

A Forrester Total Economic Impact™
Study Commissioned By Red Hat
July 2019

The Total Economic Impact™ Of Red Hat Virtualization

The Business Case Of A Large Financial
Services Company

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Executive Summary

Key Benefits



Capex and opex savings



Custom development cost savings



Reduced incident resolution efforts



“After the initial roll out of Red Hat Virtualization three years ago, we grew our Linux environment more than threefold. One of our selection criteria for new third-party applications even became the question of whether or not the application is running on a Linux operating system.”

IT director, large financial service provider

As organizations' environments continue to grow in scale and complexity, infrastructure and operations professionals seek solutions that meet these growing challenges. Abstraction is key, with a heavy focus on composable infrastructure. Virtualization is a core component of the abstraction landscape.

Red Hat Virtualization is a software-defined platform for virtualized Linux and Windows environments, built on Red Hat Enterprise Linux and kernel-based virtual machine (KVM) technologies. The platform suits both organizations that are starting new virtualization initiatives and those that are migrating from other virtualization technologies. In addition to infrastructure virtualization, Red Hat Virtualization sets a foundation for organizations that are considering deploying future technologies like containers and cloud-enabled workloads.

Red Hat commissioned Forrester Consulting to conduct a Total Economic Impact™ (TEI) study and examine the potential ROI that enterprises may realize by deploying Red Hat Virtualization. The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of Red Hat Virtualization on their organizations.

To better understand the benefits, costs, and risks associated with investing in Red Hat Virtualization, Forrester interviewed a large financial services company that has been using Red Hat Virtualization for its Linux environment over three years. The organization runs about 25% of its mission-critical workloads on the virtualized Linux environment.

Prior to using Red Hat Virtualization, the interviewed company used another proprietary virtualization solution for its Linux and Windows environments. However, with a fast-growing footprint, the organization was looking for a flexible and more cost-efficient alternative.

Key Findings

Quantified benefits. The following benefits are representative of those experienced by the interviewed company. The financial impact estimates are indicated as three-year, risk-adjusted present values (PV).

- › **Capex savings.** One of the main objectives of the interviewed organization, for migrating its entire Linux environment to Red Hat Virtualization, was capex savings. With its previous virtualization solution, the company had to pay upfront license fees plus annual maintenance and support fees. The usage of Red Hat Virtualization, however, does not require any upfront investment in licenses, but is rather based on a pure subscription model with recurring fees. With a growing Linux environment over the three years of the analysis, the capex savings have an estimated PV of approximately \$486,000 for the interviewed organization.



ROI
71%



Benefits PV
\$995,000



NPV
\$411,000



Payback
16 months

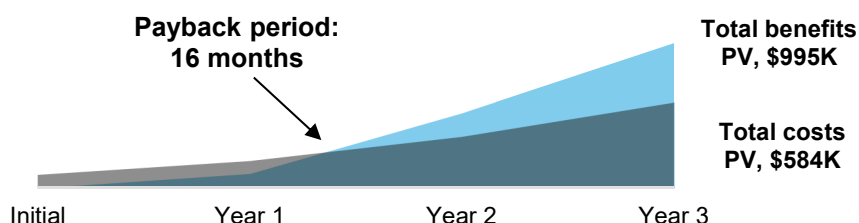
- › **Opex savings.** In addition to the above capex savings, the interviewed organization also reported opex savings due to the migration to Red Hat Virtualization. The group saved and avoided ongoing maintenance and support costs from the legacy virtualization vendor, which also included extra fees for the usage of Red Hat CloudForms — a management tool for virtual and private cloud infrastructure. With the Red Hat Virtualization Suite, Red Hat CloudForms is included and no other extra fees apply. Over three years, the opex savings have an estimated PV of approximately \$495,000 for the interviewed organization.
- › **Development cost savings.** The interviewed organization found the disaster recovery (DR) capabilities of Red Hat Virtualization more flexible and easier to maintain, as compared to the custom DR solution they had built with their legacy virtualization product. The company estimates that it saves approximately 200 hours of developer time each year. Over three years, the custom development cost savings have an estimated PV of approximately \$7,100 for the interviewed organization.
- › **Reduced incident resolution efforts.** The interviewed organization found that the Red Hat Virtualization environment is running more stable than the legacy virtualization environment. Since the introduction of Red Hat Virtualization, the company noted fewer incidents, such as unresponsive virtual machines (VMs). While these incidents did not directly impact the company's business, the reduction in incidents saves the infrastructure team time and effort, resulting in an estimated three-year PV of approximately \$6,700.

Costs. The interviewed organization experienced the following risk-adjusted PV costs:

- › **Technology costs.** These costs represent the Red Hat Premium subscription fees for Red Hat Virtualization, Red Hat CloudForms, and Red Hat Ansible Tower. Based on both the growing number of Linux VMs (from 300 in Year 1 to 950 in Year 3) and the list prices provided by Red Hat, a three-year, risk-adjusted PV of approximately \$469,000 has been estimated for the interviewed organization.
- › **Deployment and training costs.** These costs account for the initial efforts of the Red Hat Virtualization deployment and the initial migration of the 300 Linux VMs. They also include costs for the training of eight IT staff and some extra external consultancy costs. In total, these costs have an estimated three-year, risk-adjusted PV of \$115,000.

Forrester's interview with this financial service provider and subsequent financial analysis found that this organization experienced estimated benefits of \$995,000 over three years versus estimated costs of \$584,000, adding up to a net present value (NPV) of \$411,000 and an ROI of 71%.

Financial Summary



The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

TEI Framework And Methodology

From the information provided in the interview, Forrester has constructed a Total Economic Impact™ (TEI) framework for those organizations considering implementing Red Hat Virtualization.

The objective of the framework is to identify the cost, benefit, flexibility, and risk factors that affect the investment decision. Forrester took a multistep approach to evaluate the impact that Red Hat Virtualization can have on an organization:



DUE DILIGENCE

Interviewed Red Hat stakeholders and Forrester analysts to gather data relative to Red Hat Virtualization.



CUSTOMER INTERVIEW

Interviewed one organization using Red Hat Virtualization to obtain data with respect to costs, benefits, and risks.



FINANCIAL MODEL FRAMEWORK

Constructed a financial model representative of the interview using the TEI methodology and risk-adjusted the financial model based on issues and concerns of the interviewed organization.



CASE STUDY

Employed four fundamental elements of TEI in modeling Red Hat Virtualization's impact: benefits, costs, flexibility, and risks. Given the increasing sophistication that enterprises have regarding ROI analyses related to IT investments, Forrester's TEI methodology serves to provide a complete picture of the total economic impact of purchase decisions. Please see Appendix A for additional information on the TEI methodology.

DISCLOSURES

Readers should be aware of the following:

This study is commissioned by Red Hat and delivered by Forrester Consulting. It is not meant to be used as a competitive analysis.

Forrester makes no assumptions as to the potential ROI that other organizations will receive. Forrester strongly advises that readers use their own estimates within the framework provided in the report to determine the appropriateness of an investment in Red Hat Virtualization.

Red Hat reviewed and provided feedback to Forrester, but Forrester maintains editorial control over the study and its findings and does not accept changes to the study that contradict Forrester's findings or obscure the meaning of the study.

Red Hat provided the customer name for the interview but did not participate in the interview.

The Red Hat Virtualization Customer Journey

BEFORE AND AFTER THE RED HAT VIRTUALIZATION INVESTMENT

Interviewed Organization

For this study, Forrester interviewed the IT director responsible for the Unix, Linux, and mainframe systems at a large financial services company with more than 15 million customers. The company's technology department employs over 1,500 people and serves as an IT service provider to the rest of the organization. It develops software and manages all infrastructure and facilities for the group.

Key Challenges And Objectives

Prior to deploying Red Hat Virtualization, the company used another proprietary virtualization solution for its Linux and Windows environments. Twenty-five percent of the company's mission-critical workloads including fraud, internet, and mobile banking applications run on Linux operating systems. However, the technology group wanted to:

- › **Continue to grow the Linux environment in a more cost-efficient way.** With a quickly increasing Linux footprint, the company was looking for a flexible and more cost-efficient virtualization alternative.
- › **Simplify their disaster recovery solution.** The technology group had developed its own, custom disaster recovery solution but found it somewhat rigid and difficult to maintain.
- › **Attract talent.** The technology group was generally inclined to using modern, innovative technologies including open source solutions in order to attract and retain talent.

Key Results

Having used other Red Hat products for years, the technology group decided to deploy Red Hat Virtualization and use it to manage the entire Linux environment. The interview revealed that key results from the Red Hat Virtualization investment include:

- › **Capex and opex savings.** Due to the move from an upfront license model with annual maintenance and support costs to Red Hat's subscription-based model, the interviewed organization estimated that it would have had to pay more than twice as much if it had stayed with its legacy virtualization solution.
- › **Custom development cost savings.** The interviewed organization now uses Red Hat Ansible Tower to build its disaster recovery solution for the Linux environment. It finds Red Hat Ansible Tower to be more flexible and easier to maintain, resulting in annual development cost savings.
- › **Reduced number of incidents.** The interviewed company reported that the number of incidents with VMs have dropped since the introduction of Red Hat Virtualization. While this had no direct impact on the business, it saved the infrastructure team valuable time for having to investigate and solve fewer problems.

"Our [Linux] environment was growing quickly, and we were already using some Red Hat products. We therefore considered that it would be fairly easy to integrate Red Hat Virtualization with new products and technology, while at the same time realizing cost savings as compared to our legacy virtualization environment."

IT director, large financial service company



"With Red Hat Virtualization we are now only paying subscriptions and save on capex; but we also save on opex. With our legacy virtualization environment for instance, we used to have to pay subscription fees for the right to use Red Hat CloudForms for our Linux VMs. Now with Red Hat Virtualization, this is included."

IT director, large financial service company



Analysis Of Benefits

QUANTIFIED BENEFIT DATA

Total Benefits						
REF.	BENEFIT	YEAR 1	YEAR 2	YEAR 3	TOTAL	PRESENT VALUE
Atr	Capex savings	\$0	\$294,500	\$323,000	\$617,500	\$486,063
Btr	Opex savings	\$104,500	\$199,500	\$313,500	\$617,500	\$495,413
Ctr	Custom development cost savings	\$2,850	\$2,850	\$2,850	\$8,550	\$7,088
Dtr	Reduced incident resolution efforts	\$1,368	\$2,736	\$4,275	\$8,379	\$6,717
Total benefits (risk-adjusted)		\$108,718	\$499,586	\$643,625	\$1,251,929	\$995,281

Capex Savings

According to the interviewed organization, one of its principal goals for migrating the Linux environment from the legacy virtualization solution to Red Hat Virtualization was to realize capex savings. Previously, the company had to pay upfront licenses plus annual maintenance and support fees. The usage of Red Hat Virtualization, however, does not require any upfront investment in licenses, but it is rather based on a pure subscription model with recurring fees.

For the sake of this business case, Forrester took the following assumptions:

- › The Linux environment was growing from 300 VMs in Year 1 to 950 VMs in Year 3 of the analysis.
- › For this part of the environment, the company uses 2-socket servers with 1.5 TB of memory per server.
- › On average, each physical host runs 35 Linux VMs.
- › The avoided license costs related to the legacy virtualization solution have been estimated based on the relative cost savings reported by the interviewed organization.
- › There are no capex savings in Year 1 of the analysis. The license costs that had already been paid for the initial 300 Linux VMs are considered sunk costs. Capex savings are only realized for the incremental Linux environment since initial migration.

To take into account the uncertainty of these assumptions, Forrester risk-adjusted this benefit down by 5%. The total risk-adjusted present value for the capex savings is approximately \$486,000 over three years.

The table above shows the total of all benefits across the areas listed below, as well as present values (PVs) discounted at 10%. Over three years, the interviewed organization expects risk-adjusted total benefits to be a PV of approximately \$995,000.



The interviewed organization avoids approximately \$486,000 of license fees related to the growing Linux environment.

Impact risk is the risk that the business or technology needs of the organization may not be met by the investment, resulting in lower overall total benefits. The greater the uncertainty, the wider the potential range of outcomes for benefit estimates.

Capex Savings: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
A1	Estimated capex savings (legacy virtualization solution)	Interview	\$0	\$310,000	\$340,000
At	Capex savings	A1	\$0	\$310,000	\$340,000
	Risk adjustment	↓5%			
Atr	Capex savings (risk-adjusted)		\$0	\$294,500	\$323,000

Opex Savings

In addition to the above capex savings, the interviewed organization also reported opex savings due to the migration to Red Hat Virtualization.

By decommissioning the legacy virtualization solution for the Linux environment, the company saves the associated maintenance and support costs in Year 1 and also avoids those fees for the infrastructure that had been added in Years 2 and 3. The interviewee further estimated additional opex savings related to the usage of Red Hat CloudForms with its legacy virtualization product, which required extra charges. With the migration to Red Hat Virtualization, the company does not incur those fees anymore.

The avoided maintenance and support costs related to the legacy virtualization solution have been estimated based on the relative cost savings reported by the interviewed organization.

To take into account the uncertainty of these estimations, Forrester risk-adjusted this benefit down by 5%. The total risk-adjusted present value for the opex savings is approximately \$495,000 over three years.



By switching to Red Hat Virtualization, the interviewed organization saves and avoids approximately \$495,000 in maintenance and support costs over three years for its virtualized Linux environment.

Opex Savings: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
B1	Estimated opex savings (legacy and related solutions)	Interview	\$110,000	\$210,000	\$330,000
Bt	Opex savings	B1	\$110,000	\$210,000	\$330,000
	Risk adjustment	↓5%			
Btr	Opex savings (risk-adjusted)		\$104,500	\$199,500	\$313,500

Custom Development Cost Savings

Prior to adopting Red Hat Virtualization, the interviewed organization had developed a custom disaster recovery solution; however, the organization found it rather rigid and difficult to maintain. After moving its Linux environment to Red Hat Virtualization, the interviewed organization was able to use Red Hat Ansible Tower to build a simpler and more flexible DR solution.

The interviewed organization estimated that the simpler disaster recovery approach saves the organization about 200 hours of development time per year. For the sake of this business case, we assumed an average fully loaded hourly salary of \$15 for a senior developer in the region of the interviewed organization.

To take into account the uncertainty of the assumptions made, we risk-adjusted this benefit and reduced it by 5%. In this case, the risk-adjusted custom development costs have a present value of approximately \$7,100 over the three years of the analysis.

"[Red Hat] Ansible Tower provides us with a very flexible environment. We used Ansible to build our disaster recovery solution. It is easier for us to maintain than the custom DR solution we had built with our legacy virtualization environment."

IT director, large financial service company



Custom Development Cost Savings: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
C1	Estimated number of development hours saved per year	Interview	200	200	200
C2	Average fully loaded hourly salary (IT)	Interview	\$15	\$15	\$15
Ct	Custom development cost savings	C1*C2	\$3,000	\$3,000	\$3,000
	Risk adjustment	↓5%			
Ctr	Custom development cost savings (risk-adjusted)		\$2,850	\$2,850	\$2,850

Reduced Incident Resolution Efforts

The interviewed organization found that the Red Hat Virtualization environment is running more stable as compared to the legacy virtualization environment. Since the introduction of Red Hat Virtualization, the company noted fewer incidents. For example, the organizations had fewer unresponsive VMs.

While these incidents in the past did not directly impact the group's business, due to load-balancing and high availability of the underlying infrastructure, they did cost the infrastructure team time and effort investigating and resolving.

The interviewed organization estimated that the infrastructure team now saves between 8 hours (Year 1) and 25 hours (Year 3) per month due to the lower number of incidents with VMs.

For the sake of this business case, we assumed an average fully loaded hourly salary of \$15 for the local IT staff in the region of the interviewed organization.

Forrester risk-adjusted this benefit down by 5% to account for uncertainty of the estimations, resulting in a risk-adjusted total present value for this benefit of approximately \$6,700 over three years.

"When we moved from our legacy virtualization environment to Red Hat Virtualization, we also saw the number of incidents, such as unresponsive VMs, decrease."

IT director, large financial service company



Reduced Incident Resolution Efforts: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
D1	Estimated number of hours saved per month	Interview	8	16	25
D2	Average fully loaded hourly salary (IT)	Interview	\$15	\$15	\$15
Dt	Reduced incident resolution efforts	$D1 \times D2 \times 12$	\$1,440	\$2,880	\$4,500
	Risk adjustment	↓5%			
Dtr	Reduced incident resolution efforts (risk-adjusted)		\$1,368	\$2,736	\$4,275

Flexibility

The value of flexibility is clearly unique to each customer, and the measure of its value varies from organization to organization. There are multiple scenarios in which a customer might choose to implement Red Hat Virtualization and later realize additional uses and business opportunities. At the time of the interview, for example, the organization was investigating the following options:

- › **Increasing the virtualized Linux environment.** Since the introduction of Red Hat Virtualization, the organization's Linux footprint had more than tripled. One selection criteria for new third-party applications had even become whether the software was running on Linux. Compared to its legacy virtualization solution, the organization would therefore expect even more capex and opex savings. The company was also evaluating the possibility of migrating several mission-critical workloads from the mainframe to the Linux environment.
- › **Innovation.** The broad developer base in open source projects might deliver more rapid innovation to the organization. The pace of submissions can far surpass the capabilities of a single organization or vendor offering. As new releases become available, enterprises can either update or stay on its preferred code version. Red Hat's quality assurance program includes acceptance, functionality, regression, integration, and performance testing aimed at achieving the high level of standards expected for Red Hat products.
- › **Attracting talent.** The use of open source technology often signals that an organization is innovative and empowers its developers. By participating in open source communities and leveraging developer platforms like Red Hat OpenShift Container Platform, the company might have an advantage over other organizations to attract top recruits.
- › **Leveraging other Red Hat Enterprise products.** For instance, the company could use Red Hat OpenStack or Red Hat OpenShift Container Platform to build its own cloud infrastructure-as-a-service (IaaS) solution or build, deploy, and manage its container-based applications.

Flexibility would also be quantified when evaluated as part of a specific project (described in more detail in Appendix A).

Flexibility, as defined by TEI, represents an investment in additional capacity or capability that could be turned into business benefit for a future additional investment. This provides an organization with the "right" or the ability to engage in future initiatives but not the obligation to do so.

"Our vision is to invest in open source technologies because this is where the innovation lies. Using new, modern DevOps tools allows us to attract and keep talent."

IT director, large financial service company



Analysis Of Costs

QUANTIFIED COST DATA

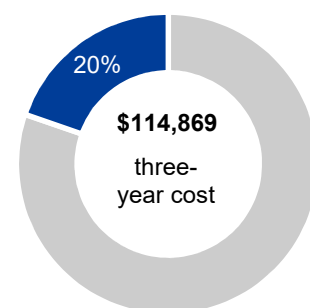
Total Costs							
REF.	COST	INITIAL	YEAR 1	YEAR 2	YEAR 3	TOTAL	PRESENT VALUE
Etr	Technology costs	\$0	\$95,000	\$190,000	\$300,000	\$585,000	\$468,783
Ftr	Deployment and training costs	\$90,000	\$10,000	\$10,000	\$10,000	\$120,000	\$114,869
Total costs (risk-adjusted)		\$90,000	\$105,000	\$200,000	\$310,000	\$705,000	\$583,652

Total Costs

This section lists the incremental costs that the interviewed organization incurred to achieve the above benefits. The costs fell into the following two categories:

- Technology costs.** These costs represent the subscription fees for the Premium version of the Red Hat Virtualization Suite (including Red Hat Virtualization and Red Hat CloudForms), plus Red Hat Ansible Tower. The Red Hat subscription includes the software, as well as access to a community of experts, knowledge resources, security updates, and support tools. The interviewed financial services company grew its Linux environment by more than 200% in the three years of this analysis, from 300 VMs in Year 1 to 950 VMs in Year 3. The company uses 2-socket servers with 1.5 TB of memory, which host 35 VMs on average. Please note that for the sake of this business case, Forrester assumed the interviewee paid list prices that were provided by Red Hat. Based on these assumptions, the technology costs have an estimated total three-year PV of approximately \$469,000 for the interviewed organization.
- Deployment and training costs.** The interviewed organization reported that it took approximately one year for: 1) the initial deployment; 2) the migration of the initial 300 Linux VMs; and 3) ramping fully up to speed and operational with the new virtualization environment. A team of eight people spent two weeks in training with an onsite trainer. In addition, the company invested 80 hours per year of extra support from an outside consultant. Note that the efforts for adding new VMs to the Linux environment in Year 2 and Year 3 have not been taken into account in the analysis because they would have been added anyway (just with the company's legacy virtualization solution). Therefore, they cannot be considered incremental costs. For the interviewed organization, the deployment and training costs have a three-year PV of approximately \$115,000.

The table above shows the total of all costs across the areas listed below, as well as present values (PVs) discounted at 10%. Over three years, the interviewed organization expects risk-adjusted total costs to be a PV of approximately \$584,000.



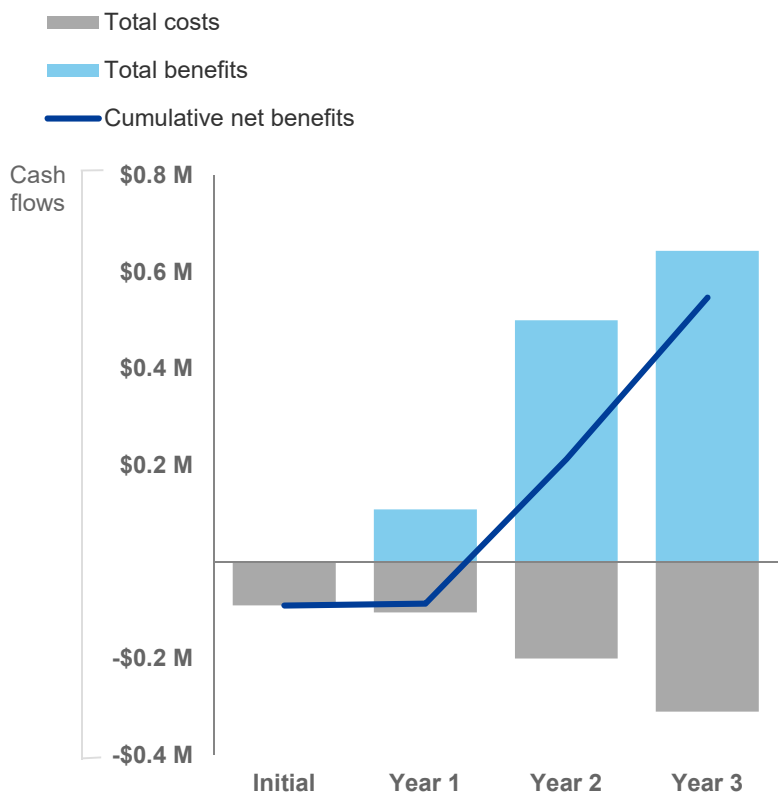
The total deployment and training costs represent 20% of the total three-year costs.

Implementation risk is the risk that a proposed investment may deviate from the original or expected requirements, resulting in higher costs than anticipated. The greater the uncertainty, the wider the potential range of outcomes for cost estimates.

Financial Summary

CONSOLIDATED THREE-YEAR RISK-ADJUSTED METRICS

Cash Flow Chart (Risk-Adjusted)



The financial results calculated in the Benefits and Costs sections can be used to determine the ROI, NPV, and payback period for the interviewed organization's investment. Forrester assumes a yearly discount rate of 10% for this analysis.



These risk-adjusted ROI, NPV, and payback period values are determined by applying risk-adjustment factors to the unadjusted results in each Benefit and Cost section.

Cash Flow Analysis (risk-adjusted estimates)

	INITIAL	YEAR 1	YEAR 2	YEAR 3	TOTAL	PRESENT VALUE
Total costs	(\$90,000)	(\$105,000)	(\$200,000)	(\$310,000)	(\$705,000)	(\$583,652)
Total benefits	\$0	\$108,718	\$499,586	\$643,625	\$1,251,929	\$995,281
Net benefits	(\$90,000)	\$3,718	\$299,586	\$333,625	\$546,929	\$411,629
ROI						71%
Payback period (months)						16.0

Red Hat Virtualization: Overview

The following information is provided by Red Hat. Forrester has not validated any claims and does not endorse Red Hat or its offerings.

Red Hat Virtualization is an open, software-defined platform that virtualizes Linux and Microsoft Windows workloads. Built on Red Hat Enterprise Linux and the kernel-based virtual machine (KVM) hypervisor, it features management tools that virtualize resources, processes, and applications — giving you a stable foundation for a cloud-native and containerized future.

Red Hat Virtualization provides ease of use, agility, and security for virtualized, resource-intensive workloads. It helps organizations optimize their IT infrastructure with better performance, competitive pricing, and a trusted Red Hat environment.

With Red Hat Virtualization, you can:

- Virtualize any Linux or Windows application.
- Standardize compute, storage, and networking resources.
- Improve workload performance and efficiency.
- Improve application density and use rates of existing servers.
- Deploy an agile environment to bring products to market faster.
- Improve the performance of — while reducing the costs associated with — high-performing Linux workstations.
- Build a foundation for bimodal IT by sharing services such as software-defined networking (SDN) with Red Hat OpenStack Platform.
- Leverage application containerization enterprise Kubernetes containers by hosting Red Hat OpenShift Container Platform on Red Hat Virtualization.

To migrate from proprietary virtualization to Red Hat Virtualization, many customers choose to leverage the Red Hat infrastructure migration solution. This solution combines Red Hat Virtualization subscriptions, migration services, training, and point-and-click tooling, allowing customers to migrate workloads at scale. Savings from the broader migration can then be redirected to transformative technologies such as automation, multicloud management, and container platforms.

Appendix A: Total Economic Impact

Total Economic Impact is a methodology developed by Forrester Research that enhances a company's technology decision-making processes and assists vendors in communicating the value proposition of their products and services to clients. The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

Total Economic Impact Approach



Benefits represent the value delivered to the business by the product. The TEI methodology places equal weight on the measure of benefits and the measure of costs, allowing for a full examination of the effect of the technology on the entire organization.



Costs consider all expenses necessary to deliver the proposed value, or benefits, of the product. The cost category within TEI captures incremental costs over the existing environment for ongoing costs associated with the solution.



Flexibility represents the strategic value that can be obtained for some future additional investment building on top of the initial investment already made. Having the ability to capture that benefit has a PV that can be estimated.



Risks measure the uncertainty of benefit and cost estimates given: 1) the likelihood that estimates will meet original projections and 2) the likelihood that estimates will be tracked over time. TEI risk factors are based on "triangular distribution."

The initial investment column contains costs incurred at "time 0" or at the beginning of Year 1 that are not discounted. All other cash flows are discounted using the discount rate at the end of the year. PV calculations are calculated for each total cost and benefit estimate. NPV calculations in the summary tables are the sum of the initial investment and the discounted cash flows in each year. Sums and present value calculations of the Total Benefits, Total Costs, and Cash Flow tables may not exactly add up, as some rounding may occur.



Present value (PV)

The present or current value of (discounted) cost and benefit estimates given at an interest rate (the discount rate). The PV of costs and benefits feed into the total NPV of cash flows.



Net present value (NPV)

The present or current value of (discounted) future net cash flows given an interest rate (the discount rate). A positive project NPV normally indicates that the investment should be made, unless other projects have higher NPVs.



Return on investment (ROI)

A project's expected return in percentage terms. ROI is calculated by dividing net benefits (benefits less costs) by costs.



Discount rate

The interest rate used in cash flow analysis to take into account the time value of money. Organizations typically use discount rates between 8% and 16%.



Payback period

The breakeven point for an investment. This is the point in time at which net benefits (benefits minus costs) equal initial investment or cost.