TECHNICAL BRIEF

Assessing storage infrastructures

Identifying opportunities to improve efficiency, increase utilization and reduce costs

MAY 2004

1 Executive summary

Implementing information lifecycle management can help your organization realize strategic goals. But to achieve success, you must first thoroughly understand your storage environment and issues. Without this understanding, you run the risk of failing to meet data performance goals, overspending on data protection and making inefficient use of storage resources.

To avoid these risks, a successful information lifecycle management implementation begins with an audit of your current storage infrastructure. StorageTek's Global Storage Architecture Services applies best practices methodologies to conduct objective assessments that yield possible solutions and recommendations. The resulting detailed design can help your organization achieve higher returns on your storage investments while delivering enhanced service levels.

2 Understanding your data and its importance to your business

For many organizations, today's IT storage environment is a product of a "just add more storage, storage is cheap" attitude. This pervasive attitude has led to costly inefficiencies. Many environments now have an overabundance of storage that is unevenly distributed and poorly managed.

This situation results in imbalances. Some areas of your business may constantly be looking to add storage while storage capacity sits unused in other areas. Data throughput may be poorly protected and some not protected at all. I/O throughput may be unsatisfactory in some areas and wasted in others. Some applications may have mixed success rates. In addition, your organization might face excessive downtime to provision storage.

To address these problems, your company needs to know what it actually has in terms of storage resources and how those resources fit into its business. Key questions to answer include:

- What are the specific server, disk, switch and tape hardware resources?
- What applications are running on what servers, with what processing power and throughput?
- What data exists, where is it, how old is it and how often is it accessed by what applications?
- Where is capacity constrained?
- Where is performance constrained?
- What applications and data are under-protected?

There is no quick way to answer these questions. Discovering this information requires a methodical process that involves close interaction with the people in your organization. Steps in the discovery process include the following:

- Interview IT personnel to understand what their processes are, whether these processes are documented and how well they are followed
- Gain an understanding of IT's most painful issues: backup? restore? storage growth? performance constraints? personnel shortages?
- Gain an understanding of the IT budget and its rate of growth or decline
- Identify business-critical applications
- Examine the data center: check its floor space, identify physical constraints, gain an understanding of the physical layout
- Collect relevant data, including information on hardware assets, configuration, capacity and performance; application assets, growth and performance; and file and database capacity, access patterns, age and growth

3 A proven assessment methodology

StorageTek's information lifecycle management assessment processes and tools respond to these information-gathering and assessment needs. The StorageTek® approach is based on a proven methodology for assessing an organization's storage challenges and opportunities.

StorageTek's Global Professional Services assessment delivery methodology, ADIM, adheres to guidelines for ISO 9004.2-compliant services. It is based on four steps:

- **Assess** the storage environment to identify business challenges and objectives and to define the current environment and processes
- **Design** the solution to resolve findings, utilizing industry best practices
- **Implement** the solution with minimal business disruption, providing knowledge transfer to users
- **Manage** the solution and seek further operational efficiencies

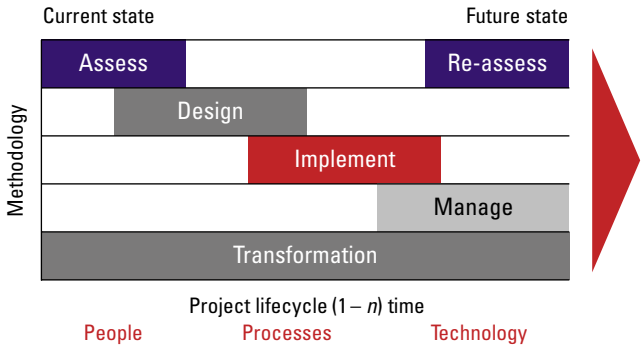


Figure 1. ISO 9004.2 compliance.

ADIM methodologies are developed within the StorageTek best practices organization. These methodologies promote the appropriate collection of data and the use of optimal quality control processes. The goal is to provide a smooth introduction of the storage solution into your environment with minimal disruption.

ADIM methodologies include project management for the entire engagement, with continuous communication and reporting to your organization. When implementation is complete, the resulting solution is handed off to StorageTek's Support Services group for ongoing maintenance and warranty management.

4 Global Storage Architecture Services

StorageTek's Global Storage Architecture Services applies ADIM methodologies to provide you with objective findings, conclusions and recommendations from highly knowledgeable storage experts dedicated to their projects.

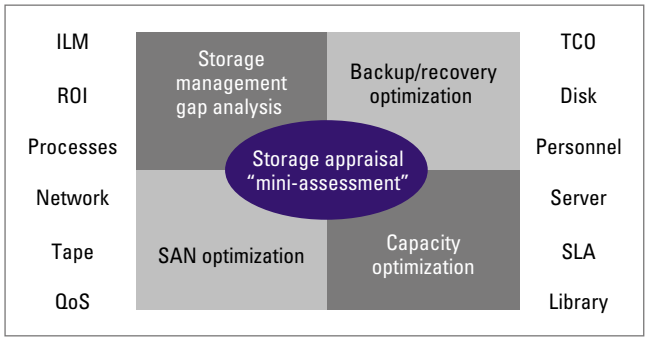


Figure 2. Global Storage Architecture Services.

4.1 The assessment process

After conducting comprehensive interviews focused on your business requirements and data storage environments, the StorageTek team audits and documents your storage systems and identifies opportunities related to operational efficiencies, processes, standards and backup/recovery. You receive a final appraisal report and executive presentation, an engineering design diagram that details the proposed solution, an interoperability guide and a project plan for implementation. Through knowledge transfer, your staff can continue to implement the solution benefits.

4.1.1 Interviews

StorageTek consultants begin by interviewing key staff members. The objective of the interviews is to quickly gather information regarding business requirements, future plans and the current status of your storage environment. Each interview lasts from one to two hours and is scheduled to minimize disruption to the participant's normal work routine.

Among other topics, the interviews explore:

- Applications support
- Capacity planning and performance management
- Change and problem management
- Contingency planning and disaster recovery
- Tape operations
- Production scheduling control
- Storage management
- Technical support

4.1.2 Data gathering

The data collection is completed with the StorageTek assessment service toolkit. This toolkit is a set of products ideally suited to collecting this information. Some of the tools are designed for general use and some are targeted toward specific areas.

For mainframe environments, StorageTek uses tools to collect data from SMF, DF/HSM, the tape management system, real-time monitors, DB2, VSAM and RMF. Specific SMF record types are identified for collection. For Open Systems, StorageTek uses tools to gather hardware, application, and historical and real-time file system data.

This data is analyzed and a summary is prepared for review with your project team. The emphasis of the review effort is to establish a baseline for the current storage environment and to see how it compares with your business requirements and future plans.

During the data gathering phase, StorageTek consultants:

- Leverage StorageTek tools for data modeling and simulation, performance analysis and storage configuration options
- Prepare and deliver a summary report
- Review current storage-related business processes with the project leadership from your team
- Establish a baseline of your current operating environment
- Compare your current environment with your business requirements and future plans

4.1.3 Develop/design

StorageTek consultants then analyze the data, develop models and simulate various configurations in their formulation of the review. At the end of this phase, StorageTek provides a summary review of the findings and plans to your project coordinator.

4.1.4 Presentation and report

StorageTek provides to your organization a formal printed report and executive presentation of the conclusions gleaned from the engagement. The report includes a discussion of the process followed in the assessment, including the following steps:

- Audit IT practices, structure and processes
- Profile storage resources and data
- Identify business and technical requirements
- Deliver a concise assessment report, including:
  - Findings
  - Conclusions
  - Gap analysis
  - Recommendations
- Design a solution
- Create a detailed design or report
- Create an implementation plan
- Create a strategic roadmap

5 Assessment services

5.1 Storage Appraisal service

The assessment process begins with a high-level review of overall storage utilization, data aging patterns, backup effectiveness, read/write ratio, data duplication and throughput. This service highlights potential high-return areas, identifies waste and uncovers opportunities to use hierarchical storage techniques.

A storage appraisal is a quick survey to identify potential problems in the environment. Unlike the other assessments, a storage appraisal takes no more than two weeks and includes only a segment of your storage environment. Ideally, data collection is performed on one or two disk subsystems, and up to five application servers, including a backup server. The interviews last no longer than 30 minutes per person.

The results include:

- Backup/recovery
  - Success rates
  - Gigabytes backed up
  - Throughput
- File system analysis
  - Age groupings by megabytes
  - Number of copies of files
  - Megabytes-per-second throughput
  - Allocation to logical unit numbers (LUNs) by server
- Database analysis
  - Table space percent allocated
  - I/O counts
  - Access patterns against age
- Switch ports
  - Capacity and utilization

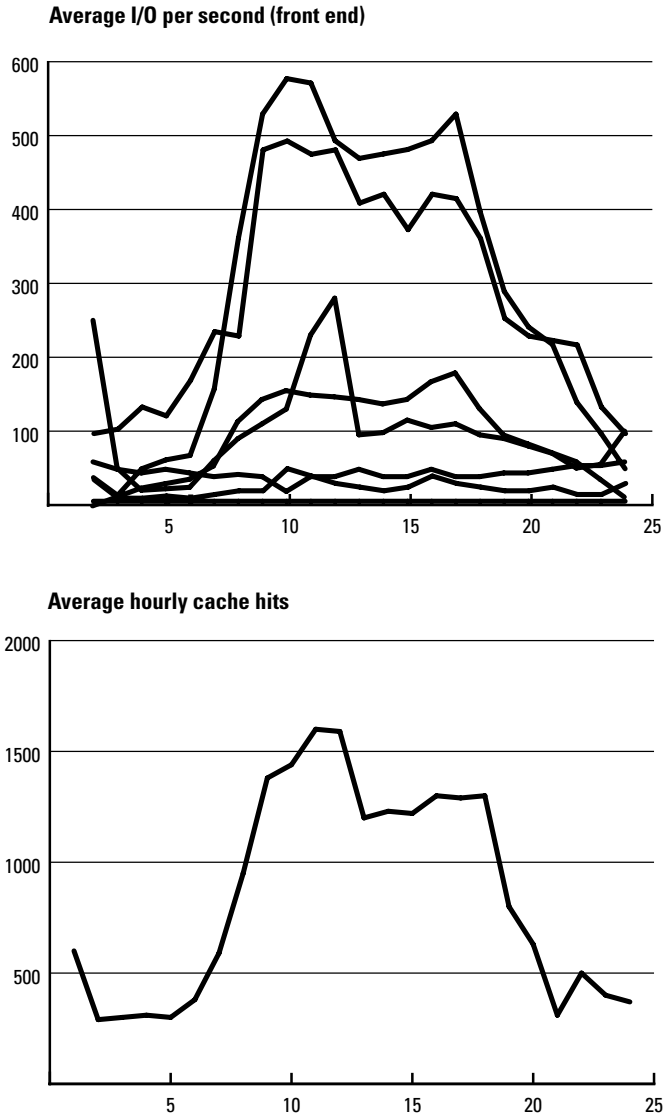


Figure 3. Samples of performance data collected as part of a storage appraisal.

5.2 Disk Capacity Optimization service

The Disk Capacity Optimization service seeks to uncover and eradicate wasted disk space and improve storage management practices in direct attached storage (DAS), network attached storage (NAS) and storage area network (SAN) arrays. This work yields metrics related to disk and database space used and allocated, aging data profile, duplicate files and optimum storage tiers.

The capacity optimization assessment strives to:

- Reduce complexity and increase storage utilization
- Reduce cost by migrating data to appropriate tiers of storage using the information lifecycle management philosophy

The assessment process involves:

- Gathering hardware asset information
- Gathering capacity and performance information for disks, switches, files and databases
- Gathering age, size and access patterns for the files and database tables
- Monitoring e-mail, backup and database applications; examining errors, traffic patterns and capacity throughput
- Analyzing all the data gathered and generating a detailed report identifying key problem areas
- Designing a solution that addresses the identified key problems

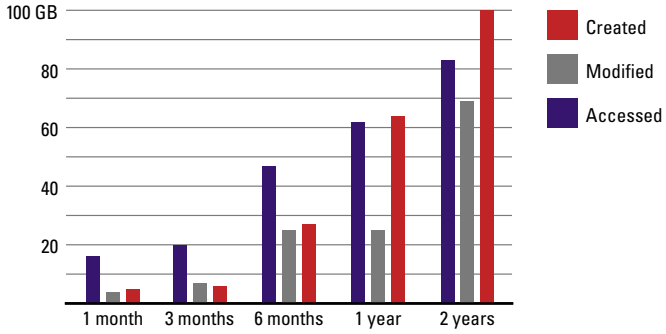


Figure 4. A capacity optimization assessment process includes the gathering of metrics on hardware, application and data utilization, such as GB accessed by age. Most of the user's data has not been accessed in the last 6 months.

5.3 Backup/Recovery Optimization service

The backup/recovery assessment option involves a discovery project that shows you how to better meet your backup/restore windows and improve mirroring of vital information or restore lost data. StorageTek may be able to help increase your confidence in meeting applicable regulatory requirements for data protection and identify the optimum way for you to meet your desired successful backup completion rate.

This assessment focuses on best practices in data protection for both disaster recovery and operational recovery. Key goals include:

- Determining whether you are adequately (but not overly) backed up
- Meeting your backup and restore windows
- Providing the assurance that you can restore lost data

The backup/restore optimization can include assistance in transitioning to new backup/recovery software or migrating from one software application vendor to another.

The assessment process involves:

- Gathering statistical information from the disk subsystems
- Gathering statistical information from the backup history
- Gathering statistical information from the tape libraries
- Understanding the expected backup window and comparing that to the actual backup window
- Understanding the expected and actual restore windows
- Discovering whether all data is being backed up that needs to be: What servers are running what applications, and how critical is their data to your business? Are those servers included in the backup policies? What process is in place for adding new servers to support backup and snap mirroring policies?
- Measuring the error rates on backups and how they are affecting service levels
- Measuring the gigabytes backed up, the throughput rate for backups and how that is affecting your service levels
- Interviewing staff to gain a closer understanding of policies for disaster recovery, backup and archiving
- Understanding the availability needs of different data and comparing those needs to the mirroring and business continuity processes in place
- Analyzing all the data gathered and generating a detailed report identifying key problem areas
- Designing a solution that addresses the identified key problems

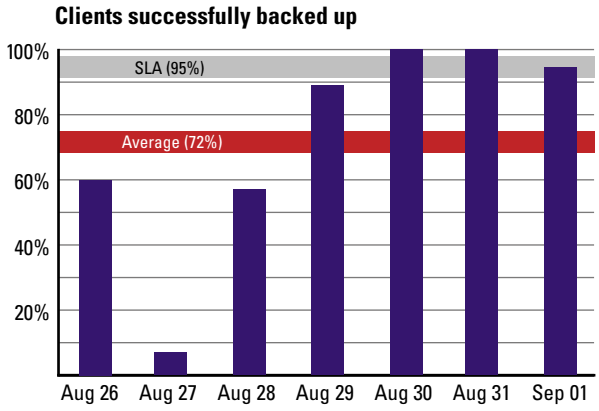


Figure 5. Backup/recovery assessment compares desired backup success rates to actual backup success rates, among other metrics.

5.4 SAN Optimization Service™ offering

This service option provides an assessment of your current environment, including DAS, NAS and SAN disk, switch and tape resources (including drives and libraries). This information is meant to help reduce SAN management costs, improve service levels, maintain interoperability and eliminate storage islands in favor of a centrally managed SAN.

Consolidating islands of storage into a centrally managed SAN can pay big benefits. If you have an existing SAN, StorageTek helps you to optimize your solution for better performance. If you are considering a new SAN, StorageTek evaluates your distributed storage to help you prepare for consolidation. StorageTek assists in determining how you will glean the most value and performance from a SAN design. Important goals are:

- Minimizing the high management costs of SAN architecture
- Achieving a high degree of interoperability
- Capitalizing on the SAN economy-of-scale promise

The SAN optimization assessment process includes:

- Discovering your existing storage environment topology
- Gathering asset information on the environment, including disks, tapes, switch types, firmware releases, port connections, zoning and LUN masking
- Monitoring performance of the existing environment from the switch, disk, controller and tape drive perspectives
- Interviewing staff to determine the desired or needed performance bandwidth and expected growth in the environment
- Identifying key problem areas - current or future - by analyzing the information gathered
- Creating a new SAN environment or altering the existing environment
- Modeling expected performance and capacity improvements
- Generating a detailed report outlining recommended changes
- Creating a presentation showing the total cost of ownership changes and the return on investment

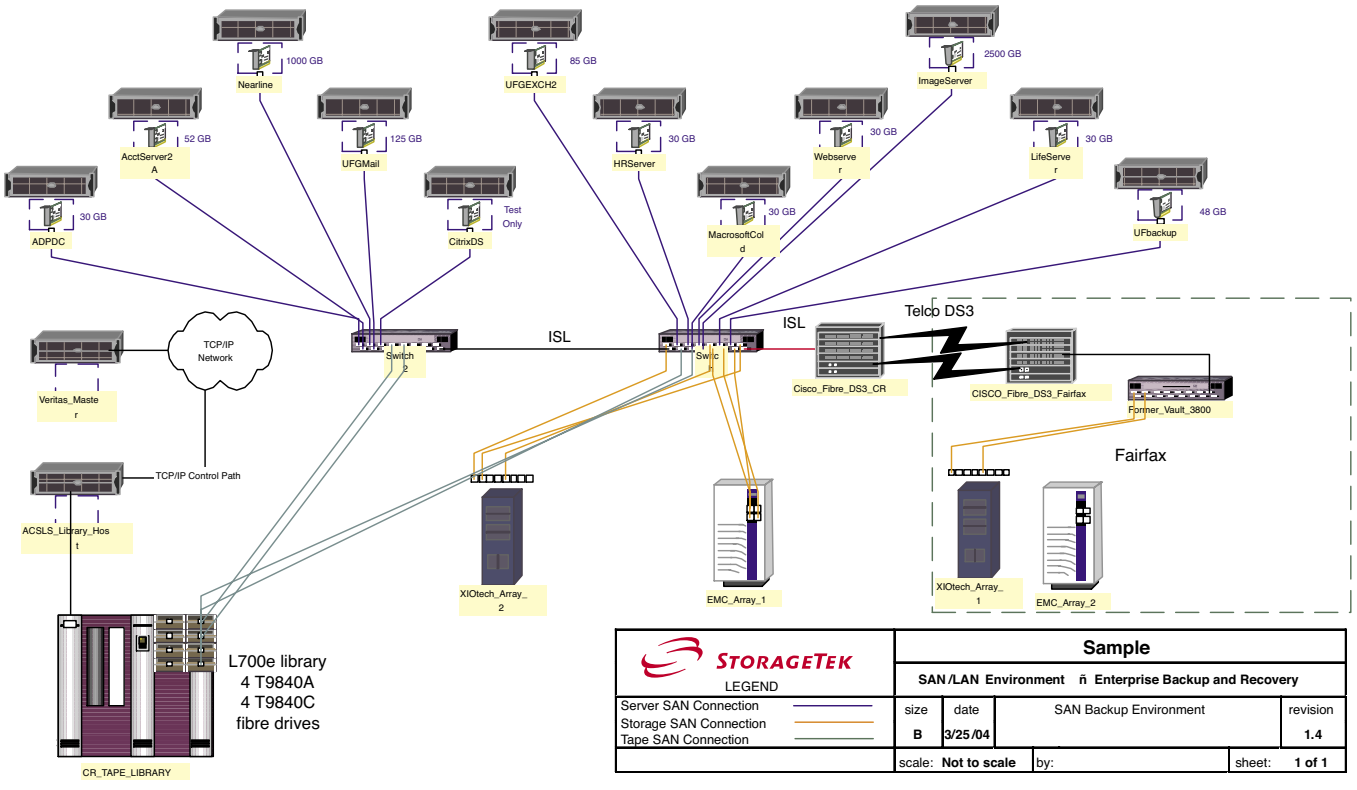
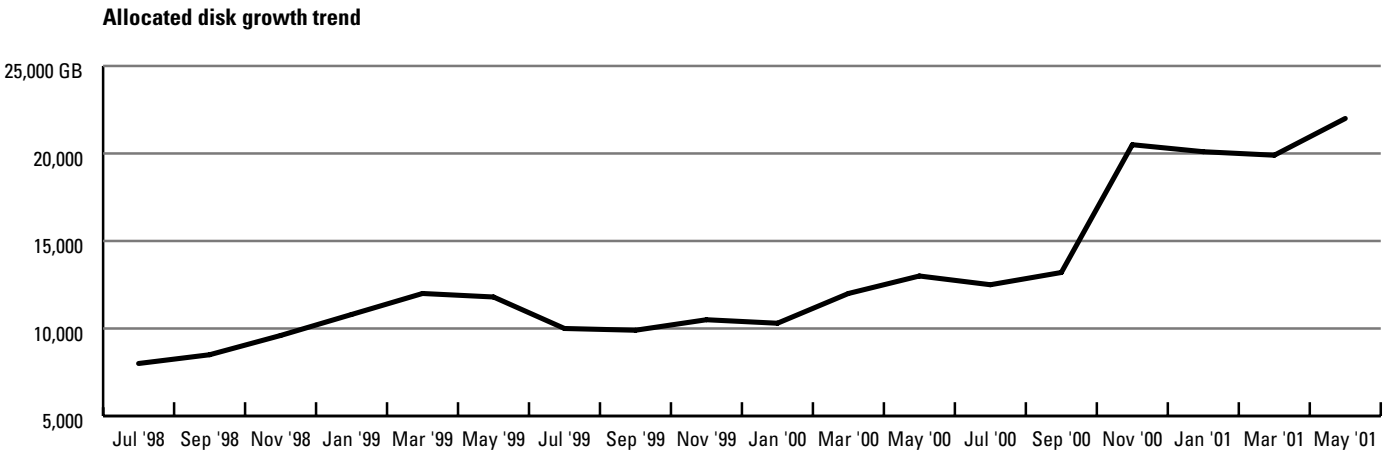


Figure 6. An example of a discovered SAN environment.



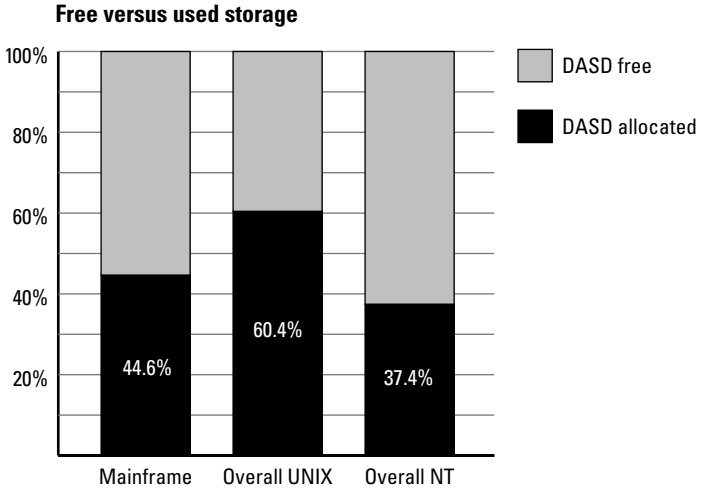


Figure 7. Assessments can include a detailed examination of disk-growth trends and storage utilization by operating system.

5.5 Storage Management Gap Analysis service

The Storage Management Gap Analysis service examines your mainframe and/or Open Systems storage management practices, including operational processes, organizational structure, documented and undocumented procedures, conventions and metrics. You can compare your practices to industry standards and best practices and review a gap report that includes recommendations for information lifecycle management, technology, processes and personnel.

To maximize the value of your storage infrastructure, StorageTek employs a broad approach to your overall storage management, processes and personnel, targeting both disk and tape in the mainframe and distributed environments. The goals of this service are to benchmark your practices against industry best practices in storage management and deliver a strategy for optimum storage efficiency while receiving the best return on your storage investments.

Storage Management Gap Analysis involves:

- Interviewing staff to audit your IT department, including:
  - Operational processes
  - Organizational structure
  - Documented procedures
  - Undocumented conventions
  - Management metrics
- Comparing the audit results to industry standards
- Comparing the audit results to best practices
- Creating a Storage Management Gap Analysis report
- Recommending improvements

Medium priority

Stoplight	Rating	Process/procedure	Recommendation and comments
Red	2	DASD provisioning	Formalize and automate the Direct Access Storage Device (DASD) provisioning processes by employing information lifecycle management philosophy.
Red	1	Storage administration	Reduce exposure to space problems by employing automation tools, reduce dependencies on Tape Mount Management (TMM) and refine Data Facility System Managed Storage (DFSMS) controls and parameters.
Red	2	Performance management	Move to application-level storage response time monitoring.
Red	2	Capacity planning	Assign roles and responsibilities for capacity planner. Set periodic capacity review cycle. Use tools to assist in forecasting growth.
Yellow	3	Configuration management	Create and enforce an "interoperability guide" to track devices, features, software and microcode levels.
Green	4	Installation planning	Prior to purchasing new DASD, examine applications to exploit new device features and functionality. Ensure adequate training and documentation is secured from vendor during the purchase negotiations.

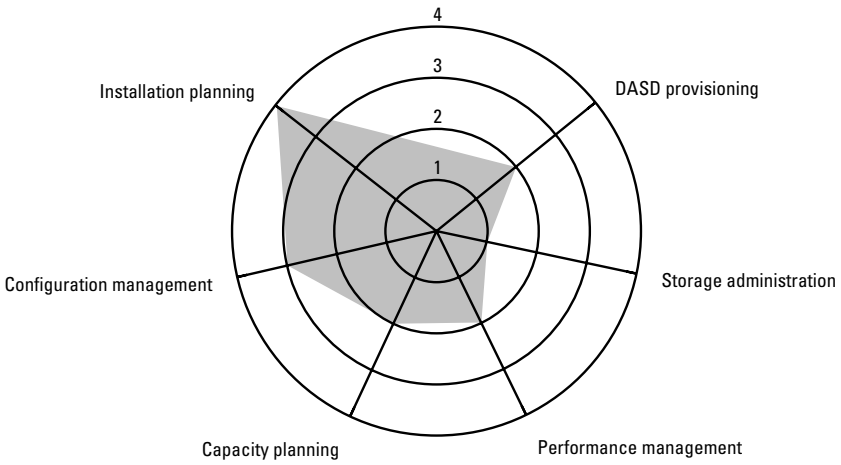


Figure 8. Storage Management Gap Analysis report depicting actual practices in relation to best practices. The higher the number, the closer to best practices.

6 Applying assessment results

Once all interviews are completed and all the data is collected, the assessment service process is completed by:

- Analyzing the collection data and interview findings. This analysis involves matching the interview results with the data to identify your most critical business problem areas. Analyzing the data involves combining the information pulled from the suite of products used.
- Creating a detailed report identifying problem areas and depicting the current status of your environment against the industry standards
- Creating a presentation showing recommendations, as well as the total cost of ownership (TCO) and return on investment (ROI) for each recommendation versus the current state with the hurdle rate

Lower TCO is made possible by:

- Recommending performance efficiency improvements for disk, tape and storage network resources
- Recommending capacity utilization improvements for disk, tape and storage network resources
- Providing talent and experience that your company does not presently have on staff
- Capitalizing on benefits from recommended process improvements
- Reaping increased internal and external client satisfaction through improved service levels
- Increasing your ability to reduce business risks caused by poorly performing backup and recovery processes
- Improving your ability to meet user/customer and regulatory requirements
- Enabling competitive advantage from lowered operation costs
- Offering advice for consolidating costly distributed storage into a centrally managed pool
- Smoothing the migration path from one backup and recovery environment to another

Current cost of ownership by category

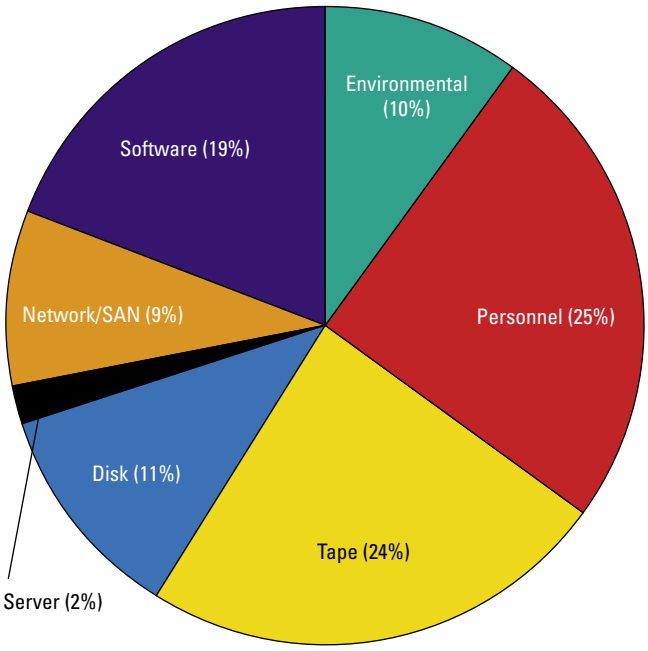


Figure 9. The assessment process provides a granular view of cost of ownership of storage resources that highlights opportunities for improvement.

Higher ROI is shown through:

- Disk storage savings
- Infrastructure savings
- Environmental savings
- Tape hardware and media savings
- Storage server and software savings
- Personnel savings
- Salvage value of capital items

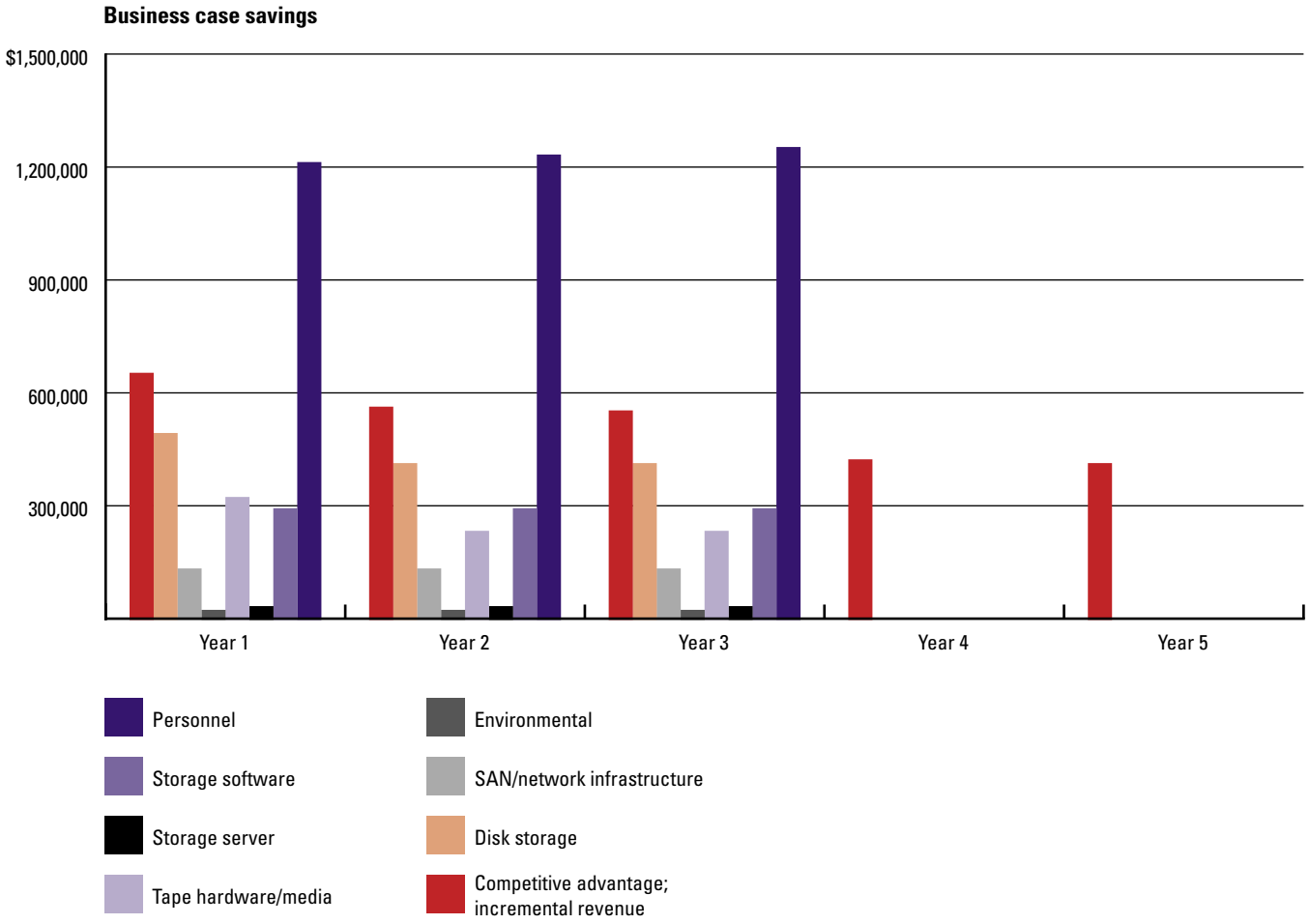


Figure 10. The assessment process includes data on opportunities to generate cost savings through enhanced processes and better utilization of storage resources.

7 Why StorageTek?

7.1 People, process, technology

StorageTek is positioned to assist your organization in assessing your storage infrastructure and identifying opportunities to employ information lifecycle management to achieve your business goal. The StorageTek approach encompasses the people, process and technology needed for a comprehensive assessment of your storage infrastructure.

People — The personnel who conduct assessments:

- Are certified professionals
- Are measured in terms of customer satisfaction
- Use a practical hands-on approach
- Understand and practice ITIL (IT Infrastructure Library) methods (ITIL provides global training and certification for levels of service expertise)
- Provide access to global experience and certified StorageTek resources, including StorageTek valued partners
- Involve clients in a consultative manner
- Are agnostic to technology and focused on heterogeneous environments
- Provide responsible leadership
- Use a training curriculum for performance development

Process — StorageTek's information lifecycle management assessment services:

- Draw on stringent change management techniques
- Take a quality-driven approach, using proven methodologies
- Manage the entire project lifecycle
- Follow strict client guidelines
- Understand service level agreements (SLAs) and service level management (SLM)
- Provide documentation
- Include set approaches to problem escalation management and risk mitigation
- Are backed by a support structure for monitoring, reporting and review

Technology — StorageTek's assessment services:

- Provide access to StorageTek interoperability labs
- Provide access to global engineering labs
- Use best-of-class technology and knowledge transfer methods
- Include stringent Q&A and training prior to field deployment
- Are backed by a heterogeneous support infrastructure

7.2 For more information

To learn more about StorageTek's capabilities in relation to your specific needs, contact your StorageTek representative. Ask how StorageTek's Storage Architecture Services can provide your team with impartial findings, conclusions and recommendations from knowledgeable storage experts.

ABOUT STORAGETEK®

Storage Technology Corporation (NYSE: STK), a $2 billion worldwide company with headquarters in Louisville, CO, has been delivering a broad range of storage management solutions designed for IT professionals for over 30 years. StorageTek offers solutions that are easy to manage, integrate well with existing infrastructures and allow universal access to data across servers, media types and storage networks. StorageTek's practical and safe storage solutions for tape automation, disk storage systems and storage integration, coupled with a global services network, provide IT professionals with confidence and know-how to manage their entire storage management ecosystem today and in the future.

StorageTek products are available through a worldwide network. For more information, visit www.storagetek.com, or call 1.800.275.4785 or 01.303.673.2800.

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