the existing hardware and data, supporting the applications to be migrated. Normally this step is relatively easy because much of the hardware environment data was gathered in step one of the functional applications analysis. This includes the following data for development, testing, staging, and deployment environments for each application:

- Number of hosts and CPUs per host
- Memory requirements
- Storage and file system requirements
- Network bandwidth and latency requirements

The main goal of this step is to take this information and consolidate it into an aggregate set of requirements for all of the applications that are likely to be migrated. Or put another way, it answers the question "How much processing power, memory, storage, bandwidth, etc. is needed for the entire set of applications targeted for migration?" This consolidated view usually represents far more resources than are actually needed to run the set of applications to be migrated, due to the low utilization rates that are typically present in a datacenter environment.



Step two: Consolidated deployment scenario and virtualization analysis

Now that aggregate resource needs for the applications targeted for migration are understood, the next step is to examine application deployment scenarios from the same consolidated perspective. This allows for the creation of application groups with common deployment scenario requirements and also gives insight into cost savings opportunities based on virtualization within those groups.

Ultimately the output of this step is a consolidated view of how all the applications to be migrated map into the new Red Hat Enterprise Linux server environment(s).

The first thing that needs to be done in this step is to create application deployment groups based upon the preferred application deployment scenarios created in step five of the functional application analysis phase, as well as the application and data dependency analysis data gathered in step four of the functional application analysis phase. This results in up to four application groupings (aggregation, dispersion, consolidation, and cloud deployment). Depending on the scope and complexity of the migration, there may only be one or two (typically consolidation and dispersion) groupings, in which case this activity can be done very quickly.

Once the grouping data is established, then target hardware profiles for each of the groups are identified. This typically involves working with a set of preferred hardware OEM partners like IBM, Dell, HP, Cisco, Fujitsu, Hitachi, or others to create a small number of common system architectures that the applications and data targeted for migration can be mapped to. This is usually based on the information gathered in step five of the functional application analysis phase.

Regardless of how this information is gathered, the goal is to create as few common system deployment architectures as possible in order to reduce hardware procurement and management costs via standardization. Normally there is at least one system architecture per deployment grouping, but this is not necessarily a requirement. Some organizations have standardized on a single deployment architecture for all migrated applications, regardless of deployment scenario. The next action is to perform a high-level virtualization analysis based on the groupings just created. This step is optional but highly recommended depending on a particular organization's policies around virtualization. The virtualization analysis examines several factors for each existing application deployment including:

- Application SLAs
- Average and peak hardware utilization rates (CPU, memory, disk, bandwidth, etc.)
- Physical location of applications (i.e. which applications are in which datacenter)
- Virtualization limitations (i.e. ISV support, regulatory and compliance issues, etc.)
- Operational type (i.e. development, testing, production, etc.)
- Security and network segmentation (i.e. what physical security zone should the application reside in)
- High availability and disaster recovery requirements
- Clustering requirements or limitations
- Specialized hardware requirements (i.e. SANs, tape drives, Infiniband, etc.)
- Power and cooling requirements

Much of this data was captured in step one of the functional application analysis phase, but additional data gathering may be required.



Each of these factors places constraints as to which applications can be virtualized. These factors also determine which virtualized application instances can be hosted on the same physical machine. The end result of this analysis is a deployment and virtualization map showing a possible arrangement of specific virtual application instances to specific physical machine system architectures.

Step three: High-level hardware redeployment analysis

Now that the migration team understands how the migrated applications are likely to be deployed, they can examine possibilities for the redeployment of a subset of the hardware that the applications are currently running. This activity will provide an opportunity to offset some of the costs of migration. For example, there may be a set of database instances running on mid-sized Sun SPARC machines that can be migrated to a Red Hat Enterprise Linux / x86 environment. The existing SPARC machines may then be redeployed into a larger existing database cluster that will not be migrated at this time. This process may sound unusual, given that one of the primary cost savings of migrating to Red Hat Enterprise Linux is achieved by eliminating expensive SPARC boxes, but experience has shown that redeployed servers can result in huge cost savings, particularly in situations where the redeployed hardware can no longer be purchased (i.e. end-of-life situations) but is still required to run mission-critical applications. Other potential cost savings may be realized by adopting multi-tiered and thin provisioned storage.

This act of redeployment not only enables additional capacity for an environment without additional new hardware cost, but the savings contributes to the bottom line as further details of the migration cost estimate. These will be tallied in step seven of this section.

Step four: Consolidated risk analysis and risk mitigation plan update

In this step, the migration team will perform an examination of the combined risk factors that were identified in the previous phases of the migration planning process. Additional consideration is provided for any new risks that have been identified in the first three steps of this phase.

The purpose of this analysis is to identify combinations of risks that were previously unknown and could affect the migration. For instance, it may have been decided earlier in this process to migrate a large, high-complexity application identified in step two (macro-level difficulty analysis) of the functional application analysis phase. That recommendation may have been based on the risk(s) examined, resulting in a mitigation strategy in the readiness and risk analysis phase that helped determine that the risk was worth it. However, after examining the consolidated deployment scenarios, it may be revisited, and decided that there is additional risk in virtualizing this application. Thus an update to the risk mitigation plan will occur to account for this new risk.

There may also be a need to update the list of applications and their associated data that will be targeted for migration based upon these new risk factors and mitigation strategies. This will become the master migration list used in the detailed cost estimation step.

Step five: Training plan creation

Now that target applications have been identified for migration, optimal physical deployment architectures have been decided, and the level of organizational readiness understood (from the readiness and risk analysis phase), the next step is to put together a final training plan.

The goal of this step is to identify staff members that will need to be trained and the specific training curriculum needed. This will almost certainly involve additional Red Hat Enterprise Linux training, but may also involve ISV software and OEM hardware training from other vendors. For convenience, the table in Section 4.3 of this document maps specific skill areas to



Red Hat Training classes that are available today. Staff members can attend classes that are publicly available on an open enrollment basis, or classes can be delivered on-site depending on specific needs. There are also a set of customized workshops listed in section 4.1 that can be delivered on-site to address topics that are not covered by existing course offerings.

Step six: Deep-dive analysis of large, high-complexity applications and data (optional)

At this point it may be ideal to go back and revisit the list of large, high-complexity applications and data that were identified in the macro-level difficulty analysis step of the functional application analysis phase. These applications with their associated data tend to be the ones with the greatest level of uncertainty as to the extent and cost of their migrations. It is often useful to take a closer look at these applications and get a firm grasp on their migration costs before proceeding to the next step, detailed cost estimation. However, this is entirely optional and should be determined on a case-by-case basis.

Step seven: Cost estimation

Now that all of the information necessary to produce a detailed cost estimate for the entire migration is identified, this step combines the following direct costs and savings in order to come up with a final migration budget estimate:

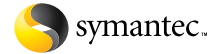
- Cost of new infrastructure ISV applications necessary to create a Red Hat Enterprise Linux environment comparable to the existing Solaris environment
- Cost of new functional ISV applications necessary to replace existing Solaris applications that are not available on Red Hat Enterprise Linux
- Cost of new hardware required to implement each migration deployment architecture
- Application migration costs
- Training costs
- Savings from redeployed hardware
- Savings from redeployed software
- Storage savings from storage optimization and migration to thin provisioned arrays

Two things should be noted about this estimate:

1. It is still an estimate and may vary depending on the actual application and data migration costs.
2. This is not meant to be interpreted as an ROI or TCO analysis because it does not include indirect savings such as the future hardware replacement costs without migrating, operational cost savings, and more.

Step eight: Master migration roadmap creation

In the final step in this phase, the master migration roadmap (MMR) is created based upon the input from the previous seven steps. The MMR acts as a project plan that details when, where, and how the migration will occur.



The first thing that must be done in this step is to analyze and prioritize specific system and application migrations. This prioritization may be based on a number of factors, including capital budget allocation timing, specific business priorities, and datacenter constraints. These factors are usually dependent on the specific organization and thus it is difficult to create a comprehensive list of factors ahead of time.

Once migration priorities have been determined, an actual project timeline is created showing specific dates and durations of the various tasks necessary for a successful migration. This timeline matches specific capital and operational expenditures to quarterly IT budgets, ensuring that migration spend is within budget at all times.

The end result is a set of migration documentation based on phases I - IV of the strategic migration planning process as well as a project plan with tasks, dates, and expenditures. A greatly simplified version of such a plan is illustrated in figure 3.5a.

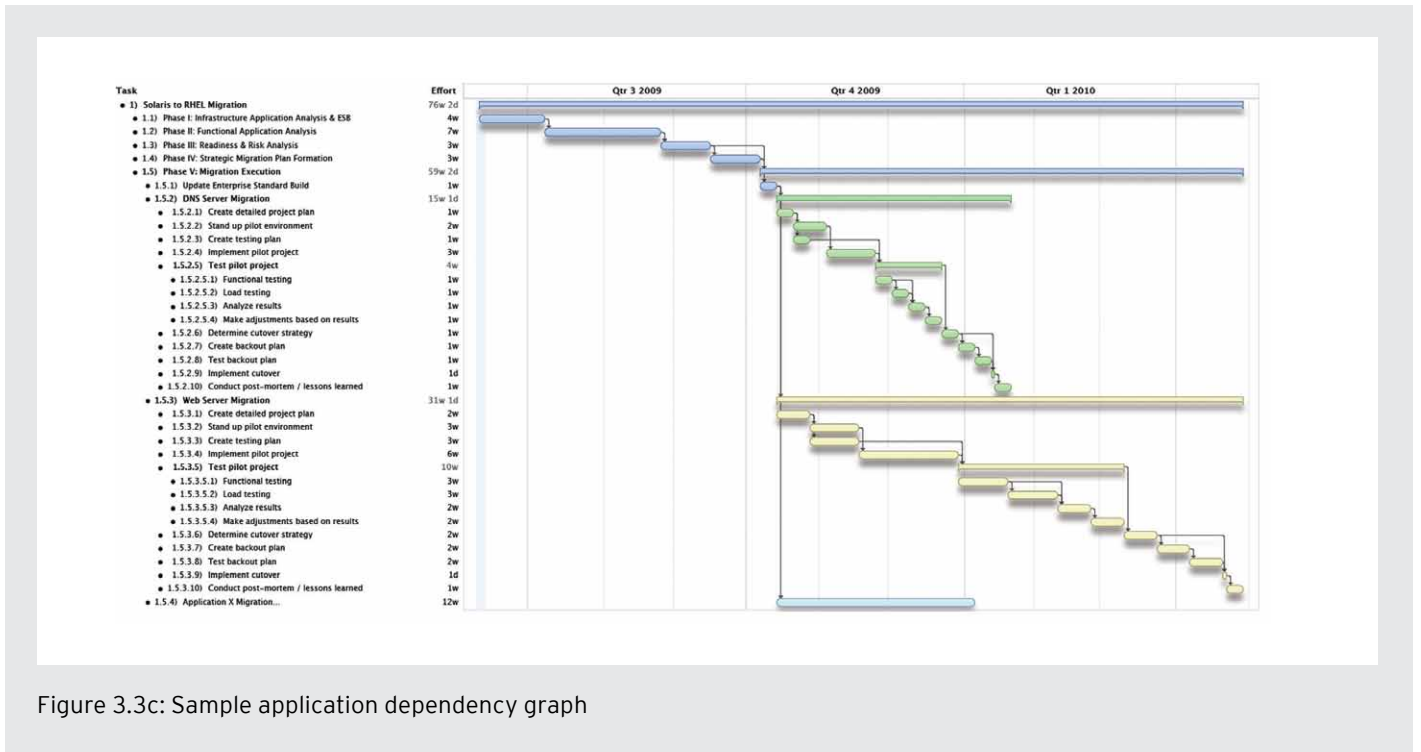


Figure 3.3c: Sample application dependency graph

3.6 Phase V: Migration implementation

Successful implementation of a new technology solution within an enterprise is heavily dependent on proper planning and design using the comprehensive methodology mentioned above. The goal is to identify areas within your environment that are prime candidates for immediate migration. Additional consideration may yield higher-risk areas with dependencies that may or may not be considered for migration, in order to ensure its success.

All this, combined with planning for new hardware use and redeployment of displaced hardware, will result in a strategic migration roadmap to help you to minimize your level of effort while maximizing your end-user experience.



4. ENTERPRISE SERVICES

In the current economic climate, it's critical to make the most of the technologies currently deployed while still looking for opportunities to carve out costs. Red Hat Consulting provides the expertise and knowledge transfer to help your organization realize a faster time-to-value and improved migration experience.

Enterprise-class consulting delivered by subject matter experts

Partnering with Red Hat Consulting to plan a platform migration ensures success by combining proven best practices and methodologies with the experience and expertise of Red Hat consultants. With Red Hat, risks are mitigated and implementation time is reduced, resulting in lower migration costs. A Red Hat consultant will ensure that the migration team has the knowledge and support needed to complete the job with minimal disruption to IT operations. Red Hat Consulting has a proven track record of helping customers do more with less by fully utilizing the value of their subscriptions. Our global team of consultants comprises architects and engineers who are Red Hat product experts. Cumulatively, they have decades of experience integrating Red Hat Enterprise Linux into unique and varying environments—always ensuring maximum performance and value.

Training to improve productivity and performance

By investing in the expertise of your IT staff, you can help ensure optimal system performance, enhance productivity, and mitigate risk. Red Hat's award-winning training and certification offerings give your team the skills and confidence needed to maximize your open source implementation.

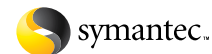
4.1 Infrastructure consulting services

With all migration efforts, having a solid infrastructure that provides a scalable foundation is the first step. Red Hat infrastructure migration planning services provide a detailed evaluation of your IT environment and deliver strategic recommendations for simplifying your IT infrastructure as you migrate. The result? You can reduce IT costs while creating a scalable IT infrastructure.

Standard Operating Environment

Red Hat provides a foundation based on the Standard Operating Environment (SOE) approach, in order to ensure a successful migration and a solid foundation for your organization's continued growth. Benefits of an SOE include:

- Simplified architecture. One code base that can be deployed on different branches and services. Support different platforms (workstations, servers, or mainframes) and storage (arrays, appliances, or Jbods) from the same build process.
- Flexible and rapid deployment. Grants the ability to take a server from bare-metal to fully configured in less than 10 minutes. Ensures identical configuration and the ability to compare machines from a centralized GUI interface, which is useful when searching for anomalies. Veritas Storage Foundation provides ease of data migration using the Portable Data Containers feature to ensure access to the same storage seamlessly.
- Secure. Enforce security policy across different machines and distributed datacenters.



- Centralized management. Manage different types of machines with different functionality remotely. Also includes the ability to delegate responsibility to regional or provincial management.
- Centralized configuration management. Enforce configuration, schedule configuration updates, compare configurations, and query current configuration.

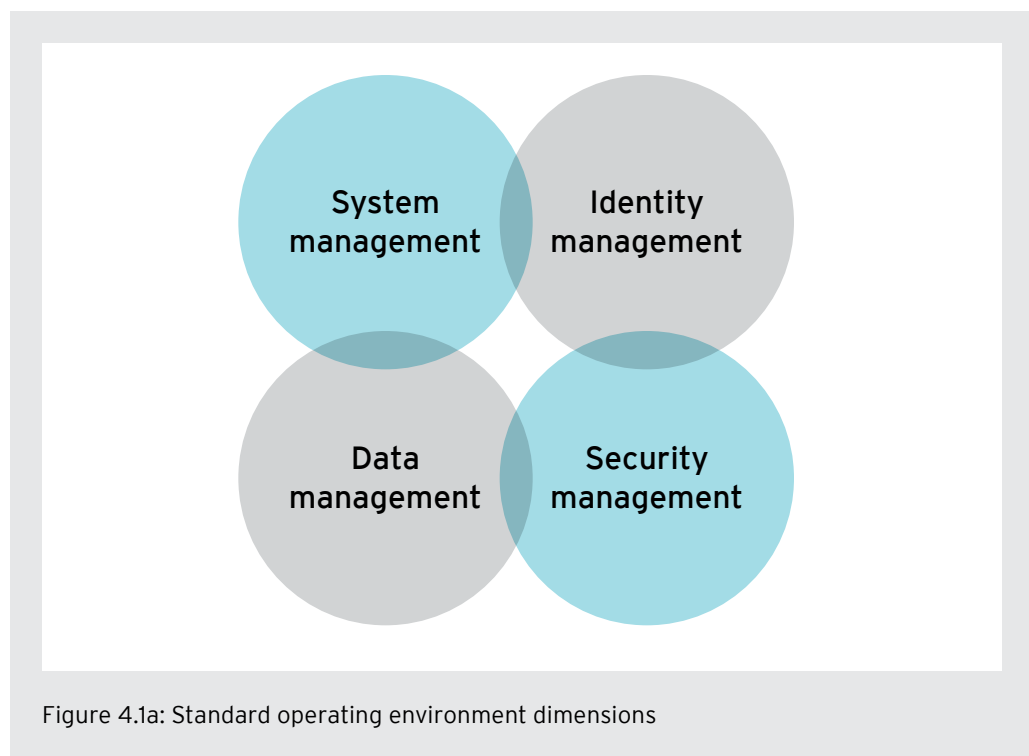


Figure 4.1a: Standard operating environment dimensions

Systems management

Evaluates and documents current systems management infrastructure. Recommendations will be provided regarding the management of systems and software post-migration and how to incorporate Red Hat Enterprise Linux into existing change management processes and systems. We will focus on the following areas:

- Bare-metal and virtual platform provisioning
- Linux software build and deployment
- Monitoring and performance management

Identity management

Determines and documents current identity management policy. Recommendations are provided for integrating Red Hat Enterprise Linux systems into existing authentication and authorization infrastructures or for migrating existing directory solutions to open source software. We will focus on the following areas:

- User and group management
- PKI infrastructure
- Policy creation and enforcement



Data management

Determines and documents availability requirements for migration services. The architect will design a strategy for meeting those requirements with a mixture of storage and clustering technologies. This migration guide is targeted to existing Symantec customers who will retain their existing Symantec infrastructure applications (eg: Veritas Cluster File System, Veritas Volume Replicator, NetBackup Bare Metal Restore) to provide the capabilities listed below. We will focus on the following areas:

- High-availability clusters
- Distributed file systems
- Load-balancing solutions
- Disaster recovery
 - Systems and data backup
 - Data recovery
- Bare-metal recovery

Security management

Identifies and documents current corporate security practices and procedures for Linux and requirements for migrated services. A thorough understanding of the end-user requirements is necessary. We will focus on the following areas:

- Operating system hardening
- Emergency security errata patching
- Security auditing and reporting
- Compliance requirements and remedial action

Within each of the above areas, a gap analysis is performed to assess existing infrastructure and processes that support the Red Hat Enterprise Linux operating system versus the support of other operating systems within your IT environment. This analysis is conducted using industry-standard practices and industry-proven methodologies. One of the additional benefits throughout these tasks is that Red Hat works side-by-side with your team members to provide hands-on mentoring, real-time knowledge share, and valuable guidance as your teams encounter issues or have questions.

4.2 Application consulting services

Once you have established the infrastructure, the next step is to ensure that required applications function optimally on the new foundation, while the path remains clear for scale and innovation. Application migration planning services from Red Hat are focused on creating a detailed migration plan for each application, applying a proven methodology to analyze key fundamental traits inherent in migrating software.



Migration type

This defines the silos of migration prioritization. An architect will work with you to understand the most basic migration classifications, asking questions such as:

- Is it a straight migration? (No changes to the application; no feature or functionality changes.)
- Are there technical improvements targeted for completion with this migration? (Improve development cycle and reduce deployment time, improve storage utilization, or improve management of queue updates.)
- Are there business improvements targeted for completion with this migration? (Improve management of third-party product support.)

Detailed migration planning

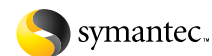
Analyzes the supporting environment and what it will look like in the new solution. This phase is critical to success since it enables you to plan first and understand the high-risk dependencies prior to migrating. This entails review and analysis of:

- Functional application migration service: Is a service provided by a third-party application needed within your development process? How does it translate in the new solution stack?
- Middleware migration service: Are you potentially moving between middleware platforms during the application migration?
- Data migration services: Are there specific data locality requirements that need to be preserved when you migrate?
- Software development environment: Are there build tools, monitoring and instrumentation packages, scripts, or processes that could pose a migration risk?
- Testing: It may be beneficial to implement a target environment that will reflect the final solution used in production as well as test the integration with infrastructure tools and processes as identified above.
- Confirmation: Verify the test environment and include usability training to targeted customer team members who will be utilizing the new solution.

Application migration

Takes the lessons learned from the steps above and commences the application and data migration. This phase is exceptionally critical in that it provides the opportunity to design the migrated application and data for scale, platform and tools independence, and open standards. Incorporating this level of freedom into the code of the application enables broad and cost-conserving future hardware and software acquisition choices. During this phase the following tasks are accomplished:

- Migration and configuration of core application server
- Conversion of proprietary application components
- Updates to the software development environment
- Upgrade of outdated libraries
- Migration of data using the Veritas Storage Foundation Portable Data Containers feature



Acceptance

Confirms applications migrated correctly. This step further confirms:

- Migration success requirements have been addressed
- Successful integration of the migrated application to the supporting development environment
- User acceptance testing has been successful
- Local testing has been successful
- Performance testing has been successful
- File systems/databases using Storage Foundation successfully brought on-line
- Data successfully migrated

Throughout the effort, requirements can be refined to meet new functionality and/or business processes. Additional tools and development processes can also be integrated for further scale and innovation. Red Hat Consulting offers a comprehensive suite of end-to-end solutions to help your business realize the benefits of your investment faster—no matter where you are in your deployment cycle.

RED HAT CONSULTING SOLUTION	DESCRIPTION
Assessment	Combines proven best practices with the expertise of Red Hat Consultants to plan a safe, stable migration.
Quick Start	Accelerates project completion and time to value.
Workshops	Combine world-class Red Hat Training and Consulting to deliver knowledge transfer tailored to your business.
Implementation	Comprehensive installation, configuration, and deployment of new technologies.
Health Check	Validates installation and configuration of the technology to identify issues that impact your business.
Optimization	Troubleshoots and resolves issues, thus increasing business effectiveness and reducing costs.

If you're ready to begin your migration initiative, e-mail or call us, and we'll have a conversation to determine how we can best support you and your organization. Tel: 1 (866) 273-3428 x44555 or redhatconsulting@redhat.com.



4.3 Training

When migrating platforms, it is critical to ensure that you have a skilled staff that can maximize performance beyond initial deployment. Hands-on training is offered and suggested to teach organizations optimal management techniques, effective troubleshooting, and the ability to maintain improved efficiencies across the entire system. Training leads to rapid, successful deployments and ensures your staff has the skills and knowledge to keep your IT organization running smoothly. Red Hat Training and Certification programs are widely recognized as a cost-effective, high-impact way to improve operations for the long haul. In fact, in 2009, IDC ranked Red Hat the leader in IT education (April 2009, IDC #21683E). With training, your staff can better manage systems, quickly troubleshoot problems, and improve efficiency across all systems. Red Hat Training courses are developed with and without the assumption of previous UNIX or Linux experience. Regardless of experience level or training goals, Red Hat Training has the right course and training path that will build on and leverage existing industry experience.

Delivery methods

Red Hat performance-based training provides hands-on, real-world skills that IT professionals need to design, execute, and maintain successful open source infrastructures.

- Classroom training: Offered regularly in 45+ locations across North America
- eLearning: Self-paced online training
- Virtual training: Online training taught in real-time by Red Hat certified instructors
- On-site training: Training led by Red Hat certified instructors located at your company's facility
- Workshops: On-site training included as part of a consulting engagement

Certification

Certification helps measure your readiness and provides an entire ecosystem of experienced system administrators to augment your migration strategy. The Red Hat Certified Engineer (RHCE) designation was created in 1999 and has been earned by more than 30,000 Linux experts. This certification is touted as one of the best—if not the best outright—in the industry. When looking for resources to help in your migration strategy, an RHCE or other Red Hat certification can serve as a metric (hopefully one of many) that will help assess individual preparation and competency for key job roles involving Red Hat Enterprise Linux.

Pre-assessment

Pre-assessment tools provide a tailored recommendation on the best entry point for individual Linux training. That way, you are sure that your team enrolls in the curriculum that best meets each individual's current abilities and can build from there. Experienced UNIX Administrators should take the RH033, RH133, and RH253 pre-assessment tests. These tests can be found at: <https://www.redhat.com/apps/training/assess/>.

Specific needs

If your migration has training needs in addition to general Red Hat system administration knowledge, here is a mapping of a few specific technologies and the appropriate Red Hat Training opportunities that cover them.

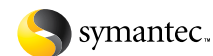


Table 4.31 Red Hat Training (see appendix C for course titles)

INFRASTRUCTURE COMPONENT	RECOMMENDED RED HAT TRAINING COURSE
Provisioning	RH401
Name service	RH253, RH300
Network File Systems (NFS)	RH253, RH300
Drive/Directory mounting	RH133, RH300
Windows (CIFS)	RH253, RH300
Package management	RH133, RH300
Default scripting tools	RH133, RH300
Systems management	RH401
Monitoring	RH401
Troubleshooting	RH442
Security - Packet filtering firewall	RH253, RH300
Security - Intrusion detection	RHS333
Identity management	RH423, RHS333
File systems	RH436
Virtualization	RH133, RH401
Storage multi-path	RH436
Job scheduling	RH442
Clustering	RH436
Backup	RH442
Bare-metal recovery	RH401

The Red Hat Training courses listed here are not exhaustive. To access a complete, interactive, or PDF/printer-friendly version of the complete course catalog, please visit <https://www.redhat.com/training/catalog/>. Red Hat Training specialists can help identify if staff requires training and what level of training is needed. Contact Red Hat at training_sales@redhat.com to craft a custom corporate training plan to meet the needs of your group.

5. SUCCESSFULLY MIGRATED CUSTOMERS

Red Hat has helped many customers—including growing businesses, government agencies, and Fortune 100 enterprises—develop and execute Red Hat Enterprise Linux migration plans. These companies successfully reduced both capital expenditures and operating expenditures while improving operational flexibility and efficiency. Here are their stories.



City of Chicago

The City of Chicago's Business and Information Services (BIS) Department supports most of the enterprise-level applications that keep the city working. More than 15,000 city workers depend on BIS for fast, reliable access to the technology required to effectively perform their jobs. In an effort to continually find a better way, the department sought to migrate its IT systems to Red Hat Enterprise Linux, hoping to improve performance and save money. The city's IT infrastructure has historically been a multi-platform environment that included more than 100 Solaris servers used to run a large number of Oracle databases and applications. Many of these servers were nearing the end of their lifecycle. The department sought to replace the servers with cost-effective solutions.

The solution: Realizing the potential for open source technology to reduce the cost of hardware and IT operating costs, BIS partnered with HP, Red Hat, and Systems Solutions Inc. (SSI) to kick off a Red Hat Enterprise Linux pilot project. An HP DL580 G2 server was installed with Red Hat Enterprise Linux AS v.2.1, Oracle 9i Database, and an HP MSL tape library with backup software from Legato. The Red Hat Consulting team was brought in to provide expert technical assistance for the duration of the project. The department also established benchmarks for measuring the success of the Red Hat deployment. It found that when running the city's long batch cycles, Red Hat Enterprise Linux proved to be fifty percent faster than Sun Solaris. Chicago's Business and Information Services Department also realized that, by migrating to Red Hat Enterprise Linux, it had:

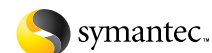
- Improved performance three-fold
- Lowered server procurement and maintenance costs
- Increased hardware options
- Increased flexibility to choose the hardware that best meets the city's needs. Recently, the City of Chicago expanded beyond the pilot project and began the migration of its Vehicle Registration System from a mainframe environment to a Red Hat Enterprise Linux v.3 and HP platform.

NYSE Euronext



NYSE Euronext (NYX) operates the world's leading and most liquid exchange group. It offers a diverse array of financial products and services and represents nearly 4,000 listed companies who total \$27.3/€17.3 trillion in global market capitalization. After a recent acquisition, NYSE Euronext faced the challenge of integrating its various trading platforms to produce a simplified and optimized technology architecture. At the same time, it sought to enhance the performance of its technology through a high-speed, low-cost platform that offered reliability and flexibility. NYSE Euronext needed to optimize processing hundreds of thousands of messages per second and billions of messages per day.

The solution: NYSE Euronext believed Linux to be the right choice for the environment, due to the flexibility it offered. When support was considered, it was quickly clear that the leading choice was Red Hat. So NYSE Euronext chose Red Hat Enterprise Linux to run its mission-critical electronic trading platform. Today, much of NYSE Euronext's high-speed trading environments rely on Red Hat Enterprise Linux. NYSE Euronext executives note that the pace of electronic trading has increased dramatically. The new solution delivers on NYSE Euronext's requirements, providing flexibility, high levels of security, and a unique customer feedback loop. NYSE Euronext will add several hundred more subscriptions to Red Hat Enterprise Linux in the coming 18 months. In addition, Red Hat solutions are slated to play a pivotal role in NYSE Euronext's next-generation trading platform, the Universal Trading Platform.



Florida Hospital

Florida Hospital is the largest hospital in the state of Florida. Its MIS Department—which includes approximately 100 developers—manages one centralized datacenter for all of its facilities, making it one of the busiest datacenters in Central Florida. Known for its excellent quality of care, Florida Hospital continually evaluates and improves its IT systems to ensure the infrastructure is reliable and high-performing. The hospital sought to deploy a web initiative to publish its internal applications to the Internet, but the project soon became cost-prohibitive. The hospital could no longer afford to use an expensive proprietary operating system. It needed to deploy a smarter system that would provide seamless business continuity for the hospital.

The solution: As a result, Florida Hospital turned to Red Hat for the cost efficiencies a Red Hat Enterprise Linux solution could provide. The hospital soon found that in addition to the web initiative, Red Hat Enterprise Linux could also help address the data warehouse hardware-software compatibility issues that often caused unnecessary system downtime. Today, 70 HP and IBM servers run Red Hat Enterprise Linux in the Florida Hospital datacenter. As a result of deploying Red Hat Enterprise Linux and other Red Hat solutions, Florida Hospital:

- Streamlined its disaster recovery processes
- Gained higher system availability that translates into better patient care
- Expedited disaster restoration time with an average recovery time between 30 seconds and five minutes to sync the data and one hour to recover
- Experienced significant efficiency gains making it possible to manage 70 servers with only two engineers
- Decreased provisioning system time to minutes versus hours or days
- Deployed the new system within a couple of weeks with the help of Red Hat Consulting



Hill Air Force Base

Hill Air Force Base (AFB) is Utah's leading employer with almost 23,000 military and civilian employees. It is estimated that Hill AFB's national economic impact is more than \$2 billion. For Hill AFB, maintaining mission-critical IT operations is crucial. Over the course of three months, Hill AFB's existing system went down eight times. With close to 18,000 users on-base, many of whom are conducting highly sensitive and deadline-driven work, it could cost up to \$1 million per hour when the organization's complex Microsoft Windows and Oracle system would go down. The base experienced surges in performance, long load time for applications, and an unreliable system. Adding to the problem: Hill had not budgeted for a system refresh, leaving very little money for new software. Hill AFB needed a cheaper, faster, more reliable system that would virtually eliminate system crashes, simplify a complicated operating environment, and cause minimal user disruption. The new system needed to enhance capacity for an increasing number of applications and users. Hill's IT specialists also sought a datacenter solution that would be transparent to the end-user community and allow for business continuity.

The solution: Hill AFB is currently one year into its datacenter restructuring using Red Hat Enterprise Linux as its new operating system. The result? Costly and frustrating systems failures have been virtually eliminated and Hill's programs and applications are now more reliable. Its datacenter now runs smoothly and efficiently, leaving personnel to focus on their jobs instead of worrying about their IT structure. Using Red Hat Enterprise Linux as the new OS, Hill AFB reduced its footprint by 25 percent, with load time for the base's largest application now at



three hours per night. Migrating to Red Hat Enterprise Linux has eliminated performance surges and identified bottlenecks in the system, providing a more streamlined environment. But best of all, at just two percent of the cost of the old system, Red Hat Enterprise Linux has performed substantially better and has increased system reliability, allowing IT professionals to focus on other areas.

For additional details on the above customer stories, see appendix B.

European Airline

The airline had recently made a decision to standardize on Red Hat Enterprise Linux and move all existing applications off of the Solaris platform. In a scale-out environment, it is important to fully utilize resources. The airline realized that with the high levels of performance and inexpensive CPU and memory of an x86-based architecture, it could stack multiple database instances on a single server to dramatically reduce both its software license costs as well as reduce its overall server footprint and power consumption. Despite having two fully redundant, highly available datacenters, this European airline was still paying nearly €30 million in airport penalties annually due to downtime.

The solution: The Red Hat Enterprise Linux platform was ideal because it would provide the airline with a cost-effective, scale-out environment for its ground control systems. The airline moved its applications from its legacy HA solution to the Veritas Storage Foundation Cluster File System that eliminated the downtime that was resulting in these penalties while also gaining other unexpected cost savings and process efficiencies.

Large U.S. government agency

Migrating data from one platform to another can be a time-consuming proposition. To do so may require a significant amount of time since the typical method for migrating from one operating system platform to another involves a network-based copy. During that time, the application is unavailable because most proprietary operating systems don't share a common file system. As a result, it is generally not possible to access a file system created on one operating system by another one. Increasingly server administrators are looking to reduce cost in their environment by deploying high-performance, cost-effective alternatives to their legacy UNIX operating systems. For this large U.S. government agency, a lengthy application downtime was simply unacceptable. Initial tests showed that using traditional native tools would take as long as three weeks to complete a migration of its most critical Oracle RAC database. This sort of migration would have required putting in place a high-speed network interface because the existing public network infrastructure could not possibly support the type of throughput required for a database migration of this magnitude.

The solution: By using Veritas Storage Foundation and leveraging Portable Data Containers, one of the many key Storage Foundation features designed to optimize migrations, in conjunction with Oracle Transportable Tablespace (TPTS), the customer was able to complete a cross-platform database migration in hours, not days or weeks.



6. SUMMARY

Every migration project, no matter the size or scope, requires detailed planning to ensure success. Understanding the risks, savings, and cost structure of a migration project is critical if you are to accurately project net improvements and realize actual return on your IT investment. The considerations and processes detailed in this guide are designed to help you identify migration opportunities, examine the risks associated with various migration scenarios, create a standard build, and help develop a comprehensive strategic migration plan. Prior to formal planning, an organization must acknowledge the motivations behind the migration, as well as understand the advantages and disadvantages to each potential migration scenario. Lacking this understanding, organizations may be unprepared for decisions and trade-offs that must be made throughout the planning process. Once motivations are clear, organizations should step through each of the five phases of the strategic migration process detailed in this guide. Those phases are:

- Examine existing Solaris architecture and determine the equivalent capabilities in the Red Hat Enterprise Linux ecosystem
- Examine third-party functional and business applications and determine the equivalent capabilities in the Red Hat Enterprise Linux ecosystem
- Measure organizational readiness and overall migration risk
- Develop a strategic migration plan, including a detailed roadmap and cost estimate
- Implement the strategic migration plan and employ implementation support strategies.

With this guide and additional Red Hat services, any organization will be armed with the necessary tools for planning and implementing a successful migration. And by combining the technology, training, and mentoring from one source, you will experience reduced development complexity and risk and see the value of your investment faster. When you are ready to embark on your journey to move your Symantec infrastructure application environment and data from Solaris to Red Hat Enterprise Linux, we encourage you to give us a call to discuss how Red Hat can help you make the right decisions from the start, reduce risk, and accelerate the impact of your deployed technology.

Appendix A - Migration scenario detail

Scenario one: Built-in functionality to built-in functionality

In this scenario, functionality built into Solaris is the same or similar to functions that are built into Red Hat Enterprise Linux (see Figure 2.2a). When functionality is part of both operating systems and works identically (e.g. Apache or Sendmail), there are few, if any, challenges to migration.

However, the situation can be highly challenging if the functionality is implemented differently on each platform or through different means. These differences generally have three forms:

Version differences

In this situation, overall functionality is largely the same. OS-specific differences may exist and entail different default versions of certain built-in applications and/or functions in Solaris versus Red Hat Enterprise Linux. For instance, Solaris 10 ships with Sendmail-8.13.8+Sun while Red Hat Enterprise Linux 5.3 ships with sendmail-8.13.8-2.



Syntactic differences

Typically there are changes in the way certain things are invoked that can vary in their level of impact. For instance, the utility `grep` is widely used in both UNIX and Linux environments for administrative tasks and scripting. However, the version included with Solaris 10 is POSIX `grep`, which does not support Perl regular expressions, a powerful option available in the GNU version of `grep`, shipped in Red Hat Enterprise Linux 5.3.

Functional differences

In this situation, similar functionality is accomplished in a different way. These differences are usually the most difficult to deal with because they represent fundamental differences in the way a function is implemented between the two operating systems and can lead to serious compatibility issues. For instance, Storage Management in Solaris 10 is performed through ZFS whereas Red Hat Enterprise Linux 5.3 uses LVM.

Scenario two: Solaris infrastructure application to Red Hat Enterprise Linux infrastructure application

In this document we are targeting existing Symantec customers who may be running Veritas Storage Foundation or Symantec NetBackup on Solaris and want to continue to do so after migrating to Red Hat Enterprise Linux. These customers may also have other infrastructure applications such as mail or print servers that are running on Solaris today, and they want a comparable set of infrastructure applications running on Red Hat Enterprise Linux. (see Figure 2.2b).

Similar to built-in functionality, there are three common situations presented in this scenario:

- The application is available and supported on both platforms at the same version level. This situation occurs more frequently than all others since thousands of leading ISV applications are certified on Red Hat Enterprise Linux. The differences between platforms are usually relatively minor and require a low degree of migration effort.
- The application is available and supported on both platforms but at different version levels. This occurs when an ISV releases versions of their software at different times for different platforms. Usually this is a function of the ISV's prioritization for testing and certification on various platforms. In most circumstances, this is only a temporary situation until the ISV releases the most current version on Red Hat Enterprise Linux. In the interim, the migration efforts can continue by utilizing the on-site technical expertise provided by Red Hat Consulting in conjunction with Red Hat's relationships with the hundreds of ISVs certifying their applications on Red Hat Enterprise Linux.
- The application is available on Solaris but not on Red Hat Enterprise Linux. In most cases, an alternative application must be found to compensate for the functionality of the application available for Solaris. With more than 5,000 ISV applications certified for Red Hat Enterprise Linux, it is usually easy to find a suitable replacement.



Scenario three: Solaris functionality to infrastructure application

In a small number of circumstances, Solaris has built-in functionality that Red Hat Enterprise Linux does not (see Figure 2.2c). For instance, to achieve the functionality of a flash archive in Solaris, an application such as Altiris Deployment Solution would be used. An additional infrastructure application may be necessary in this scenario to achieve the same functionality in a Red Hat Enterprise Linux environment.

Normally it is not a major challenge to locate an open source or proprietary product with comparable features to the functionality in Solaris. Obviously, the potential costs must be taken into account in the migration planning. But in most circumstances, there are low-cost open source alternatives that can minimize or altogether eliminate these additional costs.

Scenario four: Functional application to functional application

This scenario involves moving from one functional application on Solaris to the same or similar application on Red Hat Enterprise Linux. This type of scenario can be broken down into sub-types: ISV functional applications and custom functional applications.

A migration of ISV functional applications has very similar characteristics to scenario two in this document. The migration usually revolves around availability of, and version issues associated with, the ISV application in question. Custom functional applications usually present a more challenging situation unless exceptional care was taken to ensure cross-platform compatibility during their development phase. A discussion of a methodology for examining these applications for migration purposes is outlined in section 3.3 of this document.

Appendix B - Customer case studies

City of Chicago

Industry: State and Local Government

Solution: Software: Red Hat Enterprise Linux

Applications: Oracle9i database, Legato backup solutions, HP MSL Tape Library

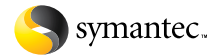
Hardware: HP DL580 G2

Benefits: Up to three times performance improvement, lower server procurement and maintenance costs, increased hardware options

One of the most well-known cities in the United States, Chicago prides itself on finding a better way to do things –from strengthening public education to inventing Cracker Jacks, lowering crime to building the first skyscraper. In the same spirit, this year they’ve begun migrating their IT systems to Red Hat Enterprise Linux to improve performance and save costs. At the center of these efforts is Chicago’s Business and Information Services (BIS) Department, which “supports most of the city’s enterprise-level applications that keep the city working,” explains Amy Niersbach, Platform Architect for the City of Chicago. More than 15,000 city workers depend on BIS for fast, reliable access to the technology required to effectively perform in their jobs. In the spirit of finding a better way, the City of Chicago undertook a pilot project with Red Hat Enterprise Linux. The city’s infrastructure has historically been a multi-platform environment that included about 100 Solaris servers used to run a large number of Oracle databases and applications. “Many of these servers are nearing the end of their lifecycle, and when we replace them, we need to do so with cost-effective solutions,” Niersbach says. BIS had three primary goals when they began to consider Linux:

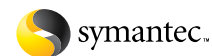
- Reduce the server hardware, maintenance, and operating costs
- Prove that Linux could effectively run enterprise-level applications
- Increase flexibility in choosing hardware vendors for significant potential cost savings





Realizing the potential for open source technology to reduce the cost of hardware and IT operating costs, BIS partnered with HP, Red Hat, and Systems Solutions Inc. (SSI) to kick off a Red Hat Enterprise Linux pilot project. SSI's systems engineers installed the HP DL580 G2 Server with Red Hat Enterprise Linux AS v.2.1, Oracle 9i Database, and HP MSL Tape Library with backup software from Legato. "We liked the approach that Red Hat took to support the City of Chicago, SSI, and HP during our pilot project. The Red Hat Consulting team was brought in for their expertise, and they provided technical assistance for the duration of the project. It was very effective," said Niersbach. As part of the pilot project, SSI installed software that would allow them to evaluate system performance and scalability, and to test backup and recovery processes and interfaces to other applications. TPC Benchmark Software was also used to ensure an accurate assessment for the performance comparison. Results were impressive. Sun Solaris benchmarked at 50,268 transactions per minute, while the HPDL580 G2 with Red Hat Enterprise Linux benchmarked at over 149,500 transactions per minute –nearly three times faster. When running the city's long batch cycles, Red Hat Enterprise Linux proved to be 50 percent faster. Recently the City of Chicago expanded beyond the pilot project to migrate its Vehicle Registration System from the mainframe environment to a Red Hat Enterprise Linux v.3 and HP platform. BIS expects that the system will allow them to issue more than one million vehicle stickers per year. The BIS team is now confident that Red Hat Enterprise Linux can help them reach their goals:

GOAL	SOLUTION
Reduce server hardware, maintenance, and operating costs.	Red Hat Enterprise Linux is optimal for low-cost, Intel-based servers. Included in the city's yearly subscription to Enterprise Linux is web and phone support, as well as Red Hat Network for systems management and errata.
Prove that Linux could effectively run enterprise-level applications.	Red Hat Enterprise Linux is certified for over 700 applications that the public and private sectors depend on. In addition, Enterprise Linux consistently achieves top benchmarks, such as ECPeef and TPC-C.
Increase flexibility in choosing hardware vendors for significant potential cost savings.	Red Hat's strategic partners include many major hardware vendors, and Red Hat Enterprise Linux is certified across seven hardware platforms, giving Chicago's BIS team the flexibility to choose the hardware that best meets its needs.



NYSE Euronext

Industry: Financial Trading

Geography: Global

Challenge: To integrate varied trading platforms to produce a high-speed, low-cost platform that offers the reliability and flexibility necessary to produce the rapid performance results demanded by the expanding financial trading industry.

Migration Path: HP UX, IBM AIX, and SUN Solaris to Red Hat Enterprise Linux

Software: Red Hat Enterprise Linux, Red Hat Network

Hardware: 200 HP ProLiant DL585 four-processor servers, 400 ProLiant BL 685c blades, AMD dual-core Opteron processors

Benefits: Reliable, secure, cost-effective solution that provided flexibility, freedom from vendor lock-in, and the ability to handle heavy workloads while producing fast-paced performance results.

NYSE Euronext (NYSE) operates the world's leading and most liquid exchange group. It offers a diverse array of financial products and services and represents nearly 4,000 listed companies representing \$27.3/€17.3 trillion in total global market capitalization.

NYSE's goal to cement its position as the world's preeminent marketplace by diversifying its product base and developing a global platform for trading led to the merger with Archipelago in 2006 and Euronext in 2007.

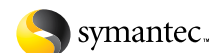
With the acquisition of Archipelago and Euronext complete, NYSE Euronext faced the ongoing challenge of integrating its varied trading platforms to produce a simplified and optimized technology architecture. During this integration, NYSE Euronext sought to enhance the effectiveness of its technology through the incorporation of features needed to remain competitive in the current market. It needed a high-speed, low-cost platform that offered the reliability and flexibility necessary to produce the fast-paced performance results demanded by the industry.

"We're working on integrating all the pieces of our business together and making the result better than any of the systems that comprised it in the first place. From a system architecture standpoint, we need to be very flexible. We must have the latest and greatest technology without painting ourselves into a corner and without finding out that we are out-running the capabilities of our solutions. Technology is in every corner of what we do, and the software that sits on our technology is key to being us remaining a viable competitor today," said Steve Rubinow, Chief Information Officer at NYSE Euronext.

When assessing the right technology solution to help enable the optimized processing of the hundreds of thousands of messages per second and the billions of messages per day that are processed by the NYSE Euronext electronic trading platform, three considerations were made. The cost of starting, the cost of support, and the cost of potentially leaving the technology solution in the future were all considered.

"Too many people forget that the cost of leaving a technology can be substantial. We didn't want to get locked into any certain technologies, and desired the flexibility to jump to a different hardware platform if necessary," said Rubinow. "Linux gives us that flexibility. We felt that Linux was right for our environment, so we decided to pursue it full-speed ahead."

NYSE Euronext investigated two competing Linux distributions, including Red Hat Enterprise Linux, and compared the solutions based purely on the offered technology and related support. When support was considered, it was quickly clear that the leading choice was Red Hat. So, NYSE Euronext decided to implement Red Hat Enterprise Linux to run its mission-critical electronic trading platform.



"We needed a good partner and found one in Red Hat. We were looking for a partner that was offering reliable software and one that would help and advise on its use while providing the value of trusted support services. Red Hat satisfied our objectives," said Rubinow.

Today, much of NYSE Euronext's high-speed trading environments rely on Red Hat Enterprise Linux. "The pace of electronic trading has picked up dramatically, and across the enterprise. The main part of our 6.5-hour trading day includes the processing of billions of messages," said Rubinow.

To maintain several hundred servers running Red Hat Enterprise Linux, NYSE Euronext employs Red Hat Network. With Red Hat Network Update and Management solutions, NYSE Euronext has been able to effectively manage its complex, mission-critical systems.

NYSE Euronext also relies on Red Hat Enterprise Linux and its included Security-Enhanced Linux (SELinux) functionality to preserve the security of its platform. With trillions of dollars flowing through the exchange each month, security is a large and very important organizational focus. "We are very security-conscious because we have to be. The operating system is a key part of every server that we operate and each server must be secure at all times. We maintain the security of our systems by relying on the SELinux features within Red Hat Enterprise Linux," said Rubinow.

Of the very elite competition in the marketplace, NYSE Euronext must compete with other top players in size and in features, but also in the demand to be the fastest and the most reliable at the lowest cost. Red Hat Enterprise Linux delivers on these requirements, in addition to providing flexibility, high levels of security, and a unique customer feedback loop.

"With the combination of speed, cost, reliability, and functionality pushed to the limit, we have to out-perform the competition in each category, and our competition is getting better all the time. Linux as an operating system has been the fastest growing with respect to these requirements, and we're not limited by what's in front of us. The quality of the Linux platform is greatly important to us and Red Hat Enterprise Linux has exceeded our expectations," said Rubinow.

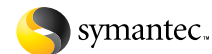
In addition, NYSE Euronext benefits from the unmatched value Red Hat places on customer feedback. Important to the open source model is the constant feedback loop between users and customers and the engineers and developers behind the software. Through Red Hat Global Support Services, there is constant feedback and development between Red Hat and its customers.

"When we have mundane questions, they're answered quickly. When we have larger technical questions, we put our best minds and Red Hat's best minds together and have these smart people work in collaboration to solve the problem," said Rubinow.

With continued growth, new development, and ongoing conversion activities, NYSE Euronext will add several hundred more subscriptions of Red Hat Enterprise Linux in the coming 18 months. In addition, Red Hat solutions are slated to play a pivotal role in NYSE Euronext's next-generation trading platform, the Universal Trading Platform.

"Red Hat is almost like water, it's pervasive within our architecture. Red Hat is extremely strategic and without it, most of our computers wouldn't be running," said Rubinow.

Watch the accompanying video detailing their path to Red Hat Enterprise Linux at: <http://customers.redhat.com/2008/05/12/nyse/>.



Florida Hospital

Industry: Healthcare

Geography: Orlando, FL

Opportunity: Design a new disaster-recovery system that would ensure seamless business continuity for the hospital

Migration Path: IBM AIX to Red Hat Enterprise Linux

Software: Red Hat Enterprise Linux; Red Hat Global File System and Cluster Suite; Red Hat Network; JBoss Enterprise Application Platform; MySQL, Oracle, CachÃ©, FoxPro, and Postgres databases; proprietary applications for reporting and management of patient data and for mail, security, and virus protection

Hardware: HP and IBM servers

Benefits: Streamlined disaster recovery and gained higher system availability and resource efficiencies that translate into better patient care.

With seven facilities totaling over 2,300 beds throughout Central Florida, Florida Hospital is the largest hospital in the state. Established in 1908, the hospital provides care to more than one million patients each year. Florida Hospital's MIS Department, which includes approximately 100 developers, manages one centralized data center for all of its facilities, making it one of the busiest centers in Central Florida.

Known for delivering the best patient care, Florida Hospital continually evaluates and improves its IT systems to ensure the most reliable infrastructure is always in place and performing at an optimal level. The hospital decided to undergo a new web initiative to publish its internal applications to the Internet, but the project soon became cost-prohibitive.

"As our environment grew, we couldn't afford to use expensive proprietary operating systems anymore," said Jack Velazquez, Sr. Systems Engineer for the Open Systems Team at Florida Hospital. In addition, the hospital began to evaluate its disaster recovery system. "Because of the way our disaster recovery system was designed, it could have taken up to two days to restore our file systems and data if anything went wrong. We knew we needed to deploy a smarter system that would provide seamless business continuity for the hospital," said Velazquez.

Initially, Florida Hospital turned to Red Hat because it provided cost efficiencies for its web initiative, but then found many more advantages for its disaster recovery project. "We realized that using Red Hat in our data warehouse would help us resolve hardware-software compatibility issues that can cause unnecessary system downtime. Red Hat's large network of certified vendors ensures that most drivers are built into the operating system kernel, resulting in smoother operations," said Velazquez. Florida Hospital also chose to use Red Hat Network, Red Hat Cluster Suite, and Red Hat Global File System (GFS) to restructure the way its disaster recovery system was designed and managed.

Today, 70 HP and IBM servers run Red Hat Enterprise Linux, which runs a number of databases, including the hospital's two-terabyte Oracle data warehouse. Red Hat Enterprise Linux also runs JBoss Application Server and the hospital's proprietary applications, which include patient care, financial, and data management solutions. A group of servers is also dedicated to communication and system protection applications, such as authentication, user id management, mail, and virus scanning.

To protect all of this critical information, the Open Systems Team created a unique disaster-recovery system by offloading all applications and data to the Red Hat Global File System running on the SAN. Using Red Hat Cluster Suite, the team created a six node cluster. Each of the clusters shares two volumes on the GFS: one for the applications and the other for data. "With



Red Hat GFS, we no longer need to replicate data or applications if a server goes down," said Velazquez. "The servers simply provide CPU and power. Everything else runs from GFS." To upgrade or restore a machine in the cluster, the team simply installs Red Hat Enterprise Linux and attaches the computer to the SAN. Within minutes, it's ready to go.

The Open Systems Team also implemented Red Hat Network to facilitate infrastructure management, security compliance, and new system deployment. "Red Hat Network makes system management easy, enabling us to deploy new applications and security patches to all servers at once," said Velazquez. Florida Hospital's data security office continually conducts security audits, and Red Hat Network tracks all system activities, making it possible for the Open Systems Team to provide detailed reports for HIPAA compliance.

As a result of deploying Red Hat, Florida Hospital streamlined its disaster recovery processes and gained higher system availability that translates into better patient care. "Red Hat solutions enabled us to create a highly efficient disaster-recovery system that expedited restoration time from days to seconds. This means we make patient data readily available and provide the highest level of care at all times," said Velazquez. Average recovery time now takes between 30 seconds and five minutes to sync data and one hour to recover data.

Florida Hospital also experienced significant efficiency gains from its Red Hat deployment. "Red Hat Network makes it possible for us to manage 70 servers with only two engineers. Provisioning systems only takes minutes when it used to take us hours or even days," said Velazquez. With the new Red Hat disaster recovery system, the hospital continues to save on resources. "Red Hat GFS enabled us to create an innovative design that saves on storage costs, network bandwidth, and processing power," he said. In addition, Red Hat Professional Services helped the Open Services Team implement the Linux disaster recovery system, helping them build and break clusters during on-site training. "Thanks to Red Hat Professional Services we were able to deploy the system within a couple of weeks," said Velazquez.

Red Hat also helps Florida Hospital maintain a technological and competitive edge. As the largest hospital systems within the Adventist Healthcare System, the hospital strives to stay ahead of the curve. "

With 100 developers on our team, we rely on Red Hat to save us time on everyday management issues so we can focus on creating new solutions. Our parent company has been impressed by our efficiency, ROI, and performance gains from using Red Hat," said Velazquez.

Florida Hospital is looking forward to expanding Red Hat usage. In the near future, the Open Systems Team will be implementing Red Hat virtualization capabilities for some of their projects.

According to Velazquez, "When it comes time to upgrade again, we intend to move more of our mid-range systems to Linux. We'd love to experience Red Hat performance and reliability throughout the entire hospital."



Hill Air Force Base

Industry: Government

Geography: Utah

Solution: Red Hat Enterprise Linux

Hardware/Software: Combination of Microsoft and Oracle

Benefits: Performance improvement, lower server procurement and maintenance costs, increased hardware options.

Hill Air Force Base encompasses nearly 7,000 acres and is Utah's leading employer with almost 23,000 military and civilian employees. It is estimated that Hill AFB's national economic impact is more than \$2 billion.

Despite downsizing by the government in recent years, Hill AFB has continued to grow. The Base Realignment and Closure Commission directed the workload from both San Antonio and Sacramento Air Force Logistics Commands. The Utah Test and Training Range, housed on Hill AFB, is one of only five live-fire air force training ranges in the county.

Over the course of three months, Hill AFB's existing system went down eight times. With about 18,000 users on base, many of whom are doing highly sensitive and deadline-driven work, it could cost up to \$1 million per hour when Hill's complex Windows and Oracle systems go down. The base experienced surges in performance, long load time for applications, and an unreliable system. According to Doug Babb, the IT systems architect at Hill and project manager for this undertaking, the existing system was providing "unacceptable application performance."

The technical challenges Hill AFB faced were immense but the problem was even greater: Hill had not budgeted for a system refresh, leaving very little money for new software.

Hill AFB needed a cheaper, faster, more reliable system that would greatly reduce or eliminate system crashes, simplify a complicated operating environment, and have minimal user disruption. The new system needed to add enhanced capacity for an increasing number of applications and users. Being a part of the U.S. Dept. of Defense meant that Hill needed a system that could guarantee security and reliability. Hill's IT specialists were also looking for a data center solution that would be transparent to the end-user community and allow for business continuity.

Financially, Hill needed a system that would provide reduced total cost of ownership, lower capital expenditures (both initially and in the long-term), and a reduced time-to-value. The lack of an allotment in the budget for the system overhaul put extra pressure on Hill to find a solution that could solve the technical problems while not putting the IT department in the red.

When choosing a vendor for the new system, the IT managers at Hill AFB considered both Windows 64-bit and Linux. Frustrated with their current Windows environment, it became clear to the IT architects that Linux was the preferred solution. Because of security concerns, Hill needed to run security-enhanced Linux that was common-criteria certified. Red Hat Enterprise Linux stood out as the only Linux that was able to meet security concerns.

In addition to having enhanced security, Red Hat solutions were much more economical than others. To sustain the existing environment and increase capability, it would have cost Hill a minimum of \$5 million per year to use Solaris. Red Hat Enterprise Linux cost \$100,000, just two percent of the cost of the old operating system.

Hill AFB is currently a little more than one year into their data center restructuring, using Red Hat Enterprise Linux as their new operating system. To integrate the new environment, Hill's CIO built a new system from scratch without affecting existing users. Hill's IT department performed



aggression testing, deployed a test environment, and had users review the new environment before switching the OS. The 11-step process used Hill's IT system architects, along with the technical capabilities of Red Hat Enterprise Linux, allowing Hill to see immediate results and value.

The project saved time and money, the two most important resources in any business, particularly the military. Red Hat Enterprise Linux almost immediately began saving time for the IT professionals at Hill. The system was received on a Friday and was already running on Monday. There have been few, if any, glitches. The costly and frustrating systems failures have been eliminated and Hill's programs and applications are more reliable. Hill's data center now runs smoothly and efficiently, leaving personnel to focus on their jobs instead of worrying about their IT structure.

The value gained from implementing Red Hat was tremendous. Using Red Hat Enterprise Linux as the new OS, Hill AFB reduced its footprint by 25 percent. The nightly load time for the base's largest application has been reduced from an average of 12 hours to just three hours per night. There is an increase in capacity, reliability, and security, allowing end-users to work more efficiently. Red Hat Enterprise Linux has eliminated performance surges and identified bottlenecks in the system, providing a more streamlined environment. End users were minimally disrupted by the change in systems but have since noticed a more improved IT environment. The total cost of ownership (TCO) has been greatly reduced.

Because of Hill AFB's military status and lack of budget allocation for this project, there was no efficiency gained but an IT crisis was averted. At just 2 percent of the cost of the old system, Red Hat Enterprise Linux has performed substantially better and has increased system reliability, allowing IT professionals to focus on other areas.

All people involved in the Hill AFB Red Hat deployment were Red Hat-certified, providing them with the necessary skills and capabilities to implement Red Hat Enterprise Linux with minimal problems. Hill's IT architects drew from the experiences of others who have used open source by becoming actively involved in the open source community and collaborating with others using open source for similar projects.

Though—because of their extensive training and learning process—they did not use Red Hat support services during deployment, the IT architects at Hill AFB are considering using Red Hat Training services during the next year to expand their knowledge of Red Hat solutions and open source.



European Airline

Industry: Aviation

Challenges:

- Migrate applications from Solaris platform to Linux platform while maintaining SLA
- Application failovers were taking 30 minutes
- €30 million in airport penalties annually
- Minimize database license fees and maintenance
- Underutilized hardware
- Passengers waiting for delayed flights

Solution: Software: Red Hat Enterprise Linux and Storage Foundation Cluster File System HA

Applications: Oracle9i, 10g database, SAP

Hardware: EMC DMX

Benefits:

- Sub-minute application failovers
- Near elimination of airport penalties
- Substantially reduced hardware, software licensing and power costs
- Improved on-time flight departures

Overview

The airline had recently taken a decision to standardize on Red Hat Enterprise Linux and move all existing applications off of the Solaris platform. The Linux platform was ideal because it would provide them a cost effective, scale out environment for their ground control systems. In a scale out environment, it is important to fully utilize resources. The airline realized that with the high levels of performance and inexpensive CPU and memory of an x86-based architecture, they could stack multiple database instances on a single server to dramatically reduce both their software license costs as well as reduce their overall server footprint and power consumption. Despite having two fully redundant, highly available data centers, this European airline was still paying nearly €30 million in airport penalties annually due to downtime. It was only when it moved its applications from its legacy HA solution to Symantec's Veritas Cluster File System that it eliminated the downtime that was resulting in these penalties while also gaining other unexpected cost savings and process efficiencies.

Achieving Software and Hardware Savings

The airline realized that database and application license and maintenance fees generally are tied to the number of cores in the data center. More servers in the data center means more cores, more software license fees, higher operational overhead, and increased power costs. In order to minimize their software and hardware license costs, the airline sought to drive up the utilization of their servers. The fast processors now commonly found in high end x86-based Linux servers made this possible since they can provide the performance required to stack multiple applications and are favorably priced. The airline was able to use Red Hat Enterprise Linux and x86 hardware to stack multiple instances of the databases that run their reservations and ground control systems on a single server. The goal is to stack as many instances as possible on a single server to minimize the number of servers required in the data center. While it is common to see as many as a dozen database instances stacked on a server, even with high performance CPUs at some point performance will start to suffer. Database accelerators in



Veritas Cluster File System allowed as many as 50 databases to be stacked on a single server before reaching the limit of CPU and application memory. By stacking 50 databases per server, the airline was able to reduce their server footprint by as much as 75 percent more than what is typically seen when only a dozen instances are stacked on a server. High performance by itself though is not enough of a factor for most enterprises to feel comfortable stacking so many application instances on a given server. For mission critical applications, when the number of applications per server reaches high levels, the risk introduced from the complexity required to manage availability becomes a deterrent. When the number of mission critical applications running on a server reaches these levels, keeping track of the state and health of the large scale environment becomes extremely challenging. It becomes extremely difficult to track and monitor which applications are running on which servers and in which data centers. Since the airline had deployed the Veritas Cluster File System with Veritas Cluster Server for high availability and fast failover, they were able to use the advanced management capabilities of Veritas Cluster Server to manage these extraordinarily dense servers.



Large U.S. Government Agency

Industry: Government

Challenges:

- Migrating off of Solaris platform
- Mission-critical applications directly impact U.S. economy
- Moving 30TB Oracle database using native tools would take three weeks
- Traditional migration techniques require high bandwidth networks

Solution: Storage Foundation Portable Data Containers

Applications: Oracle RAC database

Hardware: EMC DMX

Benefits:

- Able to do an in place migration of Oracle data files
- Large database migrated in hours rather than days
- No overtaxing of the network infrastructure
- Migrated from physical to virtual

Overview

Migrating data from one platform to another can be an extremely lengthy proposition. This is because most proprietary operating systems don't share a common file system. As a result, it is generally not possible to access a file system created on one operating system by another altogether different operating system. However, increasingly server administrators are looking to reduce cost in their environment by deploying high performance, cost effective alternatives to their legacy UNIX operating systems. To do so can require a significant amount of time since the typical method for migrating from one operating system platform to another involves a network-based copy. During that time the application is unavailable. For this large U.S. government agency, a lengthy application downtime was simply unacceptable. Initial tests showed that using traditional native tools would take as long as three weeks to complete a migration of their most critical Oracle RAC database. This sort of migration would have required putting in place a high speed network interface, because the existing public network infrastructure could not possibly support the type of throughput required for a database migration of this magnitude. There is no software company today that is better equipped to enable you to react and manage change than Symantec with Veritas Storage Foundation. Since its inception, the Storage Foundation design philosophy has been to give you, the customer, options and flexibility in how you manage your data center today, and how you react to the inevitable changes that tomorrow will bring. The goal of Veritas Storage Foundation is to reduce data center TCO by providing our customers with architectural choices, and by providing the flexibility to make architectural changes in the future with a minimum of time, effort and storage requirements. Portable Data Containers is one Storage Foundation feature that epitomizes this design philosophy. The customer used this technology in conjunction with Oracle's Transportable Tablespace (TPTS) cross-platform database migrations can be effected in hours, not days or weeks.



Appendix C - Red Hat Training curriculum

Please see <https://www.redhat.com/courses/> for a comprehensive course listing and detailed course descriptions for Solaris to Red Hat Enterprise Linux migration.

Appendix D - Other tools

Veritas Storage Foundation product family page:

<http://go.symantec.com/sf>

Symantec Storage and Clustering User Community:

<http://www.symantec.com/connect/storage-management>

Symantec Operational Readiness Tools:

<https://sort.symantec.com/>

Red Hat Hardware certifications:

<https://hardware.redhat.com/>

Red Hat Reference material:

<http://customers.redhat.com/>

<http://www.redhat.com/docs/>

<http://magazine.redhat.com/>

Red Hat Knowledgebase:

<http://kbase.redhat.com/faq/en>

Red Hat Software compatibility list:

<http://www.redhat.com/rhel/compatibility/software/>

Red Hat TCO/ROI calculators:

https://roianalyst.alinean.com/intel_migration/

<http://tinyurl.com/cws2wh>

<http://www.redhat.com/promo/corebuild>

Red Hat Training:

Self assessment - <https://www.redhat.com/apps/training/assess/>

ROI calculator - https://www.redhat.com/training/corporate/roi_calc.html

Detailed course catalog - <https://www.redhat.com/training/catalog/>

Red Hat Training Resource Center - <https://www.redhat.com/training/resource>

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Symantec is a global leader in providing security, storage, and systems management solutions to help consumers and organizations secure and manage their information-driven world. Our software and services protect against more risks at more points, more completely and efficiently, enabling confidence wherever information is used or stored. Headquartered in Mountain View, Calif., Symantec has operations in 40 countries. More information is available at www.symantec.com.

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