AIX TO RED HAT ENTERPRISE LINUX STRATEGIC MIGRATION PLANNING GUIDE

1. EXECUTIVE SUMMARY

Is your IT ecosystem in danger of becoming too dependent on a single vendor? With the increase in vendor consolidation during these turbulent economic times, we hear vendor lock-in is a concern for more customers than ever before. And for good reason. Becoming too dependent on a single vendor can put you at a huge disadvantage, making you increasingly vulnerable to cost increases and limiting your options to do what's best for your business.

Migrating from proprietary technologies to those based on free, industry-wide standards will not only help you control IT costs, but also help scale your IT ecosystem. A strategic migration plan from Red Hat Consulting provides you with the roadmap to execute that migration safely and efficiently. Developed by Red Hat's global team of architects and enterprise consultants, it provides the tools, insights, and proven processes needed to proactively plan an IBM® AIX to Red Hat® Enterprise Linux® migration based on risk and readiness. The result? You achieve maximum cost-savings and knowledge transfer with minimal disruption to your business.

This guide details the recommended process for moving from AIX to Red Hat Enterprise Linux AP. 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.

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 OS migration should be carefully considered, as these may influence choices, opportunities, and trade-offs. Likewise, understanding your potential deployment scenarios will help you be proactive in identifying any roadblocks and anticipating future needs.

The migration planning process

Red Hat has established a proven five-step process designed to identify 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.

Through this process, your organization will:

1. Examine the existing AIX architecture and determine the equivalent capabilities in the Red Hat Enterprise Linux ecosystem.
2. Examine third-party functional and business applications and determine the equivalent capabilities in the Red Hat Enterprise Linux ecosystem.
3. Measure organizational readiness and overall migration risk.
4. Develop a strategic AIX-Red Hat Enterprise Linux migration plan, including a detailed roadmap and cost estimate.
5. 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 move from AIX 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 operating system (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.

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 AIX to Red Hat Enterprise Linux. These reasons may include:

- Cost reduction in multiple areas, including:
  - Hardware acquisition costs
  - Software license and maintenance costs
  - OS support and systems administration costs
  - Power, cooling, and facility costs
- Server Run Rate calculation on lease vs. buy
- End of server lease
- Expanding business requirements with existing budget constraints
- Corporate mergers and acquisitions
- Replacement of retiring or discontinued hardware and software
- Server consolidation
- Application consolidation
- Datacenter consolidation
- Leveraging new technologies (such as virtualization)
- Capacity planning and performance
- Secuirty and stability

In many cases, a combination of motivations drive operating system 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.

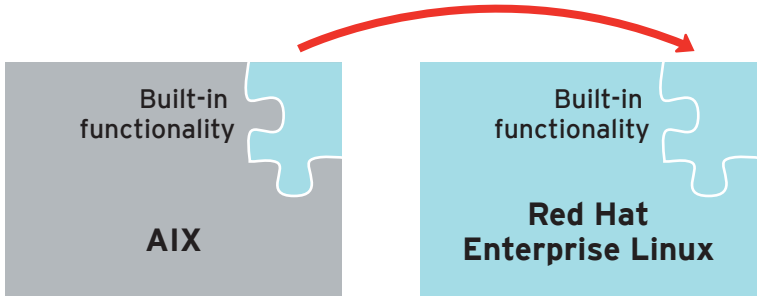
2.2 POTENTIAL MIGRATION SCENARIOS

In any migration from one operating system to another, there are five primary migration scenarios that must be closely examined in order to create a plan and conduct a successful migration implementation. 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 AIX 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. Sendmail or NTP), there are few, if any, challenges to migration.

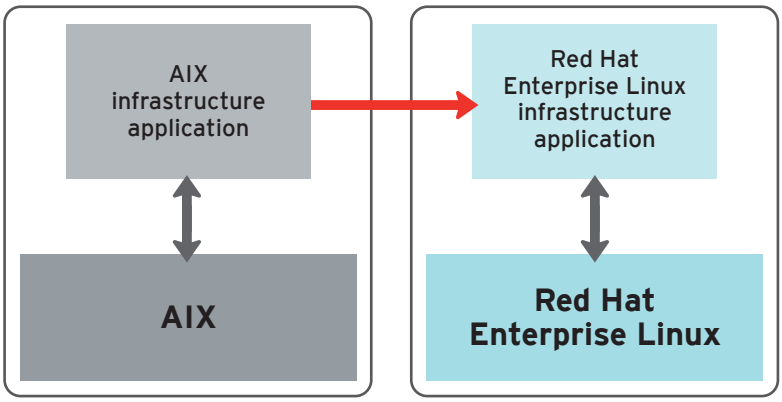
FIGURE 2.2A: AIX FUNCTIONALITY TO ENTERPRISE LINUX FUNCTIONALITY



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

Another relatively common scenario is moving from an external infrastructure application on AIX to a comparable infrastructure application running on Red Hat Enterprise Linux (see Figure 2.2b). For instance, a customer may be running Veritas™ NetBackup™ or IBM® Tivoli Storage Manager on AIX and want to continue to do so after migration.

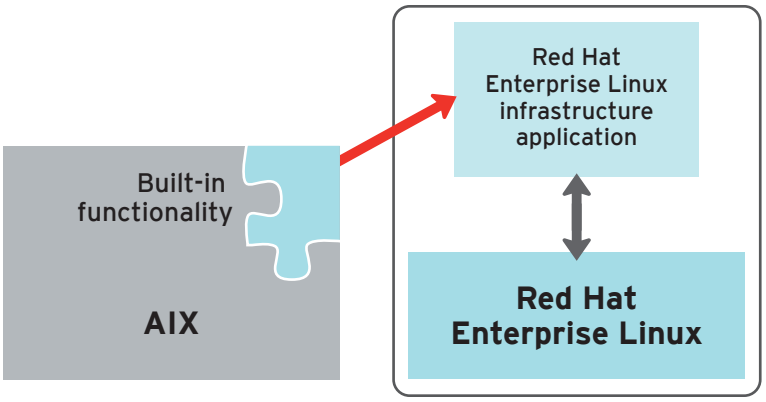
FIGURE 2.2B: AIX INFRASTRUCTURE APPLICATION TO ENTERPRISE LINUX INFRASTRUCTURE APPLICATION



Scenario three: AIX functionality to infrastructure application

In a small number of circumstances, AIX has built-in functionality that Red Hat Enterprise Linux does not (see Figure 2.2c). For instance, to achieve the functionality of a bare-metal OS recovery using mksysb in AIX, an application such as Veritas™ NetBackup™ 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.

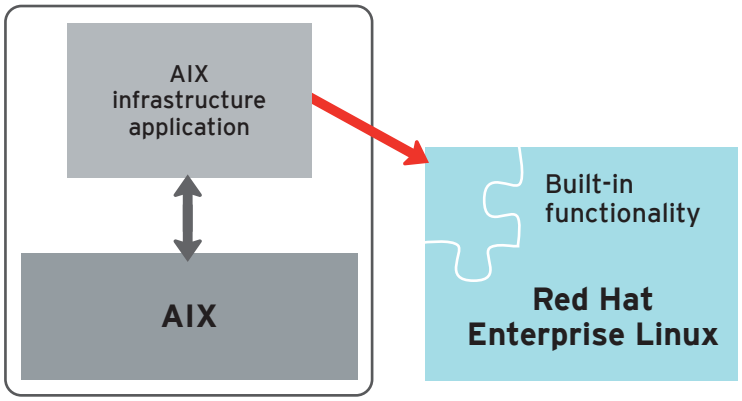
FIGURE 2.2C: AIX FUNCTIONALITY TO ENTERPRISE LINUX INFRASTRUCTURE APPLICATION



Scenario four: Infrastructure application to built-in functionality

In this migration scenario, there is an AIX infrastructure application necessary in an AIX environment that is not needed with Red Hat Enterprise Linux, as Enterprise Linux contains its own version of the functionality. For example, Veritas Clustering on AIX is not needed since Red Hat Enterprise Linux AP 5.x includes Red Hat Cluster Suite.

FIGURE 2.2D: AIX INFRASTRUCTURE APPLICATION TO ENTERPRISE LINUX FUNCTIONALITY

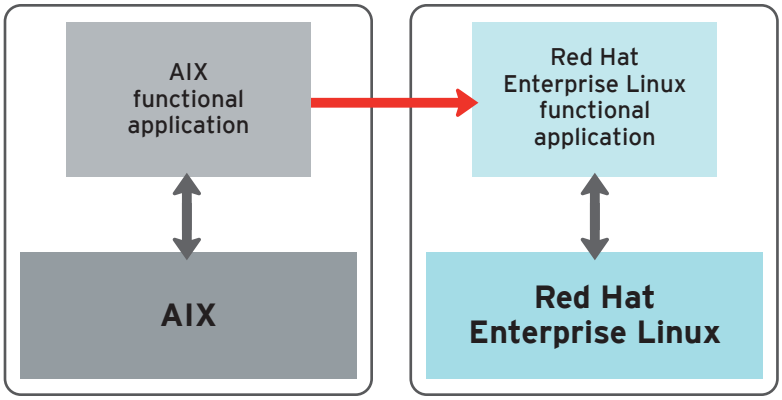


Substantial cost savings can often be realized because of the wide variety of functionality that is already included in a Red Hat Enterprise Linux subscription.

Scenario five: Functional application to functional application

This scenario involves moving from one functional application on AIX 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.

FIGURE 2.2E: AIX FUNCTIONAL APPLICATION TO ENTERPRISE LINUX FUNCTIONAL APPLICATION



The migration of an ISV functional application is very similar to Scenario 2, AIX 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.

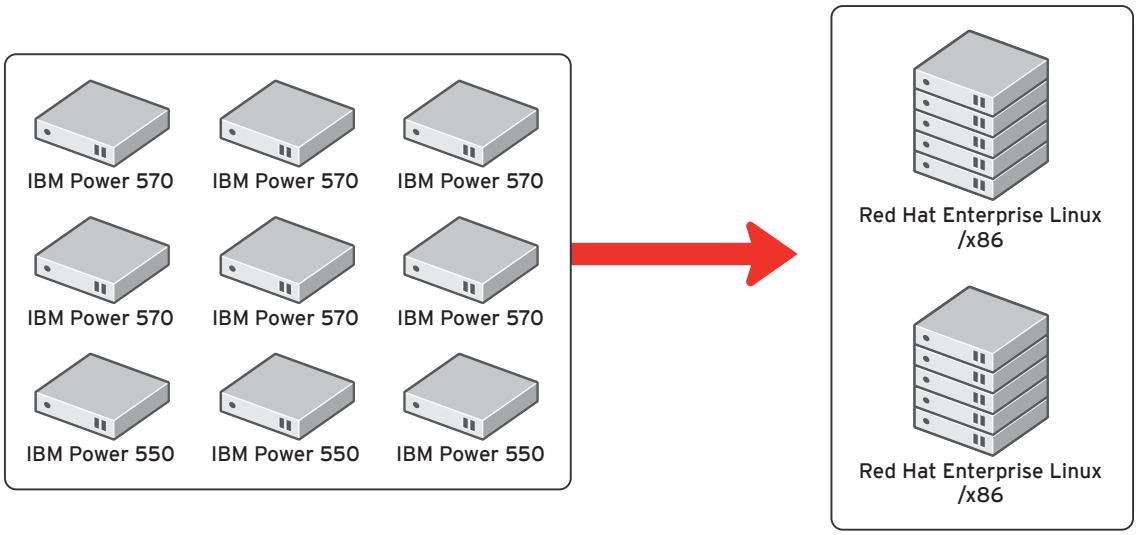
2.3 MIGRATION DEPLOYMENT SCENARIOS

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.

Consolidation

In the consolidation scenario, workloads on a large number of under-utilized Power™ or System p™ 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.

FIGURE 2.3A: CONSOLIDATION DEPLOYMENT SCENARIO



Advantages:

- Reduced hardware operational costs
- Reduced datacenter footprint
- Greater return on investment (ROI) from the chosen virtualization strategy
- Dynamic resource allocation and load balancing

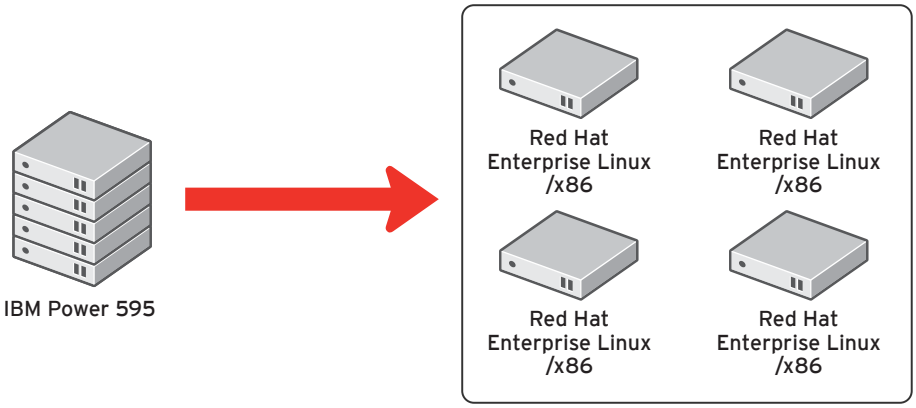
Disadvantages:

- Use of proprietary virtualization technologies can increase capital costs and create a new kind of vendor lock-in for the customer
- Performance may be degraded as virtualization add another layer (the hypervisor) between the OS and application
- Added complexity to system administration tasks

Dispersion

In the dispersion scenario, workloads on one or more large Power™ or System p™ 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 provides the customer similar advantages with lower operational costs.

FIGURE 2.3B: DISPERSION DEPLOYMENT SCENARIO



Advantages:

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

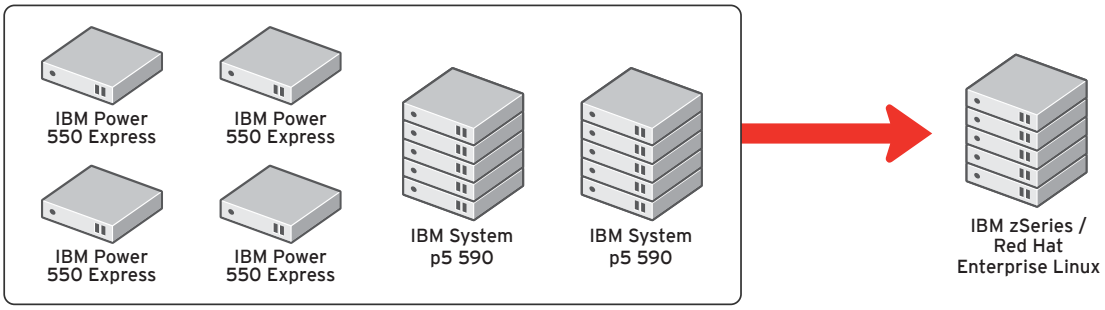
Disadvantages:

- When not properly planned, this scenario can result in higher operational costs
- Workload and resources may not be optimized and fully utilized

Aggregation

In the aggregation scenario, workloads for a large number of Power or System p 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 Power or System p platforms using Red Hat Enterprise Linux. Customers have a choice of using hardware (LPARs, partitioning) or software (zVM, Xen virtualization) to control access to system resources.

FIGURE 2.3C: AGGREGATION DEPLOYMENT SCENARIO



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

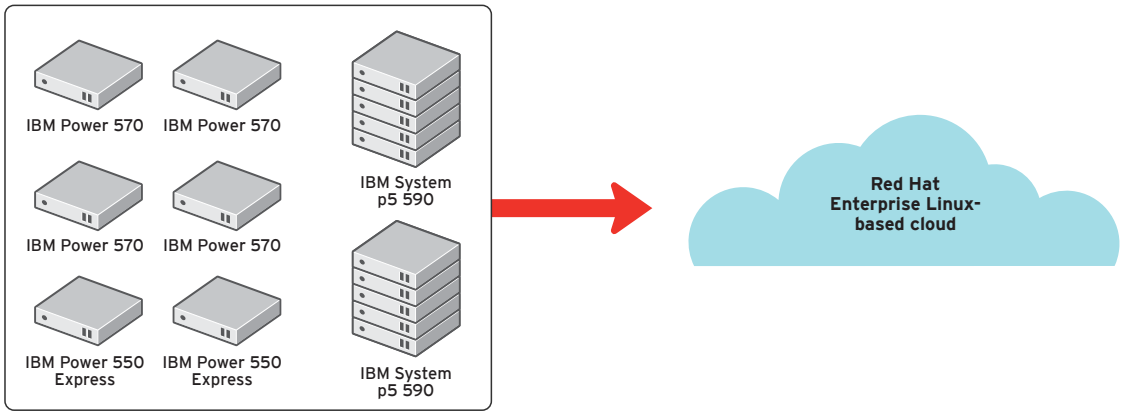
Disadvantages:

- Without prior investment in the platform, customer will incur a high capital hardware cost
- System maintenance requires downtime for multi-tier application

Cloud migration

In the cloud migration scenario, workloads on any number of Power or System p systems are migrated to run on Red Hat Enterprise Linux in a cloud computing environment (see Figure 2.3d). This may be an internal cloud created by the customer, or an external 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.

FIGURE 2.3D: CLOUD DEPLOYMENT SCENARIO



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 providing 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 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.

3.1 MIGRATION PROCESS OVERVIEW

The following table gives a high-level overview of the phases, deliverables, and durations involved in the migration planning process.

PHASE	DESCRIPTION	DELIVERABLES	TYPICAL DURATION
I: Infrastructure application analysis and standard build	This phase examines existing AIX infrastructure and administrative functionality and applications (the "As Is" architecture) to make recommendations for their equivalent capabilities in a Red Hat Enterprise Linux ecosystem. During this phase a standard operating environment build of Red Hat Enterprise Linux is created as a baseline "To Be" architecture.	• Infrastructure applications recommendations report • Enterprise standard build • High-level infrastructure	3–5 weeks
II: Functional applications analysis	This phase examines third-party functional / business applications (i.e., SAP, Oracle, custom applications) and makes recommendations for their equivalent capabilities in the Red Hat Enterprise Linux ecosystem.	• Functional applications recommendations report • High-level applications migration cost estimate	2–8 weeks (highly variable, depending on number 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 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	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.	• Server migration	TBD

3.2 PHASE I: INFRASTRUCTURE APPLICATIONS ANALYSIS AND STANDARD 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 broad ecosystem of certified third-party software vendors.

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 your environment. Examples include DNS, mail, provisioning, and backup software.

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, your 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 AIX to built-in functionality in Red Hat Enterprise Linux (e.g. Sendmail, NTP)
- Third-party ISV certified application on AIX to third-party ISV certified application on Red Hat Enterprise Linux (e.g. Veritas NetBackup, IBM Tivoli Storage Manager)
- AIX built-in functionality to third-party ISV certified application on Red Hat Enterprise Linux (e.g. mksysb)
- Third-party ISV certified application on AIX to built-in functionality in Red Hat Enterprise Linux (e.g. Veritas Clustering)
- Built-in functionality in AIX to alternative functionality in Red Hat Enterprise Linux (e.g. trace to systemtap)

Some applications will be directly portable to their Red Hat Enterprise Linux equivalent, while others may need to be re-implemented 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 AIX to Red Hat Enterprise Linux, though it is not a comprehensive listing.

TABLE 3.2A COMMON INFRASTRUCTURE APPLICATION MAPPING

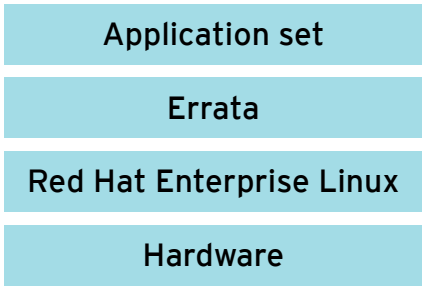
INFRASTRUCTURE COMPONENT	AS-IS AIX	TO-BE RED HAT ENTERPRISE LINUX
Provisioning	Network Installation Manager (NIM), mksysb	Kickstart, Red Hat Network/Satellite
Backup/restore	savevg/restorevg, sysback, backup/restore,	Tar, cpio, dump, restore, amanda, rsync
Network File Systems (NFS)	NFS/NFSv4	NFS/NFSv4
Drive/Directory mounting	Autofs	Autofs
Package management	LSLPP/Installp, bffcreate	RPM/YUM
Systems management	SMIT	Red Hat Network/Satellite
Device Management	cfgmgr	udev
Monitoring	IBM Tivoli® Monitoring	Red Hat Network/Satellite
Troubleshooting	raceT	Systemtap
Packet filtering firewall	p, IP Filter, NAT, IP Sec	Netfilter/IPtables
Intrusion detection	IPSec Filter Rules	AIDE
Identity management	IBM Tivoli Directory Server	Red Hat Directory Server
	IBM Tivoli Identity and Access Manager	Red Hat Certificate System
File systems	JFS, Enhanced JFS2, GPFS, LVM	Ext3/4, LVM, GFS, XFS
Virtualization	LPAR, DLPAR, PowerVM, Advanced Power Virtualization (APV)/ Micro-partitioning	Red Hat Enterprise Linux Virtualization (Xen, KVM), Red Hat Enterprise Virtualization
Storage multipath	MPIO	device-mapper-multipath
Job scheduling	IBM WebSphere MQ, IBM Tivoli Workload Scheduler	Red Hat MRG
Clustering	High Availability Cluster Multi-Processing (HACMP)	Red Hat Cluster Suite
Bare-metal recovery	mksysb	Kickstart, Red Hat Network/Satellite

Standard operating environment (SOE) build

A 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

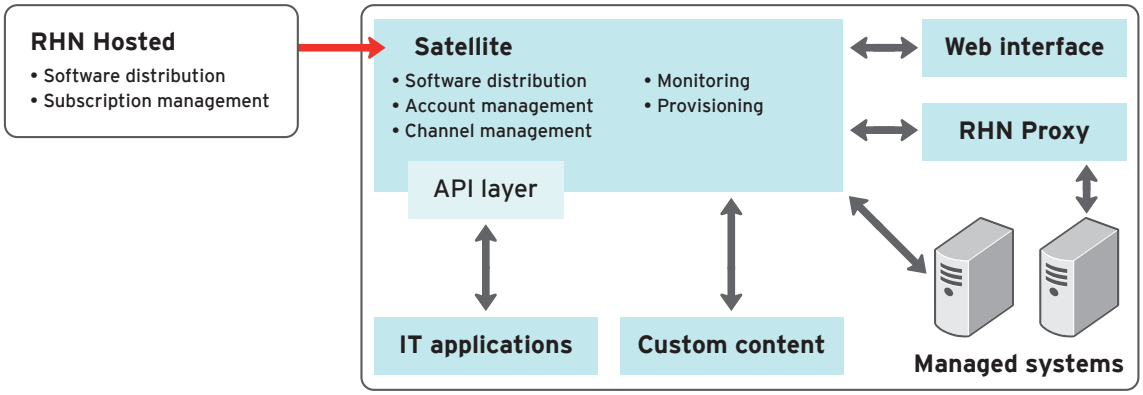


If standard hardware is not yet defined, the SOE build will be built on your current corporate standard hardware. Provisioning systems from bare-metal to the fully configured SOE build is accomplished through Red Hat Network Satellite (RHN Satellite) provisioning feature.

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 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 file(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 AIX 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 1: 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/or limitations
  - Vertical scalability requirements and/or limitations
  - Hardware utilization rates
- Security 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 2: Macro-level difficulty analysis

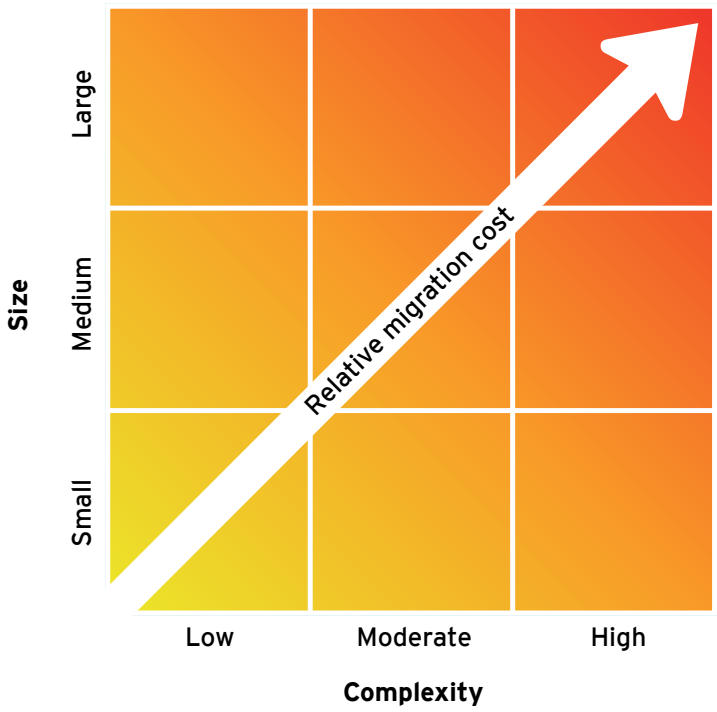
The second step in this process is to divide the functional applications into ISV applications (i.e. applications developed and written by an external software company) and custom applications (i.e. applications developed in-house or by a contracted third-party). Once this is done, then we can categorize the complexity of migration effort for each application at a macro level. We will class the effort as either low, moderate, or high based on the data we gathered in Step 1 and the general characteristics shown in Table 3.3a, shown 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.

Once the complexity rating has been established, the size of the application must be taken into account, particularly for custom-written applications. This allows for better judgments about application migration costs. When plotting application complexity vs. application 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 migration costs.

FIGURE 3.3B: APPLICATION COMPLEXITY VS. APPLICATION SIZE



Step 3: ISV application mapping

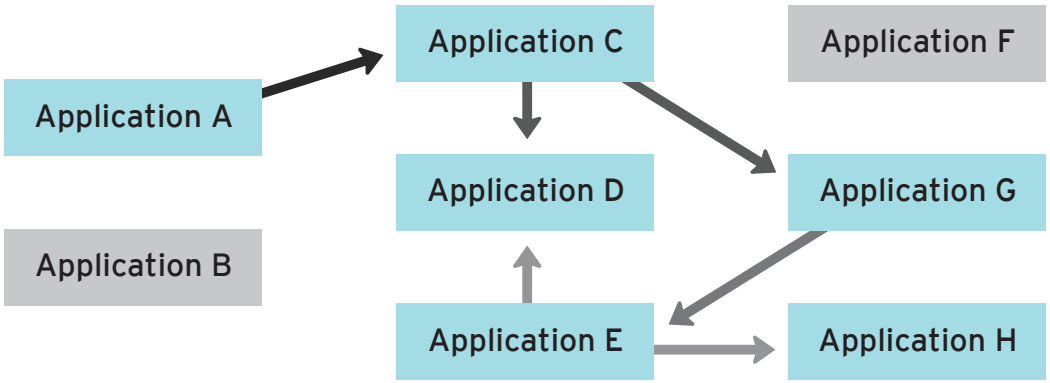
For ISV applications that are not able to be migrated due to the application or appropriate version not being available on Red Hat Enterprise Linux, a mapping exercise must be undertaken in order to replace their functionality.

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 (e.g., '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 4: Application 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 in 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.

FIGURE 3.3C: SAMPLE APPLICATION DEPENDENCY GRAPH



This process can be done manually or with the help of automated discovery tools available from various software vendors including HP, 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 5: Individual deployment scenario analysis

Conduct analysis to look at possible deployment scenarios for each application and its associated 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 Power or System p 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 Power or System p systems are distributed among a number of smaller x86-based systems running Red Hat Enterprise Linux.
- **Aggregation** - Workloads for a large number of Power or System p systems of various sizes are migrated into a single large fault-tolerant hardware platform where Red Hat Enterprise Linux can run (e.g. IBM zSeries mainframe, HP Superdome (Itanium)).
- **Cloud migration** - Workloads on any number of Power or System p systems are migrated to run on Red Hat Enterprise Linux in a cloud computing environment.

These deployment scenarios are often influenced by the application dependency information that was obtained in Step 4. 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 6: High-level application migration cost estimation

In the final step of this phase, the data gathered in steps 1 through 5 is analyzed to create a high-level migration cost estimate as well as a list of candidates for early migration pilots.

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, 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. They are an all-AIX shop and have decided to replace end-of-life hardware with x86 hardware running Red Hat Enterprise Linux. This scenario allows them to slowly close any skill gaps and approach workload migrations at a pace that they are comfortable with.

A SWOT analysis for this migration might look something like Table 3.4a.

TABLE 3.4A: SWOT ANALYSIS FOR COMPANY A

STRENGTHS	WEAKNESSES
1. The IT staff has been growing their Linux skills 2. Many of the same tools used to manage their AIX environment are similar on Enterprise Linux 3. Applications running in Java also run on Enterprise Linux	1. Reduced budget 2. The slow speed of migration may mask cost savings 3. Some IT staff members prefer the familiar legacy AIX toolsets for provisioning
OPPORTUNITIES	**THREATS**
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	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 AIX to Red Hat Enterprise Linux. The company has several thousand Power and System p 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 Power and System p 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

STRENGTHS	WEAKNESSES
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	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
OPPORTUNITIES	**THREATS**
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	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 recommendations will be given for 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 them, 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 AIX 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.

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 their system administrators with virtual Red Hat training where they learned about kickstart and Satellite without incurring travel costs. They also were able to work with a Red Hat consultant on-site to quickly deploy new systems, building the organization's confidence and allowing them to increase the pace of the migration. They were also able to determine that the replacement x86 hardware was more efficient, dramatically lowering their total cost of ownership (TCO) after analyzing their hardware acquisition costs and power and cooling data.

In contrast, 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	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.
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 their existing IT staff. The migration speed was also balanced by having an on-site Red Hat Dedicated Enterprise Engineer (DEE) and several consultants working side-by-side with existing staff to guide them, increasing the speed of the migration and reducing risk. 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 results 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 through 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
- 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 1: Consolidated analysis of existing hardware

The first step in generating the strategic migration roadmap is to perform a detailed analysis of the existing hardware supporting the applications to be migrated. Normally this step is relatively easy because much of the hardware environment data was gathered in Step 1 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 2: 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 5 of the functional application analysis phase, as well as the application dependency analysis data gathered in Step 4 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 OEM partners like IBM, Dell, HP, Cisco, or others to create a small number of common system architectures that the applications targeted for migration can be mapped to. This is usually based on the information gathered in Step 5 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 1 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 and which cannot. These factors also determine which virtualized application instances can be hosted on the same physical machine and which cannot. 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 3: 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 IBM Power or System p machines that can be migrated to a Red Hat Enterprise Linux x86 environment. The existing Power or System p 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 Power and System P 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.

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 7 of this section.

Step 4: 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 2 (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 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 5: Training plan creation

Now that target applications have been identified for migration, optimal physical deployment architectures 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 other ISV software training 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 is 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 6: Deep-dive analysis of large, high-complexity applications (optional)

At this point it may be ideal to go back and revisit the list of large, high-complexity applications that were identified in the macro-level difficulty analysis step of the functional application analysis phase. These applications 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 7: 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 AIX environment
- Cost of new functional ISV applications necessary to replace existing AIX 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 eliminating proprietary ISV applications and replacing them with open source applications
- Savings from redeployed hardware

Two things should be noted about this estimate:

1. It is still an estimate and may vary depending on the actual application 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 8: Master migration roadmap creation

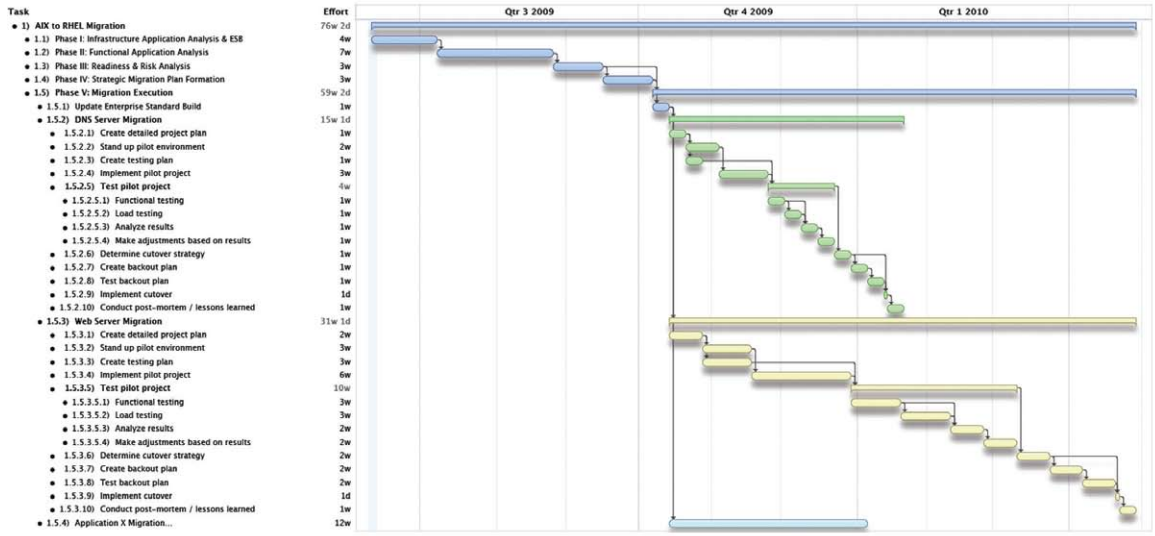
In the final step in this phase, the master migration roadmap (MMR) is created based upon the input from the previous seven steps. The MMR acts as a project plan that details when, where, and how the migration will occur.

The first thing that must be done in this step is 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 3.5A: SIMPLIFIED MIGRATION PROJECT PLAN



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 Service Solutions provide 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 better, implementation time is reduced, and as a result, the cost of the migration itself is lower. 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 helping customers do more with less by fully utilizing the value of their subscriptions. Our global team of consultants is composed of 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 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

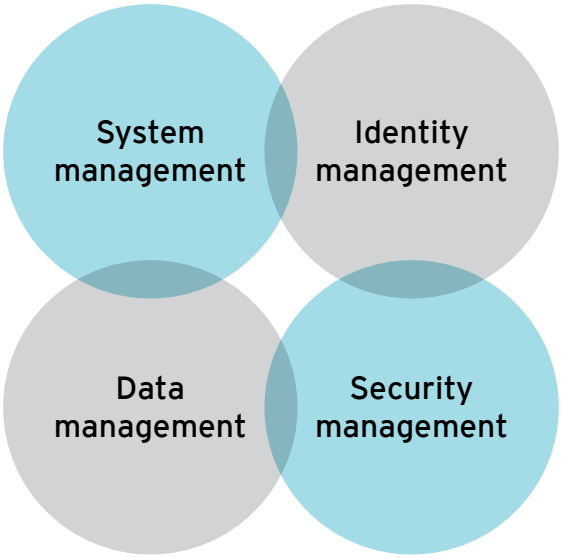
With all migration efforts, having a solid infrastructure that provides a scalable foundation is the first step. Red Hat infrastructure migration planning services provide a detailed evaluation of your IT environment and deliver strategic recommendations for simplifying your IT infrastructure as you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

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:

- **Simplified architecture:** One code base that can be deployed on different branches and services. Support different platforms (workstations, servers, or mainframes) 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.
- **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
- Public Key Infrastructure (PKI)
- Policy creation and enforcement

Data management: Determines and documents availability requirements for migrated services. The architect will design a strategy for meeting those requirements with a mixture of storage and clustering technologies.

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 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 services**
  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 services**
  Are you potentially moving between middleware platforms during the application migration?
- **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 learnings from the steps above and commences the application migration. This phase is exceptionally critical in that it provides the opportunity to design the migrated application 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

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

Throughout the effort, requirements can be refined to meet new functionalities 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.

Red Hat Consulting
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redhatconsulting@redhat.com
www.redhat.com/consulting

4.3 TRAINING

When migrating platforms, it is critical to ensure that you have a skilled staff who can maximize performance beyond initial deployment. Training leads to rapid, successful deployments and ensures your staff has the skills and knowledge to keep your IT organization running smoothly. Red Hat offers hands-on training in classroom, virtual, and corporate on-site settings to help organizations acquire optimal management techniques and effective troubleshooting strategies.

Red Hat Linux System Administration and RHCT Exam (RH133): Red Hat Linux System Administration is an intensive, hands-on course that teaches proper management of a Linux workstation or server including installation, configuration of local components and services as well as connections to existing network services. The course also includes the Red Hat Certified Technician exam, a performance-based exam that tests skills in installing, configuring, and troubleshooting Red Hat Enterprise Linux. For more information, visit **redhat.com/courses/rh133_red_hat_linux_system_administration_and_rhct_exam**

Linux Troubleshooting Techniques and Tools (RH142): The Linux Troubleshooting Techniques and Tools course teaches techniques to identify, diagnose, and resolve problems on a Red Hat Enterprise Linux system and take preventative action to avoid problems. Targeted to experienced Linux system administrators, the course deepens an administrator's understanding of troubleshooting on Red Hat Enterprise Linux. Participants will have the opportunity to debug live systems, exercising their new troubleshooting skills on a working system. For a complete course overview, visit **redhat.com/courses/rh142_linux_troubleshooting_and_tools/**

Additional Training: 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 that covers them:

TABLE 4.31 RED HAT TRAINING (SEE APPENDIX B 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, RH318, RH401
Storage multi-path	RH436
Job scheduling	RH442
Clustering	RH436
Backup	RH442
Bare-metal recovery	RH401

The courses listed here are not exhaustive. To access a complete, interactive or PDF/printer-friendly version of the complete course catalog please visit **redhat.com/training/catalog/**.

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 **redhat.com/apps/training/assess/**

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 RHCT® 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 computing. For more information on Red Hat Certifications, including the RHCE, visit **redhat.com/certification**.

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.

UNION BANK, N.A.

Union Bank, N.A., headquartered in San Francisco, is a full-service commercial bank providing an array of financial services to individuals, small businesses, middle-market companies, and major corporations. Union Bank is California's fifth-largest bank by deposits. The bank has 335 banking offices in California, Oregon, and Washington and two international offices. Its holding company, UnionBanCal Corporation, is the 16th largest commercial bank holding company in the U.S. based on assets at March 31, 2009.

Union Bank migrated its operating system from AIX to Red Hat Enterprise Linux and WebSphere to JBoss to support its mission critical applications at an improved price with greater performance and less up-keep. Union Bank used open source solutions to increase time to market, reliability, and return on investment.

Industry: Financial services

Geography: Headquarters: San Francisco, CA

Business challenge: An aging and costly IT infrastructure was impeding the ability of Union Bank to scale to growth and respond agilely to changing market dynamics

Migration path: UNIX on high-end RISC machines to Red Hat Enterprise Linux running on Intel Xeon-based HP servers; WebSphere to JBoss Enterprise Application Platform.

Software: Red Hat Enterprise Linux, Red Hat Network Satellite, JBoss Enterprise Application Platform, JBoss Seam, JBoss Hibernate, Red Hat Consulting

Hardware: More than 150 Intel Xeon processor-based HP ProLiant servers

Benefits: Improve reliability and scalability, cut costs, and deliver new financial services and products to market faster

Opportunity

When Mok Choe joined Union Bank in early 2007 as chief technology officer, the Union Bank IT infrastructure faced a host of challenges similar to those of many other companies at the time, mainly increasing costs and resources associated with the maintenance and upkeep of legacy systems.

Over the years, Union Bank's IT infrastructure had grown increasingly large, cumbersome, and complex. Not only was it costly to operate and maintain, but it couldn't scale to accommodate the bank's rapid expansion into new markets. System availability was also a continuing challenge. And as the financial services industry expanded into electronic banking products, Union Bank's reliance on IT was increasing. The bank thus required an IT infrastructure that could speed new products to market with rock-solid reliability and availability, and which could also scale as needed.

The hardware environment embraced a "big box" approach with a few massive servers at strategic locations that offered little relief when significant impacts occurred. This environment required tremendous overhead with constant monitoring and management of server problems.

The IT department at Union Bank was also under pressure to reduce the total cost of ownership (TCO) of its overall IT operations. The solution needed to deliver a robust disaster recovery environment with minimal mean-time-to-restore (MTTR) and maximum mean-time-between-failures (MTBF) times. Finally, the solution needed to better leverage Union Bank's most highly skilled IT workers. By enabling valued staff workers to reduce the day-to-day support required by overhead-intensive legacy systems, productivity would improve, and the bank's IT department could move from a reaction to proactive support model.

"First and foremost, we needed to improve system availability," said Choe. "Secondly, we needed to speed time to market of new financial services products. And at the end of the day, we needed to decrease the cost per transaction of delivering services."

Solution

Union Bank immediately focused on the task of establishing a new and innovative technology environment. The first decision: to create a new open source-based enterprise-wide IT platform to obtain improved availability, agility, scalability, and reduced TCO, while enabling the support of the bank's growing IT needs and better alignment with the bank's overall business plan.

"We did three specific things," said Choe. "First, we migrated our entire Web-based infrastructure over to Red Hat Enterprise Linux so we could go from a scale-up to a scale-out architecture. Next, we ported our teller platform over to JBoss. And third, we wrote a brand new Web-based cash management application built on the entire Red Hat technology stack: Red Hat Enterprise Linux, JBoss, Hibernate, and SEAM."

The strategy started at the operating platform level by replacing the aging UNIX-based RISC servers with commodity x86 machines running Red Hat Enterprise Linux, and migrating to JBoss Enterprise Application Platform at the application server level. Union Bank initially utilized Red Hat Network to set up centralized, secure management of its Red Hat Enterprise Linux systems.

Union Bank took advantage of Red Hat Consulting to assist the IT group with the initial design of the first phases of deploying the new architecture and Web-based applications. The bank's infrastructure and application development teams attended Red Hat Training to learn valuable tools and lessons on integration and migration issues.

The new strategy also encompassed building a new data center that leveraged virtualization technology on top of Red Hat Enterprise Linux to dramatically reduce the bank's hardware footprint. "The bank is very serious about its green initiative, and Red Hat Enterprise Linux is a key part of that," said Choe.

One of the most strategic projects was to replace the bank's operating system environment on branch teller systems with JBoss Enterprise Application Platform running on Red Hat Enterprise Linux. Within just months, the Union Bank development staff was able to create a "silent" JBoss deployment package and distribute it remotely to over 330 production branch servers.

"The JBoss-based teller application has been running successfully at the 330 branch sites ever since," said Choe, "The small footprint of JBoss has freed up much needed space on each branch server and has laid the ground work for future expansion. We plan to migrate other customer-facing web applications from WebSphere to JBoss Enterprise Application Platform."

Benefits

Union Bank's innovative approach to its IT re-architecture has resulted in improvements to system availability, scalability, and resiliency; increased ROI; enhanced security, provisioning, and configuration management; and improved time to market.

The most significant benefits have been improved system availability and resiliency. Upon migrating to Red Hat Enterprise Linux, there have been improvements of the bank's hardware infrastructure, as seen by improved mean-time-to restore (MTTR) and mean-time-between-failures (MTBF).

The return on investment (ROI) was also substantial. For example, the large RISC machines were running at less than 50 percent capacity. To ensure redundancy, the bank needed to double its hardware investment to allow for fail over. "With Red Hat's commodity model, we were able to spread the load over multiple machines and reduce our overall spend by approximately 80 percent," said Choe. "And these savings don't take into account the reduced maintenance costs of moving to the Red Hat platform, which is easier—and therefore cheaper—to maintain."

Additionally, because application performance increased significantly under the new JBoss and Red Hat architecture, the bank was able to reduce the time-to-market of new products. The bank was also able to improve customer service by boosting the performance of its teller application. "The success of that project gives us confidence to tackle the rest of our browser-based Web applications with a JBoss solution," said Choe.

The move from a vertical to a horizontal architecture and process enhancement have improved both system availability and resiliency, which allows the bank to absorb normal glitches without impacting customer transactions. "The reliability of our Web applications has improved to the point where I can go to our business partners and confidently say we have better than 'four 9s' availability," said Choe.

The Red Hat/JBoss solution requires less maintenance and enables Union Bank IT to reduce their efforts on day-to-day support of legacy systems, allowing for better resource utilization. This also helped the IT group move from a reactive to a proactive model more expediently.

Additionally, the bank's overall cost-per-transaction declined 25 to 40 percent, something that Union Bank's business centers appreciate. "We have a charge-back system in which our departments pay for the IT resources they consume," said Choe. "They've seen their charges go down month by month."

"We benefited greatly from Red Hat consulting services as they provided valuable input and assistance in helping us migrate to Red Hat technology and dramatically improved our ability to achieve our goals," said Choe. "With Red Hat Consulting, we felt there was an immediate knowledge transfer, and we were very satisfied with the level of involvement and quality of knowledge provided to our team."

And ultimately many of the ongoing benefits that Choe expects to reap in coming years as a result of transforming the bank's IT operations come from his expanded technology options. "We've achieved tremendous cost, reliability, and availability benefits, but in the end it all comes back to the fact that we now have choices when it comes to deploying hardware and software," he said. "We're no longer locked into using a particular product or vendor. Open source—and by extension, Red Hat—makes that possible."

"The high costs and overhead associated with legacy proprietary-software and infrastructure led us to the decision to deploy Red Hat and JBoss open source solutions, and this allowed us to provide core infrastructure and development platforms at a significantly lower cost and at a faster rate," said Choe. "Our use of Red Hat and JBoss solutions demonstrate creative business innovation through the use of horizontal architecture and the improvements allow Union Bank to continue to increase our customer experiences."

FLORIDA HOSPITAL

With eight facilities, 18,000 employees, and over 3,000 beds throughout Central Florida, Florida Hospital is the largest hospital and is the second largest employer in the state. Florida Hospital sees more patients through its Emergency Room than any other hospital in the U.S. Established in 1908, the hospital provides care to more than one million patients each year and is part of the Adventist Healthcare System—the largest not-for-profit healthcare provider in the nation. Florida Hospital's MIS Department, which includes approximately 100 developers, manages one centralized datacenter for all of its facilities, making it one of the busiest centers in Central Florida. Its over 500 servers and 350 applications are responsible for the life-critical healthcare-delivery machines that rely on its systems. The hospital is also known for its excellent quality of healthcare. US News and World Report magazine has ranked Florida Hospital as one of "America's Best Hospitals" consecutively for the past six years.

Industry: Healthcare

Geography: Orlando, Fla.

Business Challenge: Design a new disaster-recovery system that would ensure seamless business continuity for the hospital; determine a solution to aid in delivering high-performance, secure, cost-effective systems to ensure optimized patient care; identify a solution to enable internal hosting and support for the growing number of external websites

Migration Path: IBM AIX to Red Hat Enterprise Linux

Software: Red Hat Enterprise Linux Advanced Platform with integrated virtualization, Red Hat Global File System and Cluster Suite; Red Hat Network Satellite; JBoss Enterprise Application Platform; JBoss Operations Network, Red Hat Consulting; MySQL, Oracle, Caché, 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; achieved 35 percent growth in its datacenter without needing to expand its hardware footprint or internal resources through its use of virtualization; gained expertise through the knowledge transfer resulting from virtualization and clustering-focused engagements with Red Hat Consulting

> **"Our first priority is security and our second is performance. When you can get security and performance needs met, and it costs less than the alternative, you go for it. That's the quadrant that Red Hat Enterprise Linux plays in."**
>
> — Barbara Schleider, director of Technology Services, Management Information Systems (MIS) at Florida Hospital

Opportunity

To deliver the best patient care, Florida Hospital is constantly evaluating and improving its IT systems—ensuring the most reliable, high-performance infrastructure is always in place. In the mid 1990s, the hospital decided to undergo a new Web initiative to publish its internal applications to the Internet, but the project soon became cost-prohibitive.

Additionally, Florida Hospital's IT infrastructure was becoming extremely complex with over 300 different places where patient records could be stored. Data stored on the system must be instantly accessible in locations across the hospital, mandating a high-performance and scalable platform for its IT infrastructure.

"As our environment grew, we couldn't afford to use an expensive proprietary operating systems anymore," said Jack Velazquez, Sr. Systems Engineer for the Open Systems Team at Florida Hospital. In addition, the hospital began reevaluating its disaster recovery system. As part of the patient-care continuum, Florida Hospital's IT must be highly available and highly recoverable. "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.

"With the highly transactional nature of Florida Hospital's business and our need to access patient data with immediacy, we needed a solution that could provide high performance, reliability, and secure backup and recovery," said Barbara Schleider, director of Technology Services, Management Information Systems (MIS) at Florida Hospital. "Our first priority is security and our second is performance. When you can get security and performance needs met, and it costs less than the alternative, you go for it. That's the quadrant that Red Hat Enterprise Linux plays in."

Solution

Initially, Florida Hospital turned to Red Hat because it provided the combination of high performance, security, and cost efficiencies it needed for its Web initiative, but it quickly 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 the Red Hat Network Satellite, Red Hat Cluster Suite, and Red Hat Global File System (GFS) to restructure the way its disaster recovery system was designed and managed.

Today, 116 HP and IBM servers run Red Hat Enterprise Linux Advanced Platform, which runs a number of databases, including the hospital's eight-terabyte Oracle data warehouse. Red Hat Enterprise Linux also runs JBoss Enterprise Application Platform 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. Though millions of transactions are processed each day at Florida Hospital, today it only takes minutes to back up the Red Hat Enterprise Linux servers." 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.

As part of its evolutionary partnership with Red Hat, Florida Hospital also implemented the virtualization technology delivered as an integrated part of the Red Hat Enterprise Linux Advanced Platform operating system. "With Red Hat virtualization, we've been able to manage 35 percent growth in our datacenter without augmenting our hardware infrastructure or staff. We've done some exceptional things with virtualization," said Schleider.

To date, Florida Hospital's servers running Red Hat Enterprise Linux have produced over 1,200 days of solid uptime, thriving despite a number of serious datacenter challenges, including air conditioning malfunctions that caused the server room to overheat. "Our Red Hat Enterprise Linux systems have been very resilient and have survived the most catastrophic conditions with great stability. We've never had a problem with our Red Hat Enterprise Linux servers—it's really a self-sufficient datacenter," said Velazquez.

The Open Systems Team also implemented Red Hat Network Satellite to facilitate infrastructure management, security compliance, and new system deployment. "Red Hat Network Satellite 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 Satellite tracks all system activities, making it possible for the Open Systems Team to provide detailed reports for HIPAA compliance.

To provide expertise during its virtualization and clustering deployments, Florida Hospital relied upon Red Hat Consulting. "The knowledge transfer that resulted from our work with our Red Hat consultants was extremely valuable," said Velazquez.

"As a mission-oriented, non-profit organization, we're conscious of financial stewardship and had not used outside consulting previously," said Schleider. "We saw the value of investing in Red Hat Consulting and we made the right decision—the expertise we gained from the Red Hat Consulting experience helped us achieve our goals and work toward our mission."

Benefits

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 the data and one hour to recover.

Having faced the challenge of growing numbers of external websites being developed by third parties that translated into mounting expenses, using Red Hat Enterprise Linux Advanced Platform with integrated virtualization technology, the team was able to start migrating these sites to internal hosting. To date, 89 websites have been migrated in-house, providing expanded security and reduced costs for the hospital's IT infrastructure.

"The strength of Red Hat virtualization for us has really been through paravirtualization," said Velazquez. "It blows the performance of other virtualization solutions on the market away."

Florida Hospital also experienced significant efficiency gains from its Red Hat deployment. "Red Hat Network Satellite makes it possible for us to manage 110 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 Consulting helped the Open Services Team to implement the Linux disaster-recovery system, helping them build and break clusters during on-site training. "Thanks to Red Hat Consulting 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. Red Hat Enterprise Linux makes it possible to meet cost pressures, but also still meet mission-critical demands," said Velazquez.

"There's nothing more critical than lives at risk, so our systems must be highly recoverable. Having highly available systems means that Florida Hospital can deliver the quality care that our patients need," said Schleider.

For more customer references, please visit **customers.redhat.com**.

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 understanding 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:

1. Examine existing AIX architecture and determine the equivalent capabilities in the Red Hat Enterprise Linux ecosystem.
2. Examine third-party functional and business applications and determine the equivalent capabilities in the Red Hat Enterprise Linux ecosystem.
3. Measure organizational readiness and overall migration risk.
4. Develop a strategic migration plan, including a detailed road map and cost estimate.
5. 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.

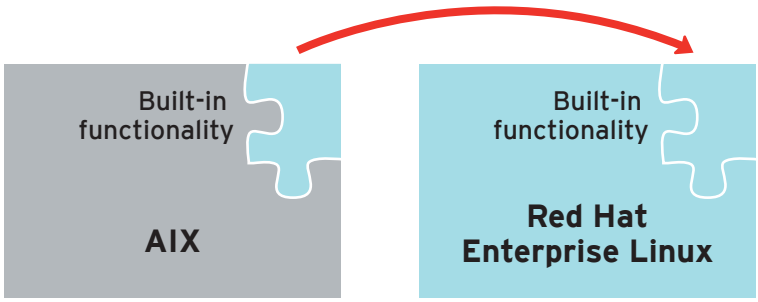
When you are ready to embark on your AIX to Red Hat Enterprise Linux migration, we encourage you to give us a call to discuss how Red Hat can help you make the right decisions from the start, reduce risk, and accelerate the impact of your deployed technology.

APPENDIX A – MIGRATION SCENARIO DETAIL

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

In this scenario, functionality built into AIX 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. Sendmail or NTP), there are few, if any, challenges to migration.

FIGURE 2.2A: AIX FUNCTIONALITY TO ENTERPRISE LINUX FUNCTIONALITY



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 AIX versus Red Hat Enterprise Linux. For instance, AIX 6.1 ships with Sendmail-8.13.4 while Red Hat Enterprise Linux 5.4 ships with Sendmail-8.13.8-2.

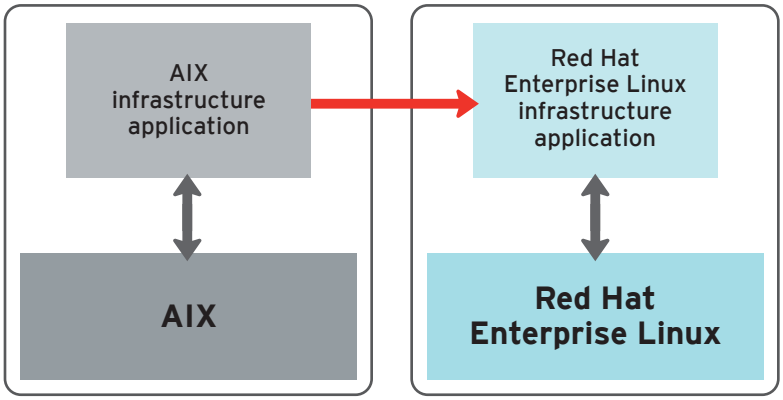
- **Syntactic differences:**
  Typically there are changes in the way certain things are invoked that can vary in their level of impact. For instance, the utility grep is widely used in both UNIX and Linux environments for administrative tasks and scripting. However, the version included with AIX 6.1 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.

- **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, software management is done through Installp in AIX, whereas Red Hat Enterprise Linux uses yum with RPM packages.

SCENARIO TWO: AIX INFRASTRUCTURE APPLICATION TO RED HAT ENTERPRISE LINUX INFRASTRUCTURE APPLICATION

Another relatively common scenario is moving from an external infrastructure application on AIX to a comparable infrastructure application running on Red Hat Enterprise Linux (see Figure 2.2b). For instance, a customer may be running Veritas™ NetBackup™ or IBM® Tivoli Storage Manager on AIX and want to continue to do so after migrating to Red Hat Enterprise Linux.

FIGURE 2.2B: AIX INFRASTRUCTURE APPLICATION TO ENTERPRISE LINUX INFRASTRUCTURE APPLICATION



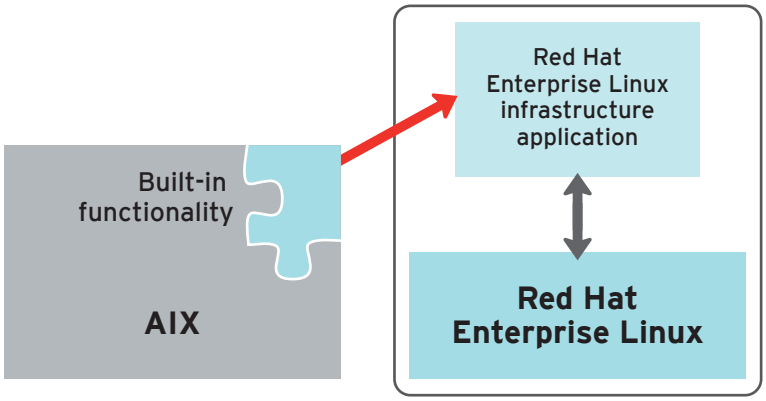
Similar to built-in functionality, there are three common situations presented in this scenario:

- **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 Services 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 AIX but not on Red Hat Enterprise Linux.** This situation is clearly the most problematic of the three. In most cases, an alternative application must be found to compensate for the functionality of the application available for AIX. With more than 3,400 ISV applications certified for Red Hat Enterprise Linux, it is usually easy to find a suitable replacement.

SCENARIO THREE: AIX FUNCTIONALITY TO INFRASTRUCTURE APPLICATION

In a small number of circumstances, AIX has built-in functionality that Red Hat Enterprise Linux does not (see Figure 2.2c). For instance, to achieve the functionality of a bare-metal OS recovery using mksysb in AIX, an application such as Veritas NetBackup 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 2.2C: AIX FUNCTIONALITY TO ENTERPRISE LINUX INFRASTRUCTURE APPLICATION

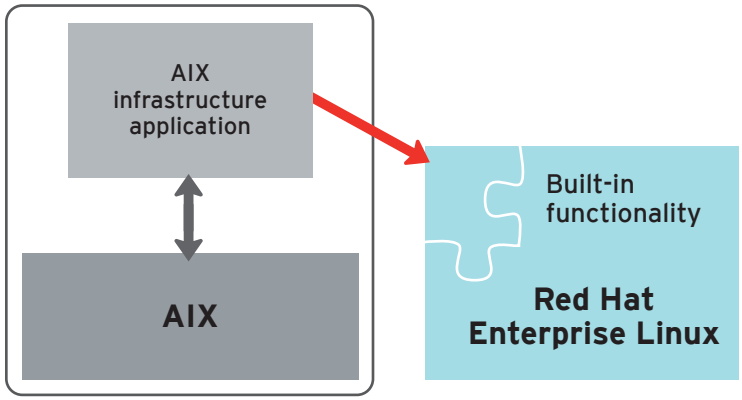


Normally it is not a major challenge to locate an open source or proprietary product with comparable features to the functionality in AIX. Obviously, the potential costs must be taken into account in the migration planning. But in most circumstances, there are low-cost open source alternatives that can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

SCENARIO FOUR: INFRASTRUCTURE APPLICATION TO BUILT-IN FUNCTIONALITY

In this migration scenario there is an AIX infrastructure application necessary in a AIX environment that is not needed, as Red Hat Enterprise Linux contains its own version of the functionality. For example, Veritas Cluster on AIX is not needed, as Red Hat Enterprise Linux 5 AP includes Red Hat Cluster Suite.

FIGURE 2.2D: AIX INFRASTRUCTURE APPLICATION TO ENTERPRISE LINUX FUNCTIONALITY

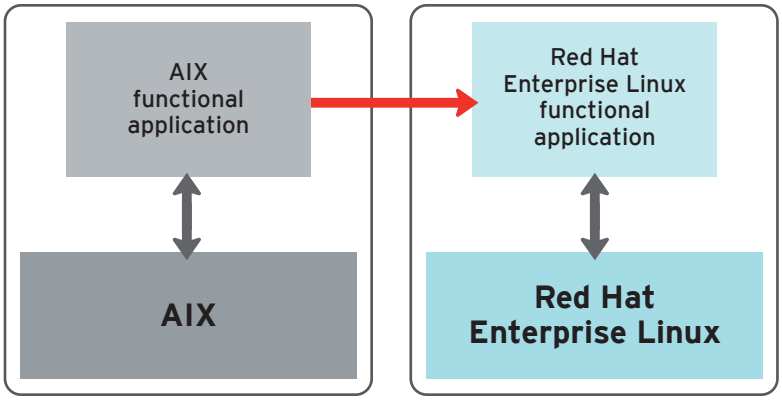


In this situation, substantial cost savings can often be realized given the wide variety of functionality that is built into the price of a Red Hat Enterprise Linux subscription.

SCENARIO FIVE: FUNCTIONAL APPLICATION TO FUNCTIONAL APPLICATION

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

FIGURE 2.2E: AIX FUNCTIONAL APPLICATION TO ENTERPRISE LINUX FUNCTIONAL APPLICATION



A migration of ISV functional applications has very similar characteristics to Scenario 2 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 – RED HAT TRAINING CURRICULUM

Selected Red Hat course listings for AIX to Red Hat Enterprise Linux migration include:

COURSE CODE	TITLE
RH033	Red Hat Linux Essentials
RH131	Red Hat Linux System Administration
RH133	Red Hat Linux System Administration (and RHCT Exam)
RH142	Linux Troubleshooting Techniques and Tools
RH145	Red Hat Directory Server Administration
RH184	Red Hat Enterprise Linux Virtualization
RH253	Red Hat Linux Networking and Security Administration
RH300	RHCE Rapid Track Course (and RHCE Exam)
RH301	Red Hat Linux Rapid Track Course
RH318	Red Hat Enterprise Virtualization
RHS333	Red Hat Enterprise Security: Network Services
RH320	Red Hat Apache and Secure Web Server Administration
RH401	Red Hat Enterprise Deployment, Virtualization, and Systems Management
RH423	Red Hat Enterprise Directory Services and Authentication
RHS429	Red Hat Enterprise SELinux Policy Administration
RHS435	Red Hat Enterprise Certificate Management
RH436	Red Hat Enterprise Clustering and Storage Management
RH442	Red Hat Enterprise System Monitoring and Performance Tuning
RHD143	Red Hat Linux Programming Essentials
RHD221	Red Hat Linux Device Drivers
RHD236	Red Hat Linux Kernel Internals

Please see **redhat.com/courses** for a comprehensive course listing and detailed course descriptions.

APPENDIX C – OTHER TOOLS

HARDWARE CERTIFICATIONS:

→ hardware.redhat.com/

KNOWLEDGEBASE:

→ kbase.redhat.com/faq/en

REFERENCE MATERIAL:

→ customers.redhat.com/

→ redhat.com/docs/

→ magazine.redhat.com/

Red Hat Consulting Resource Center:
→ redhat.com/consulting/resources

SOFTWARE COMPATIBILITY LIST:

→ redhat.com/rhel/compatibility/software/

TCO/ROI CALCULATORS:

→ roianalyst.alinean.com/intel_migration/

→ tinyurl.com/cws2wh

→ redhat.com/promo/corebuild

TRAINING:

Self assessment
→ redhat.com/apps/training/assess/

ROI calculator
→ redhat.com/training/corporate/roi_calc.html

Detailed course catalog
→ redhat.com/training/catalog/

Red Hat Training Resource Center
→ redhat.com/training/resources

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