Are Some RISC-Based Clusters Easier to Manage Than Others?

A Detailed Comparison of the Resources Required to Manage HP OpenVMS and IBM AIX Server Clusters.

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R E S E A R C H

May 2004
V1.0

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Executive Summary

In February 2004, TechWise Research published a paper entitled: *Total Cost of Ownership for Entry-Level and Mid-Range Clusters*. That paper showed that HP OpenVMS/AlphaServer clusters cost, on average, $248,000 less to manage over a three-year timeframe than IBM AIX/pSeries clusters. TechWise Research decided to conduct a follow-up study to probe specifically into the area of cluster management costs. The purpose was to better understand the differences between HP and IBM cluster management costs, and the possible reasons why HP has an advantage over IBM in this area. The results from this follow-up research are summarized in this paper.

For this study, TechWise collected and/or analyzed data from four sources. First, TechWise performed a detailed comparison between the profiles of HP and IBM respondents from the February 2004 study. The purpose was to determine if differences in management costs could be attributed to a sampling bias. HP and IBM respondents were compared on a total of seven profiling criteria. Each of which will be covered in this paper.

Second, management and availability data from the February 2004 study were examined in more detail - specifically, the six different costs associated with managing a server cluster (time and money spent managing its nodes, storage, physical environment, operating system/cluster software, applications, and network-related activities). The availability data (based on cluster downtime) was also re-examined because availability directly impacts time spent managing a cluster. Each time a cluster crashes, the cluster team needs to identify the problem, fix it and then re-boot the cluster.

Third, we conducted follow-up executive telephone interviews with HP and IBM respondents from the February 2004 study. These in-depth discussions provided further insight into management and availability differences between HP and IBM clusters. Quotes and comments from respondents are included in this paper.

Fourth, in addition to speaking with study respondents, TechWise conducted additional research in the area of management to understand the differences between the two brands. One factor that influences management costs is the number of patches that need to be installed to keep a cluster up-to-date. Security patches influence management costs because they take time to install. In addition, if installed incorrectly, a patch could cause system instability, or even worse, a crash. The CERT® Coordination Center is an organization that tracks security vulnerabilities and threats. TechWise performed an analysis of all CERT/CC advisories posted between January 1, 2000 and December 31, 2003, to compare the number of IBM/AIX security patches to those for HP/Compaq/OpenVMS. The findings are included in this white paper.

<u>**Overall Results**</u>:
The significant cost advantage HP clusters have over IBM in the area of cluster management is <u>not</u> due to sampling bias. **Rather, the data suggests that HP OpenVMS/AlphaServer clusters are more cost effective to manage than IBM AIX/HACMP pSeries clusters because the HP clusters are more stable and require fewer resources to maintain**. A number of findings support this conclusion:

- First, the IBM clusters have many more security vulnerabilities than the HP clusters. Between January 1, 2000 and December 31, 2003, IBM released a total of 29 patches for AIX in response to security vulnerabilities identified by CERT/CC, while HP/Compaq released just 2 patches for OpenVMS. This is important since the installation of patches is a time consuming process that directly impacts management costs.

- Second, the process of applying patches appears to be more complex with AIX than with OpenVMS. Some IBM respondents said they work with consultants from IBM Global Services for technical help in this area. It is interesting to note that respondents with IBM clusters are much more likely to outsource some of their cluster management activities to third parties than those who work with HP clusters.

- Third, the IBM clusters crash more frequently than HP, and also average more hours of downtime. IBM clusters average twice the number of downtime hours compared to HP clusters (17.14 vs. 8.16 hours per year, respectively) and three times more crashes than HP (15 vs. 5 per year, respectively). One IBM respondent interviewed commented that his company has 7 people dedicated to watch over their IBM cluster 24 x 7 so someone would *"always be on-site in case something happens."*

Another key finding from this study is the overall importance of cluster management costs. Regardless of brand, management costs far exceed the initial purchase price of entry-level clusters over a three-year period. In the case of IBM 2-way clusters, three-year management costs are more than eleven times the list price to purchase the cluster with its storage array and service contract. Given the continuing battle IT professionals face to manage limited resources as effectively as possible, cluster brands that have lower management hours will not only free up limited IT resources, but also impact the bottom line.

Background on This Paper
Each year, server clusters become more common in a wide variety of industries. Although far from ubiquitous, more companies are implementing and reaping the benefits of these systems. Clusters offer enhanced security, availability, reliability and performance compared to stand-alone servers, and are a natural evolution to any application that needs to be highly available - 24 x 7. Numerous studies have shown that the true cost of owning a server cluster is far greater than its initial purchase price. As IT managers continue to search for ways to stretch their IT budget, more and more firms are considering other factors, such as the cluster's operational costs, in their purchase evaluations. In February 2004, TechWise Research published a paper entitled: *Total Cost of Ownership for Entry-Level and Mid-Range Clusters*. That paper provided details regarding the Reliability-Adjusted Total Cost of Ownership[TM] of various RISC-based server clusters[1]. Part of the analysis in that paper showed that HP OpenVMS/AlphaServer clusters cost less to manage on an ongoing basis than IBM AIX/pSeries clusters. TechWise Research decided to conduct a follow-up study to probe specifically into the area of cluster management costs. This paper summarizes our findings, and includes a more robust study of the differences between HP and IBM cluster management costs, and explores possible reasons why HP has an advantage over IBM in this area.

Who Was Surveyed

This follow-up research study on management costs is based on the 64 web-based interviews that TechWise completed with IT professionals in the Fall of 2003. The chart to the left summarizes the participants for the original "Phase 1" study, as well as the approach and purpose for this current follow-up study ("Phase 2").

The Phase 1 survey was designed to collect operational and profiling data about the cluster itself, as well as demographic information about the company using it. Throughout that web survey, respondents were given several opportunities to clarify any answers they provided. One of TechWise Research's senior analysts, who specializes in server clusters, personally reviewed each completed survey and followed-up with respondents by phone if any answers needed clarification.

To qualify for the web-study, all respondents were carefully screened to ensure that they personally managed a qualifying entry-level or mid-range cluster. Furthermore, all clusters were required to meet the following four screening criteria:

1. The cluster was one of two target server platforms: HP AlphaServer running OpenVMS, or IBM RS/6000 or pSeries (hereafter referred to as pSeries in this paper) running AIX.

2. The cluster used the manufacturer's clustering software. Therefore, all HP clusters used OpenVMS Cluster, while all IBM clusters used HACMP.

3. The cluster did not contain any enterprise-class servers. An enterprise-class server was defined as one that supports more than 16 processors.

   ➤ Examples of disqualifying HP AlphaServers included the GS 320, GS 1280 M32, and GS 1280 M64. For IBM, the p680, p690, and RS/6000 S80 did not qualify.

4. The cluster was running in a *production mode* for at least six months. Clusters used in development and/or testing, or for less than 6 months, were excluded from the study.

To gain insights into the management results from Phase 1, TechWise conducted follow-up executive phone interviews with some of the Phase 1 respondents. Each interview lasted approximately 45 minutes and was personally conducted by the president of TechWise Research. The interviews were conducted with senior IT respondents from the following companies: (1) a software company that develops information systems for hospitals and medical clinics, (2) a global financial services company that has nearly $4 trillion in assets under management/ administration/custody, (3) one of the largest banks in the U.S., (4) a leading insurance company that has 50 million customers, (5) a leading information service company whose website receives nearly 2 million visitors each month who purchase information online, and (6) one of the largest U.S. wireless communications companies.

Why Should IT Managers Care About Management Costs?

There are two key reasons why IT managers would be interested in the costs associated with managing server clusters. First, a cluster that requires a lot of hands-on management takes IT resources away from other projects. A cluster that requires little management frees up IT resources to work on other projects. One HP cluster respondent we interviewed summarized this benefit as follows: *"The fact that OpenVMS requires so little time to manage is a big benefit to my firm. In the old days you needed a dedicated operator - now you don't. OpenVMS frees up my time so I can work on other things like documenting procedures. It frees up my colleague so he can spend time doing what he needs to - programming end-user applications."*

The second reason why IT managers would be interested in cluster management costs is the impact
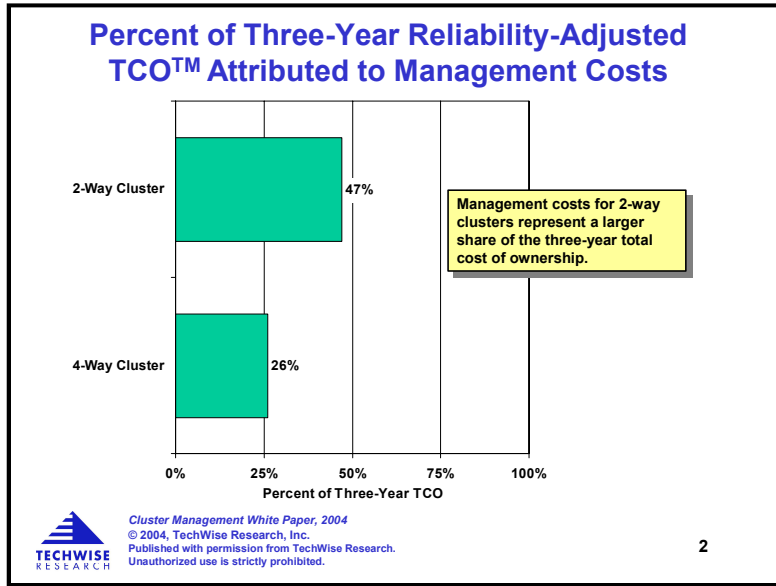
these expenses have on the overall IT budget. Cluster management costs are not trivial. In some cases, management costs are greater than the initial purchase price of the cluster itself. The chart to the left illustrates findings from the paper TechWise Research published in February 2004 entitled: *Total Cost of Ownership for Entry-Level and Mid-Range Clusters.* When the costs associated with the cluster's purchase, installation, management and downtime are all taken into account, management costs represent between 26% and 47% of the three-year TCO for the configurations tested.

What Management Costs Were Measured?

The Phase 1 web survey was designed to measure the costs associated with the following six cluster management activities:

- **Storage management -** backing up the servers in the cluster and, if applicable, backing up the storage array(s).

- **Server management -** managing and maintaining the servers themselves, including system management and hardware upgrades/replacements.

- **Environmental management (if applicable) -** cleaning and/or dusting the servers in environments that require this (i.e., manufacturing).

- **Operating system management -** managing and maintaining the actual clustering software and operating system, including version upgrades and security patches.

- **Application management -** managing and maintaining all of the end-user software applications that run on the cluster.

- **Networking management -** adding and/or removing users, setting network permissions.

Management costs have two main components. First, are the costs for companies to hire third-parties to manage their cluster on an ongoing basis. Second, are the "internal employee" costs of managing the cluster "in-house." Some respondents hired third-parties, some managed the cluster 100% in house, while others utilized a combination of the two. To ensure all costs were included, respondents provided the actual costs for outsourcing cluster management activities. Additionally, TechWise collected the total number of hours "internal staff" spent on all six cluster management activities. The internal hours spent on management were then converted into a cost figure by applying staff salary data provided by the respondents. All of the management data were combined to calculate a Three-Year Total Cost of Management[TM], or TCM[TM], for the two cluster brands. (A three-year timeframe was used because prior TechWise cluster studies have indicated that three years is appropriate to evaluate an entry-level and mid-range clusters' TCO.) The remainder of this paper will focus on comparing management costs for HP OpenVMS/AlphaServer and IBM AIX/pSeries clusters.

Total Cost of Management Findings

Three-Year Total Cost of Management[TM]
HP AlphaServer OpenVMS vs. IBM pSeries AIX

- HP OpenVMS clusters are more cost-effective to manage than IBM AIX clusters in five of the six categories measured.

Over a three-year period, HP AlphaServer clusters cost $248,000 less to manage than comparable IBM pSeries clusters.

End-User Applications: $176 / $172
Servers: $145 / $50
Cluster Software/OS: $137 / $53
Storage Array: $105 / $69
External Costs: $97 / $112
Network Permissions: $79 / $35

Cost in Thousands of Dollars

□ HP ■ IBM

3

The chart to the left summarizes the Three-Year TCM[TM] findings for HP and IBM clusters. The two brands have similar management costs for two of the six management activities: end-user applications, and external (i.e., third-party) costs.

In each of the other four categories, HP OpenVMS/AlphaServer clusters cost less to manage on an ongoing basis than comparable IBM AIX/ pSeries clusters. The greatest cost differences are in the areas of managing the servers themselves, and managing the clustering software and operating system.

In terms of servers, on average, <u>IBM pSeries servers require nearly triple the number of hours to manage compared to HP AlphaServers</u>. In terms of cluster software and operating system, <u>HACMP/AIX requires an average of 2.5 times more hours to manage than OpenVMS</u>.

For the last two cluster management activities, HP cluster respondents spent half the time than IBM respondents spent managing network permissions, and 34% less time managing their storage arrays.

In summary, when all six management factors are combined over a three-year period, HP OpenVMS/AlphaServer clusters cost $248,000 less to manage than comparable IBM AIX/ pSeries clusters.

Another way to look at management costs is to compare them with the purchase price of the cluster itself. TechWise performed this analysis for the 2-way cluster configuration. The chart to the right describes this configuration in detail, and lists the actual server models used in the analysis. The specific server models were selected because they represent comparable machines in terms of performance and expandability. List prices for these systems were collected in December 2003 from IDEAS International. These are the same list prices that were used in the February 2004 TCO paper. (IDEAS International is recognized worldwide as a leading authority on systems technology, specializing in the research of comparative information on computer systems.)
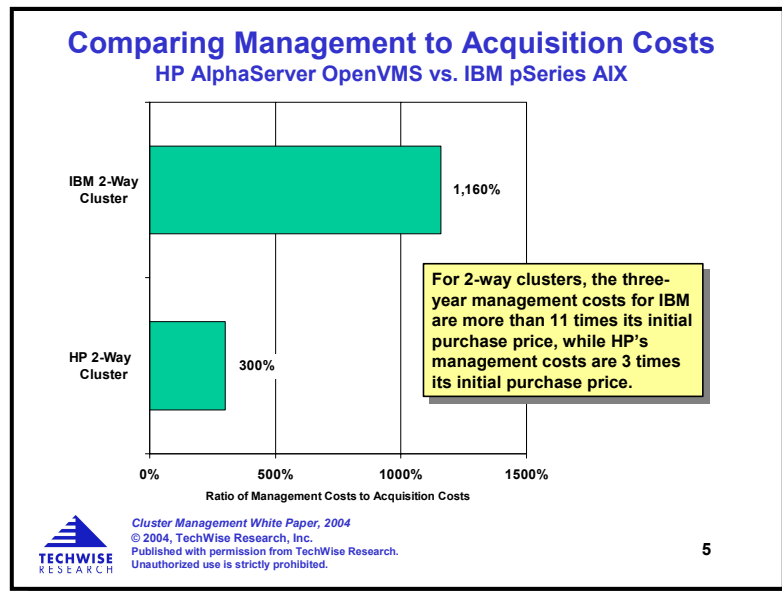
Cluster Configurations Used in Analysis

■ Management costs were further analyzed for the following 2-way cluster configuration:

– Nodes in Cluster	2
– Processors / Node	2
– Memory / Node	2 GB
– Storage Array	438 GB

■ The following server models were selected for the analysis because they represent comparable machines:

– HP AlphaServer:	DS 25
– IBM pSeries:	615-6E3

Comparing the 2-way clusters' list prices with their three-year management costs yields the chart below. There is an important message in this chart for IT managers about cluster management costs. **For both HP and IBM 2-way clusters, management costs are far greater than the initial purchase price of the cluster**. In fact, for the IBM 2-way cluster configuration shown above, three-year management costs are more than <u>eleven times</u> the initial purchase price for the servers, clustering software, array and service agreement. For the HP 2-way cluster shown above, the three-year managements costs are three times the initial purchase price. Cluster management costs, therefore, are essential to consider in any cluster purchase decision.

Another key finding is that IBM cluster management costs are proportionately much higher than HP cluster management costs. In this scenario, the 2-way IBM AIX cluster has a lower list price than the comparable 2-way HP OpenVMS cluster. **However, once management costs are considered, the HP cluster costs 18% less than the IBM cluster**. Note, this analysis ignores several other aspects of cluster TCO, including costs associated with cluster installation, training and downtime. These latter costs are reported and analyzed (in detail) in TechWise's February 2004 paper: *Total Cost of Ownership for Entry-Level and Mid-Range Clusters*.

Comparing Management to Acquisition Costs
HP AlphaServer OpenVMS vs. IBM pSeries AIX

IBM 2-Way Cluster — 1,160%

HP 2-Way Cluster — 300%

For 2-way clusters, the three-year management costs for IBM are more than 11 times its initial purchase price, while HP's management costs are 3 times its initial purchase price.

Ratio of Management Costs to Acquisition Costs

0%   500%   1000%   1500%

Why Do HP Clusters Have Lower Management Costs than IBM Clusters?

Chart #3 shows the average cost to manage a HP OpenVMS/AlphaServer and IBM AIX/pSeries cluster over a three-year period. As previously reported, HP clusters cost $248,000 less to manage than IBM clusters, on average. Further review of the data shows that 72% of HP's advantage ($179,000 out of $248,000) is due to lower costs associated with managing the servers, the operating system, and the cluster software. The chart below includes comments by HP respondents regarding the management of their OpenVMS/AlphaServer clusters. Their comments from both Phase 1 of the research, as well as from the follow-up executive phone interviews, have a consistent theme; OpenVMS/ AlphaServer clusters require little maintenance, and generally run on "autopilot." The comments from the IBM respondents, on the other hand, are more mixed. Some indicate that their IBM cluster is easy to manage. Others comment that the management process is time consuming and tricky.

Respondent Comments Regarding HP OpenVMS/AlphaServer Clusters

- **Respondent quotes about HP OpenVMS AlphaServer clusters:**
  - The HP cluster "*is very easy to manage.*"
  - It "*requires so little time to manage.*"
  - The HP cluster "*pretty much runs on autopilot.*"
  - OpenVMS is a "*stable clustering system.*"
  - It requires "*low maintenance.*"
  - OpenVMS "*has fewer patches and updates.*"
  - It "*frees up my time so I can work on other things.*"
- **Other feedback on HP OpenVMS clusters.**
  - HP's patches and updates are easy to install.
  - OpenVMS' Single System Image allows IT personnel to manage the entire cluster from a single console.

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6

What accounts for HP's lower management costs? There are several factors - one is cluster availability. Each time a cluster crashes, the cluster team needs to spend time to identify the problem, fix it and then re-boot the cluster. HP OpenVMS/AlphaServer clusters offer higher availability than the IBM AIX/pSeries clusters. This difference in downtime and availability between the two brands is covered in detail in TechWise's 2004 paper: *Total Cost of Ownership for Entry-Level and Mid-Range Clusters*. That paper examines how long the clusters' primary applications went off-line due to crashes caused by several factors, including the cluster's: servers, storage array, operating system, cluster software, end-user applications and system management applications. It also covered crashes caused by viruses or worms. In that study, IBM clusters averaged twice the number of downtime hours per year compared to HP clusters (17.14 vs. 8.16 hours per year, respectively). In addition, IBM respondents reported that their cluster crashed, on average, once every four weeks compared to once every twelve weeks for HP cluster respondents. Essentially, IBM respondents spent more time managing their clusters because of crashes than HP respondents.

Another factor that influences management costs is the number of patches that need to be installed to keep the cluster up-to-date. Security patches influence management costs because they take time to install. In addition, if installed incorrectly, a patch could cause system instability, or even worse, a crash. Respondents in the Phase 2 phone discussions indicated that there are more patches for IBM AIX/pSeries clusters than for HP OpenVMS/AlphaServer clusters. TechWise decided to investigate this further, and researched the number of patches that have been released for both types of clusters.

The CERT® Coordination Center (CERT/CC) is a major reporting center for Internet security problems. Run by Carnegie Mellon University and primarily funded by the U.S. Department of Defense and the Department of Homeland Security, CERT/CC is a center of Internet security expertise. CERT/CC staff members analyze product vulnerabilities, provide technical advice, and coordinate responses to security compromises.

TechWise Research analyzed all of the CERT/CC advisories that were issued between January 1, 2000 and December 31, 2003, to determine which ones required a security patch to be installed on AIX, HACMP or OpenVMS. **During this three-year period, IBM released a total of 29 patches in response to security vulnerabilities identified by CERT/CC. During this same period, a total of 2 patches were released for OpenVMS**. From a standpoint of patches and security maintenance, the IBM clusters require more time to manage than the HP clusters.

Below are some respondent quotes from the executive phone discussions regarding their HP OpenVMS/ AlphaServer clusters:

"One of the main reasons we are still using OpenVMS is because it is so low maintenance."

"OpenVMS is so solid that we do not need to do anything to manage it."

"Once you are over the learning curve, OpenVMS clusters are very easy to manage. The learning curve for OpenVMS is the same as it would be for someone learning to run an IBM or a Sun cluster."

"OpenVMS is easier to learn and manage than Oracle [Parallel Processing] cluster."

"As long as you are watching the right things, like memory and CPU utilization, the OpenVMS cluster pretty much runs on autopilot."

"The fact that OpenVMS requires so little time to manage is a big benefit to my firm. In the old days you needed a dedicated operator - now you don't. OpenVMS frees up my time so I can work on other things like documenting procedures. It frees up my colleague so he can spend time doing what he needs to - programming end-user applications."

"If you are not familiar with OpenVMS, there is a learning curve. It may take you a while to learn, but no longer than it would take to learn any other new OS for the first time. I would recommend OpenVMS if you are looking for a stable clustering system. It gives you good performance compared to a UNIX cluster."

Below are some respondent quotes from the executive phone discussions regarding their IBM AIX/pSeries clusters:

"In terms of management, IBM clusters are getting better. Third-party applications work fairly well on IBM. I also managed an OpenVMS cluster three years ago. That [OpenVMS] cluster required less time in management."

"I give IBM clusters high marks in terms of maintenance. As long as you follow standard protocols (i.e., make sure the backups are running and the system resources are OK), there is not a lot to do in terms of managing this cluster."

"This IBM cluster initially took me away from my other activities. I needed to drop one of my four application development projects."

"Several things can cause you to run into problems day in and day out with an IBM cluster. If you don't have your data mirrored properly, if you don't use workload manager to solve problems or if you don't keep your applications updated with the latest patches."

"Recently, we have been doing a lot of application upgrades on our IBM cluster. Examples include PeopleSoft and Oracle. We install the new application and it doesn't work. Sometimes we turn to our IBM Global Services consultant for help with this."

"The IBM cluster takes some getting used to. Upgrades to the operating system are very difficult. If one small thing is missing, like a DLL, or is done incorrectly, like a system file is setup incorrectly, it is a nightmare to find it. Sometimes these problems are not documented, but our IBM Global Services consultant knows about them."

"As time goes on, the IBM cluster becomes easier to manage. I expect in another six months we will be able to reduce the number of hours we spend on this cluster by 25%. At that point we will be able to cut back on our use of our IBM Global Services consultant. I expect we will be able to manage the cluster with the equivalent of 1.5 full time people."

It is interesting to note that several of the IBM respondents rely on their IBM Global Consultant to help them out of challenging situations. In fact, overall, IBM study respondents were more likely to outsource some or all of their cluster management to a third-party (see Chart #11). HP respondents, on the other hand, were more likely to handle 100% of cluster management activities "in-house." One IBM respondent, who is familiar with both operating systems, commented that the OpenVMS code has not changed that much over the past 10 years. In his view, OpenVMS is robust and very stable. AIX, on the other hand, has had more patches and updates.

Top Reasons Why HP OpenVMS Clusters Cost Less to Manage than IBM AIX Clusters

■ **Between Jan. 1, 2000 and December 31, 2003, HP clusters required far fewer security patches than IBM.**

   – **Only 2 for HP compared with 29 for IBM.**

      • **Source: CERT® Coordination Center. This is an organization that tracks Internet security problems. CERT/CC is operated by Carnegie Mellon University and funded by the U.S. Department of Defense and the Department of Homeland Security.**

■ **Applying patches in OpenVMS is easy due to Single System Image and rolling upgrade.**

■ **HP clusters provide higher availability than IBM.**

   – **IBM clusters have, on average, three times more crashes than HP clusters.**

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7

The chart to the left summarizes the key reasons why HP clusters have lower management costs than IBM clusters. When taking differences in availability, ongoing maintenance and security patches into account, **the data indicates that the primary reasons for HP's TCM[TM] advantage over IBM are due to differences between the HP and IBM servers themselves, as well as their operating systems and clustering software**.

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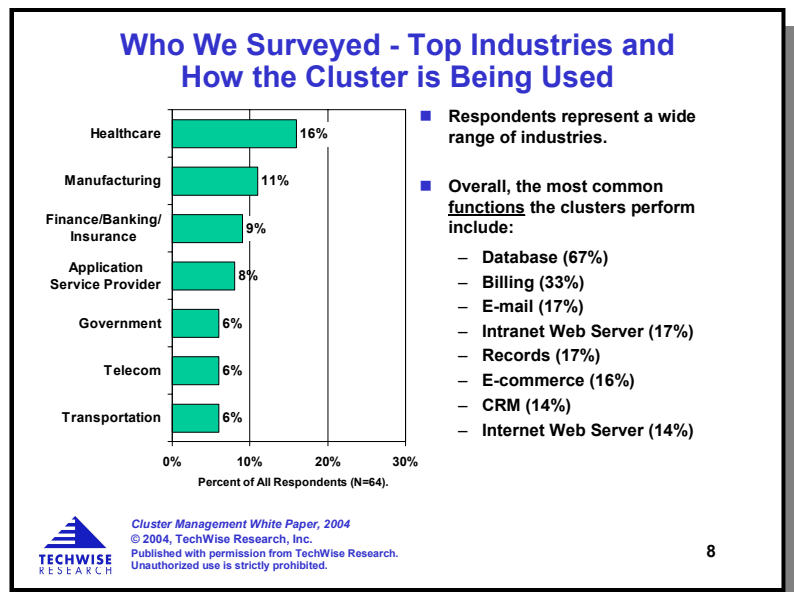
Testing for Sample Bias

The quantitative and qualitative findings show that HP OpenVMS/AlphaServer clusters are more cost-effective to manage than IBM AIX/pSeries clusters. However, it is possible that the magnitude of HP's TCM[TM] advantage over IBM was influenced by differences in the profile of the HP and IBM respondents. To understand what impact, if any, sample bias may have had on the findings, TechWise Research compared the profile of the HP and IBM respondents to determine if there are any differences due to the following:

> Industries surveyed
> Cluster function
> Type and number of applications running on the cluster
> Size of cluster and its array
> Cluster upgrade history
> Who manages the cluster
> Respondents' level of expertise

The next sections explore each of the above factors and compare the findings between the HP OpenVMS/AlphaServer and IBM AIX/pSeries clusters. These sections show that the **significant cost advantage HP clusters have over IBM in the area of cluster management is <u>not</u> due to sampling bias**. The profile of the HP and IBM respondents are similar in terms of (1) industries surveyed, (2) cluster function, (3) type and number of applications running on the cluster, (4) size of the cluster and its array, (5) cluster upgrade history, (6) who manages the cluster, and (7) the respondents' level of expertise with the cluster.

Is There a Difference By Industry?

It is possible that management costs may be dependent on the type of industry in which the cluster is being used. Some industries, such as government, may have different needs than others. The chart to the right shows the industry breakdown for this study. All of the respondents were randomly recruited from a broad mix of industries. There is no difference between HP and IBM clusters in terms of the industries represented. **The difference in TCM[TM] between HP OpenVMS and IBM AIX clusters, therefore, does <u>not</u> appear to be the result of an industry sample bias**. Overall, the top represented industries include: healthcare, manufacturing, and finance/banking/insurance.

Who We Surveyed - Top Industries and How the Cluster is Being Used

Healthcare 16%
Manufacturing 11%
Finance/Banking/Insurance 9%
Application Service Provider 8%
Government 6%
Telecom 6%
Transportation 6%

0%   10%   20%   30%
Percent of All Respondents (N=64).

- Respondents represent a wide range of industries.

- Overall, the most common <u>functions</u> the clusters perform include:
  - Database (67%)
  - Billing (33%)
  - E-mail (17%)
  - Intranet Web Server (17%)
  - Records (17%)
  - E-commerce (16%)
  - CRM (14%)
  - Internet Web Server (14%)

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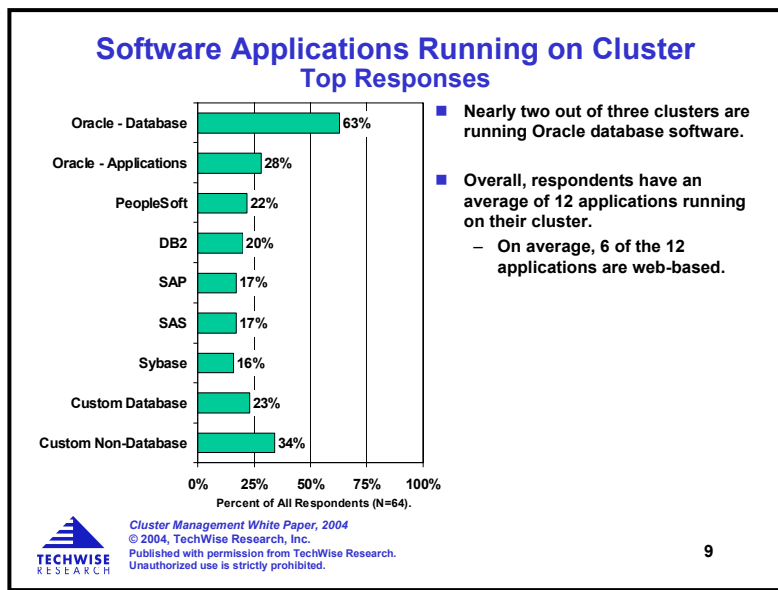
8

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Is There a Difference By Cluster Function?

It is also possible that the cluster's function could impact management costs. Some functions may require more hands-on management than others. For this reason, we asked respondents to indicate the primary functions their cluster was performing. These findings are also summarized in the above chart. There is virtually no difference in cluster function when comparing HP to IBM respondents. Although a few more IBM respondents indicated that their cluster is used for e-mail and e-commerce, these numbers are so small that they would not have an impact on the findings.

Therefore, cluster function does not account for the difference between HP's TCM[TM] and IBM's TCM[TM].

Is There a Difference By Type and Number of Apps Running on the Cluster?

It is possible that the actual applications running on the cluster would impact management costs. For this reason, TechWise collected the names of all the applications running on each cluster. The chart below summarizes the overall findings.

Software Applications Running on Cluster
Top Responses

Oracle - Database 63%
Oracle - Applications 28%
PeopleSoft 22%
DB2 20%
SAP 17%
SAS 17%
Sybase 16%
Custom Database 23%
Custom Non-Database 34%

Percent of All Respondents (N=64).

- Nearly two out of three clusters are running Oracle database software.
- Overall, respondents have an average of 12 applications running on their cluster.
  - On average, 6 of the 12 applications are web-based.

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9

The majority of the clusters in this study are running a database application (some are running two databases). As seen in other studies TechWise has conducted on server clusters, Oracle is the most popular database, and in this instance, runs on nearly two out of three clusters. It runs as commonly on HP as it does on the IBM clusters in this study.

There are a few differences in the actual applications running on the cluster brands. Not surprisingly, IBM's database product, DB2, is only running on the IBM clusters. Forty percent of the IBM clusters are running this database (which translates into 20% overall). IBM clusters are also slightly more likely than HP to be running IBM's Informix (not graphed). HP clusters, on the other hand, are more likely to be running a custom database or custom application.

Regarding the number of end-user applications, both the HP and IBM clusters are running an average of six non-web based applications. In terms of web-based applications, IBM clusters averaged more than HP (8 versus 5, respectively). Despite IBM having more web-based applications, HP's clusters had a higher average number of end-users accessing the cluster's web-based applications. In a typical 24-hour period, HP clusters averaged 3,600 end-users versus 2,900 for IBM.

Overall, the HP and IBM clusters are running similar types and numbers of applications. The differences noted above do not appear to have had an impact on the TCM[TM] findings. Additionally, both brands averaged nearly identical costs for application management (as shown previously in the "Three-Year Total Cost of Management[TM]" chart). **Differences in applications, therefore, are not the reason behind HP's lower TCM[TM] compared to IBM**.

Is There a Difference Based on Number of Nodes or Size of the Storage Array?

The size of the cluster and its array may also impact management costs under the assumption that a larger cluster with a larger array would require more time to manage than a smaller cluster. In the web survey, TechWise Research collected information about each cluster. In terms of the number of nodes in the cluster, there was no statistical difference between the HP and IBM clusters studied. Overall, the median number of nodes in the clusters studied is three. Forty-four percent of the clusters have two nodes, while thirty-six percent have between three and five nodes. The remaining twenty percent have six or more nodes. The largest cluster studied (in terms of nodes) has 12 servers in it.

In terms external arrays, four out of five clusters studied have an external storage array. In a few instances, some of the arrays are from third-parties, usually EMC. In order to eliminate the impact a third-party array may have on management costs, those with third-party arrays were excluded from the storage management analysis. Therefore, only those using their manufacturer's brand storage array are included in the analysis. (For example, IBM clusters with IBM brand arrays.) The average size of the HP cluster's storage array is almost identical to the size of the IBM cluster's array (1.4 terabytes versus 1.2 terabytes, respectively). **Therefore, the number of nodes in the cluster and the size of its array do not appear to be factors in the TCM^{TM} findings provided in this report**.

Is There a Difference Based on Cluster Upgrade History?

A cluster upgrade has the potential to temporarily increase the amount of time it takes to manage a cluster. Whether it is adding a new server, or upgrading the operating system or cluster software, these changes could cause an increase in cluster management costs. **Cluster upgrades were not a factor in this study's findings**. By design, each cluster must have been running in a production mode for at least six months. As it turns out, virtually all (91%) of the clusters in this study have been in production for at least 12 months with the same servers. Furthermore, most clusters have been running their current operating system and cluster software for more than 12 months. The chart on the right lists the actual versions being used at the time of the web survey. Overall, respondents reported that their cluster's operating system and cluster software versions have each been running for an average of 18 and 17 months, respectively.

Cluster Software Version Used

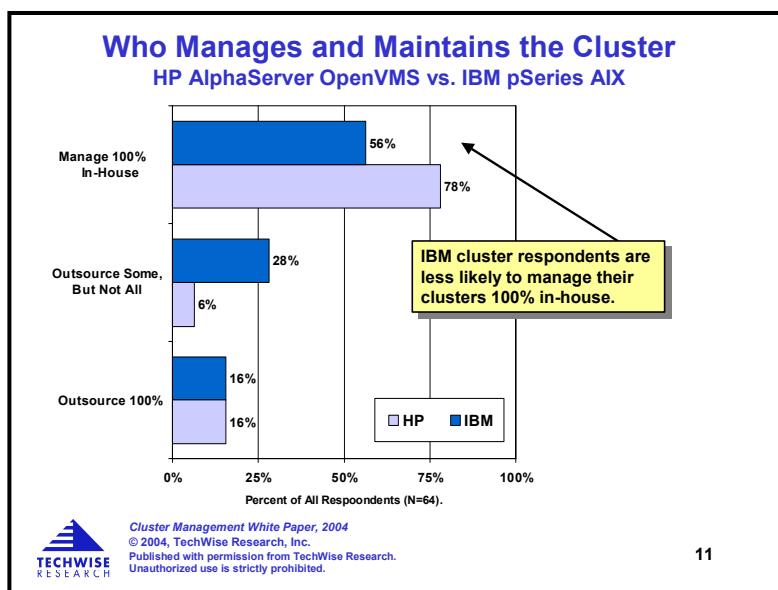| HP AlphaServer	IBM RS/6000 or pSeries
OpenVMS Cluster 7.3 (50%)	HACMP 4.x (72%)
OpenVMS Cluster 7.2 (38%)	HACMP 5.1 (28%)
OpenVMS Cluster 6.2 (9%)	
Other OpenVMS Cluster (3%)	

Is There a Difference Based on Who Manages the Cluster?

The number of people working on a cluster varied from company to company. In some cases, a single person manages the cluster. In other cases, a team of people manages the cluster. The way the cluster is being used sometimes dictates the number of people involved in managing it. For example, one IBM respondent said: *"Due to the nature of our business [a large bank], we need to have someone on the cluster 24 x 7 to provide a single point of contact in case a problem comes up. I am one of seven people who are dedicated to managing this [IBM] cluster."*

Additionally, companies outsource some or all of their cluster management to a third-party. The chart on the next page illustrates who manages and maintains the clusters on an ongoing basis.

Who Manages and Maintains the Cluster
HP AlphaServer OpenVMS vs. IBM pSeries AIX

- Manage 100% In-House: 56% (IBM), 78% (HP)
- Outsource Some, But Not All: 28% (IBM), 6% (HP)
- Outsource 100%: 16% (IBM), 16% (HP)

IBM cluster respondents are less likely to manage their clusters 100% in-house.

Percent of All Respoondents (N=64).

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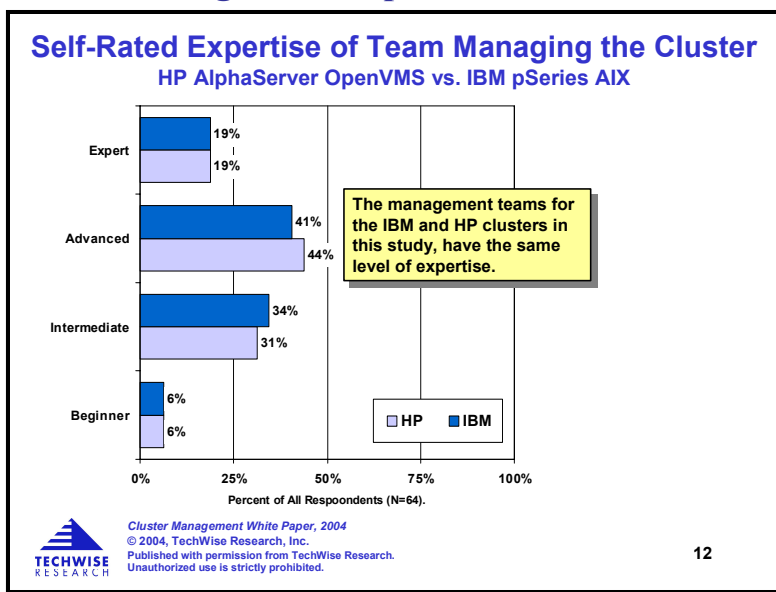Unauthorized use is strictly prohibited.

11

Nearly four out of five of the HP clusters are managed 100% in-house. The percentage is lower for IBM. Respondents with IBM clusters are more likely than those with an HP cluster to outsource some of their cluster management to a third-party. For example, one IBM respondent described his team as follows: *"Three people are involved in managing the cluster. My colleague works full-time on cluster administration, patches and fixes. I split my job between overall cluster management, backing up my [IBM Cluster] colleague, and developing applications for our clients. Third, we have an IBM Global Services consultant who spends about 20 hours a week helping us with this cluster."* Another respondent was managing a six-node IBM cluster. Five of the nodes are located onsite and are managed in-house. The sixth node is located offsite and is managed by a third-party. As previously explained, TechWise collected both the internal and external costs associated with managing each cluster. This approach ensures that the analysis reflects the total cost of managing the cluster. **The fact that IBM respondents are more likely to outsource some part of their cluster management had no impact on the finding that HP clusters have a lower TCM^{TM} than IBM**. This is because HP respondents pay, on average, 15% more money to a third-party than their IBM counterparts.

Is There a Difference Based on Cluster Management Expertise?

Regardless of who is managing the cluster, respondents were asked to rate the expertise of their cluster management team. This is important because differences in expertise may impact the amount of time spent managing a cluster. Only a few respondents indicated that this was their first experience managing a cluster. The chart to the right illustrates these findings in more detail. There are several key "take-aways" from this chart. First, **there is no sample bias in terms of respondent expertise**. The teams managing the HP and IBM clusters have the same level of expertise.

Self-Rated Expertise of Team Managing the Cluster
HP AlphaServer OpenVMS vs. IBM pSeries AIX

- Expert: 19% (IBM), 19% (HP)
- Advanced: 41% (IBM), 44% (HP)
- Intermediate: 34% (IBM), 31% (HP)
- Beginner: 6% (IBM), 6% (HP)

The management teams for the IBM and HP clusters in this study, have the same level of expertise.

Percent of All Respoondents (N=64).

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12

Second, more than half rate their team as either "Advanced" or "Expert." Finally, only 6% rated their team as "Beginner." This paper's management cost findings, therefore, are based on the time experienced IT teams spend managing clusters with which they are familiar.

Conclusion

This white paper focused on comparing the Three-Year Total Cost of Managing^{TM} HP OpenVMS/AlphaServer and IBM AIX/pSeries server clusters. Data from TechWise's February 2004 TCO study, and subsequent white paper (*Total Cost of Ownership for Entry-Level and Mid-Range Clusters*) were re-analyzed, and then combined with results from in-depth respondent interviews and additional research, to better understand the reasons for HP's TCM^{TM} advantage over IBM.

The significant cost advantage HP clusters have over IBM in the area of cluster management is <u>not</u> due to sampling bias. **Rather, the data suggests that HP OpenVMS/AlphaServer clusters are more cost effective to manage than IBM AIX/HACMP pSeries clusters because the HP clusters are more stable and require fewer resources to maintain**. Some of the findings that support this conclusion are based on HP's higher availability, lower security vulnerability, and easier/less frequent implementation of patches and updates. HP OpenVMS/AlphaServer clusters also seem to derive benefit from OpenVMS' Single System Image, which allows them to manage their entire cluster from a single console.

Cluster management costs are essential for IT managers to consider in any purchase decision. Regardless of brand, management costs far exceed the initial purchase price of entry-level clusters over a three-year period. For example, in the case of HP 2-way clusters, three-year management costs are three times the list price to purchase the cluster with its storage array and service contract. For IBM 2-way clusters, three-year management costs are eleven times the list price to purchase the cluster with its storage array and service contract. Given the continuing battle IT professionals face to manage limited resources as effectively as possible, cluster brands that have lower management hours will not only free up limited IT resources, but also impact the bottom line.

TechWise Research is an independent primary market research firm that specializes in the computer industry. If you have any questions regarding this research, please contact us at:

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(1) For a free copy of the TechWise Research paper entitled *Total Cost of Ownership for Entry-Level and Mid-Range Clusters*, visit www.techwise-research.com/whitepapers.html