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**Tivoli** software  
IBM TotalStorage®

## **IBM storage solutions:** A total cost of ownership study



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### Executive summary

In November 2002, IBM sponsored an independent study of over 200 IT managers with storage area networks (SANs). The main objectives were to discover and quantify the principal drivers of the total cost of ownership (TCO) for SANs, to understand the pain points in managing SANs and to quantify how various technology improvements could reduce these costs.

The study shows that improvements that reduce the complexity and centralize the management of storage into common pools of storage have the potential to save costs through:

- *Increased disk utilization and reduced cost of the storage subsystems on a SAN*
- *Improved productivity of the personnel managing SAN storage*
- *Improved application availability by reducing the planned and unplanned outages of access to data on SAN storage*

If these improvements could be made, the study respondents who were averaging 5.1 terabytes (TB) of SAN storage each, would expect the following TCO savings in the first year:

- *U.S.\$227000 reduction in disk costs by increasing disk utilization and reducing storage subsystems costs*
- *\$80000 reduction in personnel costs by improving storage administrator productivity*
- *\$2.6 million reduction in lost-opportunity costs by improving application availability*

The study respondents reported a number of pain points that contributed to greater complexity and higher cost of managing storage. In order to lower SAN TCO and minimize pain points, the study respondents highly valued solutions that:

- *Maintain access to data at all times—this minimizes application downtime and the lost-opportunity costs associated with the downtime.*
- *Centralize storage management—this facilitates the ease of managing storage and the ability to use powerful automated tools across all the storage subsystems. This includes the desire to manage across different server and storage subsystem brands.*
- *Ease the management of growth—respondents need the ability to grow storage for applications quickly and to understand, control and minimize the growth.*



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## Highlights

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- *Increase the rate of storage utilization – this allows more efficient use of storage devices, and reduces the number of storage devices purchased and managed.*
- *Improve the ease, speed and reliability of backup and restore.*
- *Facilitate and ease the movement of data – this improves the ability to manage the data on storage subsystems and facilitates server consolidations.*
- *Allocate data easily to the storage device with the appropriate quality of service and cost.*
- *Facilitate and ease disaster-recovery planning.*

*The survey targeted persons responsible for SAN storage of at least 2 TB for UNIX/Linux or Windows servers.*

### **Study background and respondent profile**

In August 2002, Protocol Market Research, Inc., under contract to IBM, conducted a survey of IT organizations about the drivers of TCO. The respondents were screened to ensure that they met the following criteria:

- *Had one or more SANs with at least two TB of storage currently installed or planned to be installed by year end 2002.*
- *Primary operating systems of the servers on these SANs were either UNIX®/Linux or Microsoft® Windows® platforms (open-systems environments).*
- *Had responsibility for purchasing or operating the SANs, and knowledge about their SAN storage environment.*

The survey concluded in November 2002 with a total of 202 respondents meeting the criteria. Highlights of the respondent profile:

- *Two-thirds were information technology (IT) managers or directors.*
- *Two-thirds worked in companies with 1000 or more employees.*
- *88% worked in data centers.*
- *The average respondent had 5.1 TB of SAN storage for his or her UNIX/Linux or Windows servers.*
- *They were equally distributed between having small (2 to 4 TB) or large (5 or more TB) amounts of storage on their SANs, and between having UNIX/Linux or Windows as the primary operating systems on their SANs.*




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**Highlights**

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*The survey respondents averaged 5.1 TB of SAN storage for their UNIX/Linux or Windows servers with a 48% utilization rate.*

*The survey respondents planned to have their SAN storage personnel handle 39% more storage per person in 2003 than in 2002.*

**Respondent SAN profile**

Getting into the details of their storage environment, the respondents had the following profile for their SANs:

- *An average of 5.1 TB of SAN storage for their open-systems (UNIX/Linux and Windows) servers. This is planned to grow 57% to 8.0 TB in 2003.*
- *The average disk-utilization rate was 48%, with a desire to achieve 68% utilization. This works out to 1.0 TB more capacity than desired for the average respondent's storage capacity (20% of 5.1 TB).*

**SAN storage personnel**

In order to control administrative costs for their storage environments, the IT managers surveyed planned to increase the amount of storage managed by each full-time equivalent (FTE) by 39% in 2003. Figure 1 shows how the FTEs for open-systems SANs are distributed across the major labor task categories.

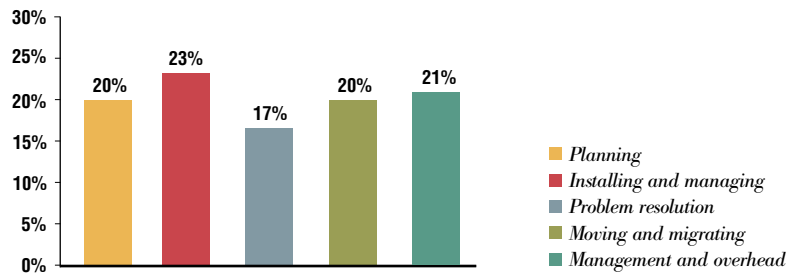


Figure 1. Allocation of open-systems SAN labor tasks (major categories).

These major labor task categories were broken down further into subtasks, providing a more complete picture of how personnel manage the SAN storage environment. These subtasks form the basis of the storage personnel productivity analysis in this white paper.

**Improving TCO**

Respondents were asked a number of questions on their storage costs, starting with how they calculate return on investment (ROI). From there, the survey gathered details on what storage tasks take up significant time and cause pain, and what the utilization rates of disk storage and the opportunity costs of storage downtime are.



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## Highlights

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*The main ROI factors focus on improvements in application availability, storage utilization and personnel productivity.*

*The pain index is a combination of the amount of time a storage task takes and the pain associated with the task.*

*Over 90% of survey respondents rated continual access to their data as important. Respondents rated centralized control next in level of importance.*

### **ROI factors**

When calculating ROI for their SAN storage purchases, respondents are most likely to use three factors: increased application availability (in 76% of ROI calculations), improved storage system utilization (in 68%) and improved storage personnel productivity (in 59%). The average payback period used to determine ROI is 23 months.

### **Storage task pain index**

The survey asked respondents to calculate how much time their FTEs spend on storage tasks, and how much pain each of these tasks causes. Multiplying these two numbers results in the *pain index*, which is used to make an ordinal ranking of the storage tasks. With indices of 0.449 and 0.417, respectively, the tasks of “physically moving data” and “application server consolidation or migration” are at the top of the ranking. After these two tasks, the pain indices fell to 0.302 (“troubleshooting and fixing backup problems”) and below, with “providing storage usage information for billing” coming in last with a pain index of 0.038.

### **Business efficiency**

The survey asked respondents to rate a number of storage environment characteristics for their importance to business efficiency. Over 90% of the respondents rate continual access to their data as important (a score of 4 or 5 on a scale of 1 to 5, with 5 being very important). The top three characteristics of continual access to data are “grow storage without impacting access to data,” “back up data without impacting access to data” and “move data without impacting access to data.” Centralized control comes next in degree of importance to the respondents, with “centralized data and storage management,” “central control point for backup and restore and copy services,” “having a common pool for unallocated storage” and “detailed knowledge of storage device utilization” next on the list.



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## Highlights

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*Survey respondents estimated that they could significantly improve their storage personnel efficiency with the ability to:*

- *Create new storage easily for new applications*
- *Move and migrate data nondisruptively*
- *See server data from a centralized point*
- *Have centralized access to their storage*

### **Improving personnel efficiency**

The survey asked a number of questions on how the respondents could improve the efficiency of their SAN storage personnel. Their estimated overall 2003 SAN storage personnel costs are \$188 000.

- *Planning and implementing new applications that require significant amounts of storage—the respondents estimated that about 50% of their personnel effort is spent on these tasks. They estimated that if they could cut this effort in half by using better tools that make it easier to create new storage for new applications, they could save 25% of their personnel costs. This calculates to \$47 000 of their estimated 2003 personnel costs.*
- *Moving and migrating data—the respondents estimated that about 20% of their personnel effort is spent on these tasks. They estimated that they could cut this effort by 41% if they had the ability to move and migrate data nondisruptively. This calculates to \$15 000 of their estimated 2003 personnel costs.*
- *Planning for growth—the respondents estimated that about 20% of their personnel effort is spent on these tasks. They estimated that they could cut this effort by 37% if they could see server data from a centralized point. This calculates to \$14 000 of their estimated 2003 personnel costs.*
- *Going server to server to manage storage—the respondents estimated that they spend about nine hours per week doing this. They estimated that they could cut this effort by 34% if they had centralized access to their storage. This calculates to \$5500 of their estimated 2003 personnel costs.*

*Note: These numbers are not necessarily additive as there may be overlap between these tasks.*

### **Reducing storage costs**

Respondents plan to spend an average of \$269 000 on disk storage for their SANs in 2003. This section looks at how this cost could be reduced.

- *Disk storage utilization—the respondents estimated their disk storage utilization at 48%. They would like to be at 68%. If they could achieve this utilization, they would get savings in two ways. First, they would be able to gain an additional 1.0 TB of existing storage by using the 20% delta between the actual and desired utilization of their existing 5.1 TB of 2002 SAN storage. This would allow them to defer 2.125 TB of*



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## Highlights

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*Survey respondents could significantly reduce their SAN disk storage costs with the ability to:*

- *Achieve their desired disk utilization*
- *Share data effectively*
- *Move data to storage with the appropriate quality of service and cost*

- purchases that they would have had to make at a 48% utilization rate. Using a figure of \$0.05 per megabyte (MB) of disk storage, this calculates to \$106 000. Second, they would be able to increase the utilization of their 2003 planned disk purchases, and thus reduce the amount of disk storage space they need to purchase. Based on the amount of data that the respondents anticipate storing in 2003 less the added storage space they would gain from the increased utilization rate on their existing storage, the savings calculate to \$48 000 at \$0.05 per MB.*
- *Duplicated data—the respondents estimated that 22% of their SAN disk storage is duplicated. They estimated they could reduce this by 23% with effective data sharing. If they could achieve this data sharing, they would get savings in two ways. First, they would be able to gain an additional 124 GB of existing storage by deleting the unneeded duplicated data from their 5.1 TB of SAN storage. This allows them to defer 258 GB of purchases that they would have had to purchase at a 48% utilization rate. Using a figure of \$0.05 per MB of disk storage, this calculates to \$12 900. Second, they would be able to increase the utilization of their 2003 planned disk purchases by deleting unneeded duplicated data that they plan to store in 2003, and thus reduce the amount of disk storage space they need to purchase. Based on the amount of data the respondents anticipate storing in 2003, the savings calculate to \$13 600.*
  - *Data on storage with appropriate quality of service and cost—the respondents estimated that they would move 31% of their data from higher- to lower-cost storage devices if they had an automated way to allocate files to storage devices with the appropriate quality of service and cost. For example, the respondents could move data of lesser value from a high-end, replicated storage device to a lower-cost storage device with tape backup. Based on the existing data stored and the data that the respondents anticipate storing in 2003, and assuming that existing and anticipated duplicate data is deleted, if 31% of the existing data and anticipated data could be placed on storage devices at one-half the cost, the savings calculate to \$77 000.*
  - *If the respondents could implement all three of the cost savings mentioned, their total savings, accounting for overlapping savings, calculate to \$227 000.*



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## Highlights

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*Survey respondents estimate that their annual opportunity costs arising from the difficulty of managing storage are about \$2.6 million.*

### ***Improving application availability***

Respondents were asked about the details of their application outages, and how much of these outages are due to the problems caused by the difficulty of managing storage. The opportunity cost of the outages is measured in terms of revenue, profit or savings lost, so the addition of these numbers can't be used beyond a directional sense of the magnitude of the costs of downtime.

The application outages are divided into four parts:

- *Planned downtime for mission-critical applications—the median response was 40 minutes per week at an average opportunity cost of \$3300 per minute.*
- *Planned downtime for nonmission-critical applications—the median response was 60 minutes per week at an average opportunity cost of \$1200 per minute.*
- *Unplanned downtime for mission-critical applications—the median response was 10 minutes per week at an average opportunity cost of \$14800 per minute.*
- *Unplanned downtime for nonmission-critical applications—the median response was 16 minutes per week at an average opportunity cost of \$2200 per minute.*

These numbers calculate to an average total annual opportunity cost of application outages of \$20.1 million.

Respondents estimate that 13% of these outages are caused by problems stemming from the difficulty of managing storage. If these problems were eliminated, they could reduce the opportunity costs of application outages by \$2.6 million.

### **Conclusion**

The study yields a number of conclusions. SAN storage is growing rapidly, and storage personnel are being asked to manage this storage with minimal increases in headcount. The study respondents believe that the problems with managing storage can be improved with better tools and products. These improvements may lead to reduced costs and greater business agility and efficiency. The savings and benefits from these improvements may add up significantly.



**The next step**

Integrated storage solutions from IBM, organized under both the IBM TotalStorage® and IBM Tivoli® software brands, are designed help IT managers reduce their TCO by evolving to an on demand operating environment. While SANs provide value today, in terms of connectivity, performance, scalability, consolidation and manageability, the added functionality from virtualization could help maximize their value. The IBM TotalStorage Virtualization Family and Tivoli storage software components have been designed to improve SAN functionality and to address many of the pain points and components of SAN TCO discussed in this paper. With the IBM TotalStorage family of virtualization products, customers will have the ability to manage their storage infrastructure from a centralized point of control with centralized volume, file and device management. Together with Tivoli storage software components, the products have been designed with the goal of helping customers drive down the cost and complexity of storage management while providing greater flexibility to address rapidly changing storage needs.

The capabilities of IBM storage solutions address the four main areas of TCO (see Figure 2).

IBM Storage Solutions	Main TCO area addressed
A centralized point of control for volume management	Productivity of the personnel managing SAN storage
Designed for reduced downtime for planned and unplanned outages, maintenance and backups	Application availability
Designed to improve resource utilization	Disk utilization and cost of the storage subsystems on a SAN
A single, cost-effective set of advanced copy services	Productivity of the personnel managing SAN storage

Figure 2. IBM storage solutions capabilities to address TCO.



IBM TotalStorage Solution Centers and IBM Storage Software sales specialists have been trained on cost of ownership assessment tools that leverage the details behind this and other studies. They can work with IT managers to assess their particular environment and estimate the potential savings and benefits that could be gained by moving to a virtualized storage environment. Moving to virtualization is a key next step in evolving to an on demand operating environment. This has the potential to meet the changing needs for storage that are driven by business and business application needs.

For more information about IBM e-business on demand™ and IBM storage, go to [ibm.com/ondemand](http://ibm.com/ondemand), [ibm.com/totalstorage](http://ibm.com/totalstorage) and [ibm.com/tivoli](http://ibm.com/tivoli)

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A total cost of ownership study***



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