Improving Availability and Lowering TCO with HP Integrity Servers and OpenVMS

Comparing mid-range UNIX cluster TCO, availability, and business value

ALINEAN

Introduction

Organizations continue to look for more ways to make each dollar of computing investment go further, driving the continued need for application and server consolidation and reduced management costs, while increasing systems and applications availability. On average, over 90% of existing IT budgets are spent on sustaining and evolving the computing infrastructure and delivering mission critical and utility services.[1] Therefore, helping to reduce data center infrastructure costs represents one of the most substantial savings opportunities for most IT organizations. At the same time, business environments are more dynamic than ever driving the need for more agile data centers, with the ability to scale and adapt to changing business and user demands such as new business opportunities and mergers and acquisitions.

> *Based on typical mission critical scenarios, HP OpenVMS running on HP Integrity servers is 59-84% less expensive, more available, and more secure than competitive configurations from Sun and IBM respectively.*

Today there are many choices of operating system platforms and servers to help meet the challenges of lowering costs and meeting higher availability and adaptability requirements.

HP OpenVMS has been a mainstay in environments that require scalability, extreme availability, ease of management, proven disaster tolerance, virtually impenetrable security, and extensive performance. As a result industries such as Financial Services, Telecommunications, Manufacturing, Healthcare, and Government have relied upon OpenVMS mission critical computing for over 25 years. The latest version of HP OpenVMS v8.2 is the first production release with support for HP Integrity servers based on the industry standard Intel ® Itanium ® 2 microprocessor, as well as support for AlphaServer systems. OpenVMS v8.2 includes mini-merge support for host based Volume Shadowing, infrastructure changes to support performance, and scalability enhancements in OpenVMS releases for future Integrity servers, as well as updates to security. This release also includes support for mixed architecture AlphaServer and Integrity server clusters with shared fibre channel storage, up to 16 nodes[2], making migrating and upgrading to the latest servers easier and less expensive, while maintaining usefulness of existing investments. HP's Alpha RetainTrust (ART) program helps to reduce the cost and simplify migration from AlphaServer systems to HP Integrity server solutions. Customers considering or requiring clustered solutions should consider OpenVMS running on Intel Itanium-based HP Integrity servers, as OpenVMS clustering is superior to most of the clustered proprietary UNIX solutions from IBM and Sun. OpenVMS also provides lower total cost of ownership (TCO), higher availability and security risk avoidance, and greater business agility through the use of industry standard hardware.

To help organizations understand which operating system and server infrastructure offers the best business value, total cost of ownership (TCO) analysis was utilized. When making a purchasing decision, initial procurement price is certainly important – selecting the lowest cost asset in order to save the company money, but studies have shown that if you consider the cost of the asset from initial purchase through deployment, maintenance, support, management, and ultimately to retirement, less than 20% of the costs are for the initial hardware and software investment. TCO analysis helps decision makers make more intelligent investments by analyzing the total cost of the asset over its useful life. This ensures that the decision is not made simply on the lowest initial purchase price, but considers change costs, ongoing support and maintenance, and service levels which include availability of applications and data. In TCO analysis the following lifecycle costs are typically included:

- Hardware and software
- Labor and service fees for change costs such as planning, porting, testing, and deployment

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[1] According to Alinean IT Budget research, only 10% of IT budgets are currently designated for innovation and new functions. The burden of ongoing IT operations, management, and maintenance commands 65% of the budget, while migrations and upgrades consume 25% annually.

[2] The initial release of OpenVMS v8.2 will support up to 8 Integrity nodes in a cluster, however, up to 16 mixed AlphaServer and Integrity nodes (with a maximum of 8 Integrity nodes in the cluster) are supported. Eventually, it is planned to support Integrity servers for up to the full 96 node capability of OpenVMS clusters.

- Labor and service contracts, ongoing management, administration, and maintenance and support
- Facilities costs and overhead
- Change costs
- Availability and the impact of downtime losses

To enhance the analysis and assure that the decision is not just based on the lifecycle costs above, a common criticism of TCO analysis, comparative business benefits are added to the TCO analysis. By considering not only the lifecycle costs, but the business impact of the decision, the team can help improve the efficiency of IT via lower lifecycle costs, and seek to maximize business value.

Several business benefits were considered in the analysis:

- Improving the time to solution
- Increasing user productivity
- Improving customer satisfaction
- Driving additional revenue opportunities

In this white paper, TCO analysis is specifically used to compare mission critical hosting options for the data center in order to drive IT efficiency and effectiveness improvements, comparing OpenVMS running on HP Integrity server clusters versus IBM pSeries with AIX and Sun Solaris.

The Bottom Line

By examining the TCO and Return on Investment (ROI) of various UNIX installations and scenarios, HP Integrity servers and OpenVMS have been found to significantly help companies:

- Achieve the highest levels of availability and security
- Better price / performance
- Reduce ongoing operations management and maintenance
- Increase adaptability for business critical computing

Contrasting HP OpenVMS running on HP Integrity servers to proprietary UNIX solutions from Sun and IBM, results in typical total cost of ownership (TCO) savings of 59-84% respectively for the OpenVMS configurations.

Comparisons to IBM AIX

Comparing OpenVMS specifically to IBM AIX, based on specific case study analyses comparing the TCO of various mid-range UNIX cluster configurations, HP OpenVMS running on Integrity servers yielded savings of almost 84%, or $35.8 million, over IBM AIX running on pSeries 650 servers, including $1.1 million in direct savings.

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| TCO Comparison (cumulative 5 - year)	IBM AIX Total Cost	HP OpenVMS Total Cost	Benefits[3]	Benefits %
IT Costs				
Server Hardware	$1,806,240	$1,470,661	$335,579	18.6%
Server Software	$3,916,680	$3,751,810	$164,870	4.2%
IT Operations	$738,610	$712,465	$26,145	3.5%
IT Administration	$141,080	$141,080	$0	0.0%
Facilities	$77,480	$41,560	$35,920	46.4%
Change Costs	$753,798	$172,836	$580,962	77.1%
Total	$7,433,888	$6,290,412	$1,143,476	15.4%
Business Operating Costs				
Downtime - Business Hours	$32,887,500	$330,000	$32,557,500	99.0%
Downtime - Non Business Hours	$645,000	$0	$645,000	100.0%
Security Business Impact	$1,708,500	$238,200	$1,470,300	86.1%
Total	$35,241,000	$568,200	$34,672,800	98.4%
Total	**$42,674,888**	**$6,858,612**	**$35,816,276**	**83.9%**

TCO Comparison Chart

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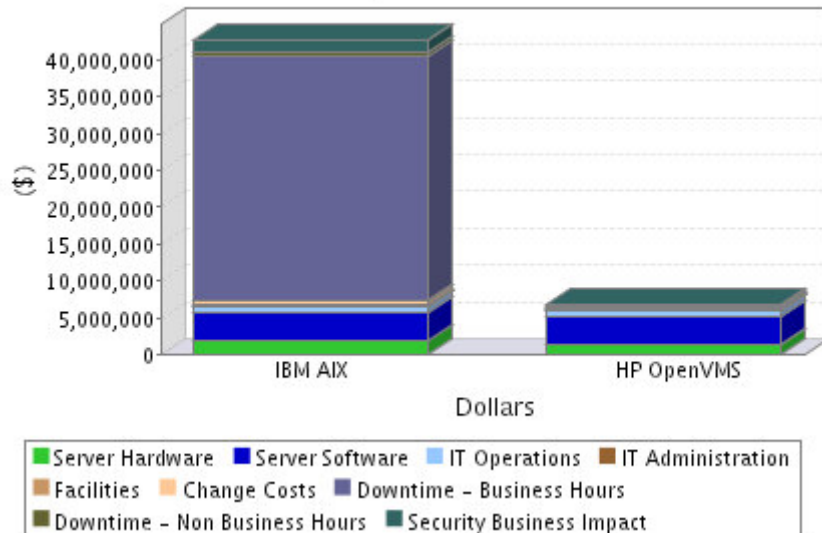
[3] Benefits in the IT Cost section are reductions in IT costs, while benefits in Business Operating Costs section are efficiencies in business operations.

Comparisons to Sun Solaris

With a similar case study analyses comparing the TCO of HP OpenVMS running on Integrity servers versus Sun Solaris, savings were more than $1.3 million over the five year analysis period, over 17%, in direct savings, and an additional $8.6 million in availability and security benefits, yielding a significant $10.0 million of TCO benefits.

TCO Comparison (cumulative 5 - year)	Sun Solaris Total Cost	HP OpenVMS Total Cost	Benefits	Benefits %
IT Costs				
Server Hardware	$2,003,348	$1,470,661	$532,687	26.6%
Server Software	$3,933,302	$3,751,810	$181,492	4.6%
IT Operations	$705,410	$712,465	($7,055)	-1.0%
IT Administration	$141,080	$141,080	$0	0.0%
Facilities	$114,280	$41,560	$72,720	63.6%
Change Costs	$728,812	$172,836	$555,976	76.3%
Total	$7,626,232	$6,290,412	$1,335,820	17.5%
Business Operating Costs				
Downtime - Business Hours	$6,847,500	$330,000	$6,517,500	95.2%
Downtime - Non Business Hours	$645,000	$0	$645,000	100.0%
Security Business Impact	$1,708,500	$238,200	$1,470,300	86.1%
Total	$9,201,000	$568,200	$8,632,800	93.8%
Total	**$16,827,232**	**$6,858,612**	**$9,968,620**	**59.2%**

TCO Comparison Chart
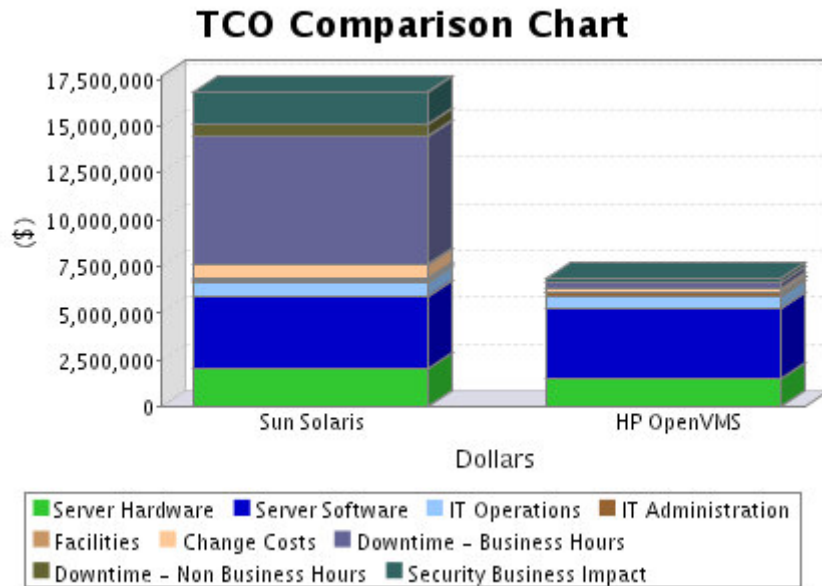
TCO Analysis Methodology

With the current focus on fiscal responsibility and due diligence, CIOs and IT executives have indicated in ComputerWorld and CIO Insight surveys that more than 80% of current IT purchases require financial analysis for justification. This white paper analyzes the TCO of various enterprise database and application hosting strategies, configurations, and platforms in order to assess which might be the most cost effective and provide the greatest business benefit to a typical organization.

The TCO analysis provided in this white paper can be used by IT decision makers to provide guidance and awareness into the factors that contribute to OpenVMS on HP Integrity servers being the platform of choice in certain scenarios for lowering costs, improving service levels, enhanced security, and improving business competitive advantage.

This analysis was modeled and analyzed independently and the cash flows of investments and benefits compared to determine which solution cost more over a five year lifecycle. For this analysis a scenario was established for a particular application, OS and system upgrade, with specific configuration plans and benefit opportunities. Assumptions were applied such as typical businesses, applications, locations, best practices (people, process, and technologies), platforms, configurations, costs, and discounts in order to arrive at results which could be applied easily to those considering the various alternatives. The summary of the results are presented in this white paper.

The analysis was conducted using TCO and ROI models developed by Alinean, the leading ROI consultancy, whose founders were the original developers of the Gartner TCO Manager and Analyst benchmarking tools. Alinean applied IT spending and TCO benchmarks modeled for over 30 different industries and over 15,000 companies as of June of 2004. This baseline information was then used to model typical data center strategies and best practices of specific alternative server and operating system solutions. The calculations are performed using comparable scenarios, with all calculations performed in US dollars, using list pricing for hardware and software investments, burdened labor rates for the defined industries, and US suburban locations. Hardware and operating system pricing was obtained from IDEAS International, August 2004.

The results are calculated and compared for the specified configurations and practices, business assumptions, and migration / consolidation scenarios in order to determine relative total cost of ownership, business benefits, and competitive advantages. As a result, the TCO analysis is highly dependent upon:

- Specific application type, industry, users and workload, current system and application configurations, current IT capability and maturity, and many other factors.
- Hardware and software list prices at the time of the analysis for the specific system specifications, and software licensing configurations and schemas.
- Estimated business costs and practice assumptions utilized to model labor, facilities, and downtime experiences and costs.

The TCO model analyzes the lifecycle costs and benefits for several competitive operating system and server platform and application configurations over a five year analysis period, a typical useful life of business critical servers. The analysis quantifies all of the costs of a particular solution including the initial investment requirements, ongoing expenses, change costs, and downtime costs of each solution – comparing and contrasting the costs for head-to-head assessments. Measuring the total costs over time assures that decisions are made not just on initial purchase price, but on total lifecycle costs of the IT environment.

Because decisions should not be made on cost savings alone, the example includes an analysis of basic business benefits from the comparative solutions.
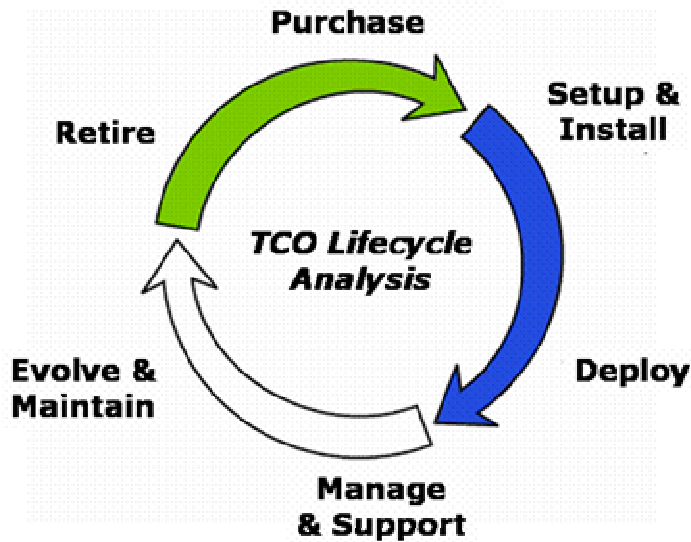
TCO Lifecycle Analysis calculates the total cost of owning the asset from initial planning and procurement through retirement.

TCO Categories

Total Cost of Ownership (TCO) categories are used to collect cost of ownership metrics and place them in accounting categories to enable comparisons and analysis of various alternative solutions and improvements. The TCO categories are organized as follows:

TCO Chart of Accounts Category	Description
Hardware	Initial purchase price of servers, storage, networking devices, racks and cabling, spares, and associated hardware maintenance and support contracts.
Software	Software licensing costs including operating system, applications, middleware, database, systems management, and associated software support and maintenance contracts.
IT Operations	The labor or labor equivalents (outsourced / contract labor) cost for running the data center operations. Tasks include: service desk, performance and availability management, user administration, OS support, break-fix management, software deployment, application management (provisioning and scheduling), systems management, disk and file management, storage management, security management, and database management and administration.
IT Administration	The labor or labor-equivalent (outsourced / contract labor) costs for strategic management and overhead tasks in running the data center including: vendor management, procurement, asset management, IT finance and chargeback, IT training, and user training course development.

Facilities	Costs for data center floor-space, power consumption, and HVAC cooling.
Change Costs (Upgrade Labor and Services)	The labor costs and services for migrating the servers and applications / databases to the proposed server configurations including the servers, storage, applications, database, network and facilities. These costs include: installation, training, testing, data conversion and migration, systems setup and installation, porting applications and procedures, recompiling applications, loading OS, loading applications, and de-installation and retirement of existing assets.
Unplanned Downtime	Unplanned downtime from hardware and software failures, data-loss, network outages, human error, capacity, accessibility, and response issues. The cost for unplanned downtime is typically measured as lost productivity for applications which support user functions, and lost business value and revenue for applications which support business transactions and key processes.
Planned Downtime	Planned downtime to perform regular maintenance and upgrades including adds, moves, and changes to hardware configurations, software configurations, and patches and application updates and upgrades. The cost for planned downtime is usually a fraction of that for unplanned downtime, but can have some impact on productivity or the business in 24 x 7 operations.
Security Risks	Unplanned downtime caused by security incidents including the time to find and mitigate the issue and repair damaged systems or data. Risks include viruses, worm, and Trojan attacks, network intrusions, internal incidents, and denial of service. The cost for unplanned downtime from security incidents is typically measured as lost productivity for applications which support user functions, and lost business value and revenue for applications which support business transactions and key processes.
Time to Solution	Time to solution deployment comparisons whereby the solution which is quicker to implement, particularly for new or improved applications, can help deliver productivity or business benefits more quickly. Future-proofing investments from change, avoiding future asset or labor costs because the existing system can adapt and absorb change quickly without additional investment.
Strategic Business Benefits	Agility, flexibility, and adaptability to handle changing business demands and requirements can often result in additional revenue and business opportunities.

TCO Analysis

With any TCO analysis, the configuration of the current "As Is" environment is an important consideration in the analysis results. The "As Is" configuration establishes the opportunities for savings and change costs required for each of the proposed solutions. As well, the proposed solutions "To Be" environment is also critical in that it establishes the potential for consolidation, change costs, investments, and savings. Slight changes in any of the assumptions in either environment can affect the results for any of the TCO calculations. These analyses are only valid for the prescribed opportunities and proposed solution sets. To determine personal opportunities for savings contact HP or Alinean for a customized TCO / ROI analysis utilizing Alinean / HP ROIAnalyst™ tools.

The TCO Analysis Scenarios

The analyses were performed for a financial / trading application for a $750 million annual revenue financial services company located in a suburban office location with 2,000 internal users (75% concurrent usage).[4]

Financial Trading J2EE Application with Oracle Database
Migrating the existing application from OpenVMS AlphaServer Systems
Single tier, clustered solution
Mission critical OS
Metro area disaster recovery configuration

Users	2,000 internal users (75% concurrent usage)
Storage	4.0 terabytes of storage, SAN configuration
Availability and support requirements	24 x 7 x 52
During business hours	$150,000
During non-business hours	$15,000
Average cost per kWatt hour	$0.09
Average annual cost per sq. ft. of data center space	$62.50

HP Configuration

- HP Integrity Server rx4640 mx2 1.1GHz 32MB 8 processors (4 mx2s)
- OpenVMS v8.2
- HP OpenView management software
- BEA Systems middleware

IBM Configuration

- IBM - pSeries 650-6M2 1200 MHz-1.5MB, 8 processors
- IBM AIX v5.3
- Tivoli management software
- IBM WebSphere middleware

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[4] The type of company, location, and annual revenue are used in the model to calculate key financial metrics that relate to vertical industry, location, and company size such as downtime risks/costs and salaries.

Sun Configuration

- Sun Fire E2900 1.05 DGHz – 16MB, 8 processors
- Sun Solaris 10
- Computer Associates management software
- BEA Systems middleware

These configurations were chosen to compare performance and availability requirements head to head. Performance comparisons were chosen using JBB2000 benchmarks from www.specint.org. Under the specified configuration, half of the processors are allocated to support the application and the other half support the Oracle database.

HP Integrity Servers with OpenVMS deliver compelling Value for Performance

HP Integrity servers based on Intel Itanium processors offer a complete range of high performance, reliable, industry-standard servers that can run multiple operating systems - providing investment protection and choice of platforms instead of locking you into proprietary solutions.

> *HP Integrity servers have a 42% and 26% price / performance advantage over mid-range Sun Fire servers and mid-range IBM servers respectively.*

Based on independent performance testing compared to server prices, HP Integrity servers have a 42% and 26% price / performance advantage over mid-range Sun Fire servers and mid-range IBM servers respectively.

With the recent introduction of the HP mx2 dual processor module with two Intel Itanium 2 processors, HP has doubled the capacity of these servers, providing almost double the performance in the same form factor. By doubling the number of processors, HP is able to offer a greater reduction in the number of servers, leading to additional consolidation opportunities. This results in direct cost savings via better price / performance, improved flexibility to double capacity without doubling server counts and other costs, and lower power, cooling, floor space and management costs. In addition, by consolidating on Integrity servers, customers benefit from enhanced flexibility and have the ability to deploy additional capacity for future growth.

Comparative Configurations – Performance / Value Analysis

Server Type	Number of Production Servers Needed	JBB2000 Benchmarks[5]	List Price per System	Total Cost	Annual Hardware Support and Maintenance	Spares
HP Integrity Server rx4640 mx2 1.1GHz 32MB 8 processors (4 mx2s)	6	114,145	$81,016	$486,096	$24,305	Included
IBM - pSeries 650-6M2 1200 MHz-1.5MB, 8 processors	6	114,892	$80,000	$480,000	$92,640	Included
Sun Fire E2900 1.05 DGHz – 16MB, 8 processors	6	123,017	$131,071	$786,420	$67,632	$52,475

For all solutions, storage costs were estimated to be about the same, at 0.21 per MB, $840,000 for the specified 4 terabytes. As well, networking costs were estimated to be $23,040 for the solutions, similar for each.

With regards to software expenditures, application licensing costs are significantly lower with OpenVMS and OpenVMS includes disaster recovery features and software at no charge. This leads to 4.4% less software costs on average.

Server Type	Operating System Cost[6]	Database Cost	Application Licensing	Systems Management[7]	Disaster Recovery[8]	Annual Support and Maintenance Contracts
HP OpenVMS	$499,680	$960,000	$252,000	$90,000	Included	$390,026
IBM AIX	$573,000	$960,000	$19,200	$108,000	$268,560	$397,584
Sun Solaris	$571,752	$960,000	$252,000	$84,000	$37,500	$405,610

In order to compare the operating systems and configurations, each was scaled with additional add-ons and software applications to selected functionalities, in the case study a cluster of servers was deployed with Mission Critical level functionality and Metro level disaster recovery capabilities.

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[5] Actual JBB2000 benchmarks independently measured from SPECINT, with the latest results available at www.specint.org. Where direct benchmarks were not available for the specific configuration and application load, information was extrapolated from known benchmarks in order to calculate the number of servers needed for the specific workload and applications. Benchmarks are shown per server.

[6] Includes cost for the operating system foundation, user licenses, and mission critical software to support virtualization, file systems, user, systems and storage management, high availability / clustering, and web middleware.

[7] Software to manage enterprise systems and storage, connecting individual systems management and other tools into an enterprise platform for server manageability. Product options include Tivoli, HP Open View, and CA UniCenter.

[8] Data mirroring and backup software licensing.

Solaris Functionality when comparing with OpenVMS I64 Integrity

Solaris: Foundation Level Functionality

- Foundation Level Functionality (Included with Server)

Solaris: Enterprise Level Functionality

- Includes Solaris Foundation Level Functionality
- Solaris Bandwidth Manager (per server)
- Sun Resource Manager (per server)
- Sun Management Centre 3.5 Enterprise Suite (1 RTU license per Solaris Image):
    - Advanced Systems Monitoring
    - System Reliability Manager
    - Service Availability Manager
    - Performance Reporting Manager
- Solaris Management Console (per system / OS image)
- Solistice Disk Suite (included with Solaris)
- Sun StorEdge Instant Image (included with Solaris)
- Veritas File System

Solaris: Mission Critical Level Functionality

- Includes Solaris Enterprise Level Functionality
- SunPlex
- Sun HA Agent (server and application dependent)
- SunPlex agent license for HA IBM WebSphere MQ agent (one license required per cluster)
- WebSphere MQ (per processor)

Solaris: Disaster Tolerant Level Functionality

- Additive to Solaris Mission Critical Software
- Sun StorEdge Availability Suite

AIX Functionality when comparing with OpenVMS I64 Integrity

AIX: Foundation Level Functionality

- Included with Power 4 servers
- Separate add on product for Power 5 servers
- Tivoli Risk Manager (per processor)

AIX: Enterprise Level Functionality

- Includes Foundation Level Functionality
- Policy based Resource Management (included with AIX)
- AIX Performance Toolbox (per server)
- Logical Volume Manager & Journaled file system (included with AIX)
- GPFS (per processor)

AIX: Mission Critical Level Functionality

- Includes Enterprise Level Functionality
- Cluster System Management (per processor)
- Loadleveler (per processor)
- HACMP (per processor)
- WebSphere MQ (per processor)

AIX: Disaster Tolerant Level Functionality

- Additive software to Mission Critical Costs
- Optional XD Extended Distance Feature (per processor)

OpenVMS I64 for Integrity Servers

OpenVMS I64: Foundation Operating Environment

- OpenVMS Operating System
- OpenVMS Unlimited User Licensing
- TCP/IP Services for OpenVMS
- DECnet-Plus for OpenVMS End System
- DECwindows Motif for OpenVMS
- DECnet IV
- Performance Data Collector
- Web Agents
- WEBM / CIM
- Integration Technologies
- Secure Web Server (SWS)
- Secure Web Browser (SWB)
- SDK for the Java™ Platform
- XML Technology
- NetBeans
- Simple Object Access Protocol (SOAP) Toolkit
- Kerberos
- Enterprise Directory
- CDSA
- SSL
- OpenSource Tools

OpenVMS I64 Enterprise Operating Environment:

- Includes OpenVMS I64 Foundation Operating Environment Functionality
- RMSjournaling
- Volume Shadowing
- DECram
- OVMS Management Station
- Availability Manager

OpenVMS I64 Mission Critical Operating Environment:

- Includes OpenVMS I64 Enterprise Operating Environment Functionality
- OpenVMS Clusters
- OpenVMS Reliable Transaction Router

OpenVMS I64 Disaster Tolerant Level Software:

- Additive to OpenVMS Mission Critical Environment Software
- Volume Shadowing (included in both Enterprise and Mission Critical Operating Environments)

Reducing IT Operations Costs

Managing server infrastructure is an important allocation of resources, but organizations are seeking ways to reduce allocating resources to infrastructure administration, enabling these resources to be freed for more strategic programs.

OpenVMS includes integrated systems management tools including:

OpenVMS Systems Management

- Availability Manager
- OpenVMS Web Agents for Insight Manager
- OpenVMS WBEM for CIM
- HP OpenView Operations Agent for OpenVMS
- Business Partner management software: Appmind, TECsys Development, PointSecure and Orsyp
- Hard and soft partitioning (soft partitioning will come later with the support of mid-range and high end Integrity servers)

The core operating system, combined with the integrated management tools and superior server consolidation, make OpenVMS one of the easier mission critical operating systems to manage and support.

Server Type	Average Number of Servers per IT Operations FTE	Full Time Equivalents	Annual Cost for IT Operations for Prescribed Configurations
HP OpenVMS	5.94	1.01	$142,493
IBM AIX	6.00	1.00	$147,722
Sun Solaris	6.00	1.00	$141,082

Facilities Costs

Facilities costs include the cost for system power, cooling, and an allocation for real estate based on data center floor space consumption. Using $0.09 cost per kWatt hour of power and $62.50 annual cost per square foot of data center space, the HP Integrity servers needed to support the example application cost nearly 1/3rd less than the facilities costs of the Sun solution, and almost half that of the IBM AIX solution. Facilities savings are the result of superior performance and consolidation, as well as the space and power savings engineered into the HP Integrity servers with mx2 chipsets.

Server Type	Number of Production Servers Needed	Cooling (watts per server)	Power (watts per server)	Floor Space (sq feet per server)	Total Annual Facilities Cost
HP Integrity Server rx4640 mx2 1.1GHz 32MB 8 processors (4 mx2s)	6	1,044	668	0.63	$8,312
IBM - pSeries 650-6M2 1200 MHz-1.5MB, 8 processors	6	1,584	1,600	1.27	$15,496
Sun Fire E2900 1.05 DGHz – 16MB, 8 processors	6	2,407	2,430	0.10	$22,856

Change Costs

Change costs are driven by a few factors including the number of servers to setup and install, complexity of the software environment and availability configurations, and application and procedures porting requirements. The costs can be reduced through vendor provided migration services, tool-kits, and rebates.

Since the comparative configurations chosen require the same number of servers, there is not a significant cost variance in setup and installation or professional services costs. However, application and procedures porting is not required for OpenVMS based on the configuration, but is a significant labor and services cost for IBM AIX and Sun Solaris.

| Server Type	Number of Production Servers Needed	Setup and Installation Project Management Person Hours	Average Application Porting and Procedures Migration Costs	Professional Services	Total Change Costs
HP OpenVMS	6	864	$0	$108,000	$172,836
IBM AIX	6	864	$487,904	$198,000	$753,798
Sun Solaris	6	864	$465,976	$198,000	$728,812

Availability and Downtime Costs

In mission critical environments even the smallest of downtime can cause serious financial consequences.

Downtime Losses by Application	Business Losses per Minute of Downtime
Multiple (Application Portfolio)	$40,000
Financial / Trading	$40,000
On-line Transaction Processing	$10,000
Supply Chain Management (SCM)	$10,000
Financial Management (ERP)	$10,000
Customer Relationship Management (CRM)	$8,000
Web Server (E-Commerce and E-Business)	$8,000
Human Capital Management (HCM)	$1,000
Portal	$5,000
Business Intelligence	$5,000
Data Warehouse	$5,000
Technical and Scientific	$3,000
Engineering and Development	$3,000
Messaging	$1,000
Infrastructure	$700
Other	$5,000

In mission critical environments, an hour of downtime can cost millions. Figures here are for typical enterprise applications, with research by Alinean and Standish Group. A more reliable and conservative way of measuring the impact of downtime is to estimate the company revenue or productivity tied to the application.

Downtime has many causes and percentages for the causes are fairly evenly divided between hardware, software, network, human error, and natural disasters. Having the right mission critical systems, fault and disaster tolerant configurations and practices, training and skills, proactive policies and procedures, monitoring and management tools can help eliminate many of these issues. But it takes a comprehensive program of improving people, processes, and technology to make an impact.
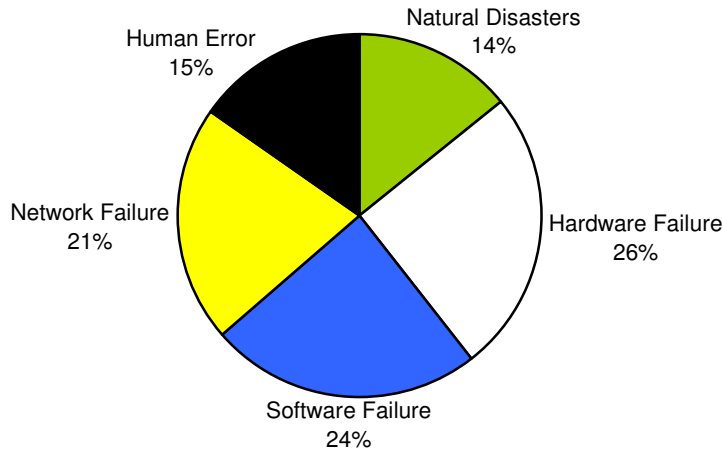
Unplanned downtime has many causes, requiring a focus on all aspects of the computing environment, mitigation of risks from natural disasters, as well as processes, procedures and training to mitigate against human error. Because of the distributed nature of such issues, achieving higher availability becomes cost prohibitive for most IT budgets.

Availability (System and Data)	HP OpenVMS on HP Integrity Servers	IBM AIX	Sun Solaris
High Availability Clustering	99.995%	99.498%	99.896%
Base Configuration	99.900%	99.900%	99.900%

Based on our mission critical case study with 24 x 7 x 52 operations, and downtime cost during business hours of $150,000 per hour, HP OpenVMS results in half the downtime cost per year of the Sun solution and only 1% the downtime cost of the IBM solution.

Server Type	Availability	Unplanned Downtime Hours per Year	Annual Unplanned Downtime Costs
HP OpenVMS	99.995%	0.44	$66,000
IBM AIX	99.498%	43.85	$6,577,500
Sun Solaris	99.896%	9.13	$1,369,500

HP Integrity servers provide these significant business resilience features to help improve availability:

Keep it Running

1. Partitioning and goal based workload management provide optimum rule based allocation of assets based on demand and priorities
2. Hot swappable cabinet blowers, I/O fans, DC power supplies, and cell backplane DC power
3. Error correction including ECC on CPU cache, parity protected CPU and I/O links, single wire correction on fabric and I/O, ECC on all fabric and memory paths and chip kill should an issue be found
4. Redundant AC input power

Fix it Fast

1. Diagnostic features including test station, enhanced predictive support, high availability observatory, EMS monitoring system, dynamic processor resilience, and dynamic memory resilience
2. Fault isolation technologies
3. Online removal and replacement of cell assemblies, I/O cards, and I/O cages

To help reduce the chance that a regional issue can cause availability issues, OpenVMS can maintain clusters beyond metropolitan boundaries, providing for availability of applications through symmetrical and synchronous data mirroring across multiple locations. OpenVMS supports links of up to 150 miles, and up to 500 miles with the optional Disaster Tolerant Cluster Services for OpenVMS package.

Planned Downtime

OpenVMS separates application availability from system availability, allowing systems administrators to perform maintenance on individual servers within a cluster while avoiding application downtime. Therefore, OpenVMS can avoid planned downtime costs that can be very costly with proprietary UNIX solutions from IBM and Sun.

Server Type	Number of Servers to Manage	Planned Downtime Hours per Year	Annual Planned Downtime Costs
HP OpenVMS	6	0.0	$0
Proprietary UNIX	6	8.6	$129,000

Security Management and Risks

For a high availability environment, security risks are a grave threat with more than 76,000 incidents in the first six months of 2003 alone.[9] Computer security has become one of the highest priorities for IT managers. External threats such as viruses, worms, Trojans, denial of service, and network intrusions threaten organizations with denied access, damaged data, and theft.

HP OpenVMS clusters average the fewest hours of security-related risks and downtime compared to proprietary UNIX systems, averaging only 0.8 hours of downtime per year versus 4.9 hours of downtime for Sun Solaris and IBM AIX. Based on our case study availability costs of $150,000 per downtime hour, HP OpenVMS clusters can save more than $1.4 million per year in lost productivity and business impact. These costs only consider the direct productivity or business transaction costs of the security violation to the business, and do not consider indirect costs such as brand damage or competitive losses.

There are several reasons and evidence as to HP OpenVMS and Integrity server's lower security risks:

1. Security best practices including Host IDS, IP filtering, IP security, secure shell, OpenSSL, SSH, CDSA, GSSAPI, security patch-check and management, security hardening and lockdown, and buffer overflow protection.

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[9] National Cyber Security Summit, December 3, 2003, Tom Ridge US Secretary of Homeland Security

2. Secure memory and disk structure design, whereby no virus has ever been reported on OpenVMS.[10]

3. Every transaction on an OpenVMS process / node cluster is audited and permission access is granted or denied through the security model.

4. A low incidence of security patches needed. For the three year period from January 2000 to December 2003, HP clusters required far fewer security patches than IBM and Sun clusters, only 2 security-related patches for OpenVMS compared with 29 each for AIX and Solaris.[11]

5. A low incidence of documented security vulnerabilities, only 5 for OpenVMS, compared to 89 for AIX and 157 for Solaris.[12]

6. Solaris and AIX contain a considerable amount of open source code that is widely available for access and exploit.

Because of the maturity of OpenVMS as an operating system, it is viewed as the most secure and stable. This is evidenced by the declaration that OpenVMS was "cool and unhackable" at the Defcon9 hacker convention.

Typical Security Incidents	HP OpenVMS	Proprietary UNIX
Virus, worm, Trojan attacks	0.1 attacks per year	0.2 attacks per year
Network / host intrusion	0.7 attacks per year	3.7 attacks per year
Denial of Service	0.0 attacks per year	1.0 attacks per year
Downtime	0.8 hours per year	4.9 hours per year
Annual lost productivity and business impact costs due to Security Issues	$47,640	$341,700

Comparing typical application environments OpenVMS can help eliminate almost all security risks and resultant downtime.

Conclusions

As a result of these case study scenarios, HP Integrity servers and OpenVMS have been found to significantly help companies:

- Achieve the highest levels of applications and system availability and security
- Gain a more favorable price / performance situation
- Reduce ongoing operations management and maintenance expense
- Increase adaptability for business critical computing

Comparing HP OpenVMS running on HP Integrity servers to proprietary UNIX solutions from IBM and Sun, results in typical total cost of ownership (TCO) savings of 59-84% for the OpenVMS configurations, with average savings of $10.0 to $35.9 million in cumulative 5-year savings.

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[10] However, viruses can infect other servers and systems on the OpenVMS system

[11] CERT Coordination Center Database

[12] MITRE corporation CVE database, Q1 2004

When OpenVMS Makes the Better Business Case	The OpenVMS / Integrity Server Advantage
Price / Performance	HP Integrity servers are on average 42% superior to midrange Sun Fire solutions, and 26% superior to midrange IBM pSeries solutions with regards to price / performance.
Mission Critical	The higher business value of downtime losses, the more advantage the higher availability solution will deliver. OpenVMS offers the highest availability of 99.995% vs. 99.498% for AIX and 99.896% for Solaris. This small percentage improvement in availability with OpenVMS can mean hundreds of thousands of dollars in reduced productivity losses or business impact.
Security	The OpenVMS platform has the lowest set of documented vulnerabilities, lowest number of required patches, lowest percentage of open-source, and highest set of security best practices. As a result, vulnerabilities are reduced by 86% over Solaris and AIX.
Change Costs	HP OpenVMS does not require application and procedures porting; resulting in more than a 76% cost advantage over Sun Solaris and IBM AIX.
Future Proofing	Because of the Integrity server platform with partitioning and / or virtualization, the organization has the flexibility to, in the future, integrate to HP-UX 11i, Linux, and Windows without requiring a hardware change. The OpenVMS solution offers the business protection against future changes and preservation of the initial investment regardless of changing business, market, or customer needs.
	Upgrades to 2x processors for near doubling of processing capacity in the same server and footprint avoiding the requirement to buy larger server platforms up-front with room for future expansion, and avoiding the need to add additional server boxes to handle the growing need for computing capacity.

About Alinean

Since 1994, the Alinean team has been the pioneering builder of tools to help quantify and improve the ROI and TCO of IT investments. Alinean was named for the Spanish word for "Align", matching the Alinean mission as the leading developer of analytical tools to help IT vendors, consultants and IT executives align IT investments with business strategies.

The Alinean team has over a decade of experience in the practical development and application of ROI and TCO methodologies, models and tools to optimizing IT investment decision making. In 1994, the Alinean team formed Interpose, the original pioneers of ROI tools, developing analytical software for over 50 major IT vendors and consulting companies worldwide, and creating the industry standard TCO Manager and TCO Analyst software. Interpose was sold to Gartner in 1998, where the team continued their developments and marketing of ROI and TCO software tools. The original team reunited to form Alinean in 2001, once again becoming the leading pioneers and developers of ROI sales and analytical tools. Current customers include leading IT solution providers such as HP, IBM, Dell, Intel, Symantec, NetIQ, EMC, SAP, Oracle, SBC, and Microsoft, as well as leading consultancies and Global 1000 companies.

Additional information about Alinean and helpful ROI educational resources can be found at http://www.alinean.com

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