



MANAGING INFORMATION STORAGE: TRENDS, CHALLENGES, AND OPTIONS 2011-2012

Including impact of virtualization and
cloud computing

How are IT and storage managers coping with the organizational challenges posed by the explosion of data, increasing criticality of digitized information, and rapid introduction of new storage technologies?

This updated paper contains the findings of a study based on input from over 1,000 storage professionals and IT managers worldwide.

This research will assist IT/storage managers in comparing and correlating their environment and plans with the overall trends in the industry, and the impact of emerging technologies such as storage virtualization and cloud computing.

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EXECUTIVE SUMMARY

The explosion of data, its criticality, and business' growing dependency on digital information are leading to larger and more complex information storage environments that are increasingly challenging to manage.

Poorly designed or managed storage infrastructures put the entire business at risk in the case of a catastrophic failure. A robust storage infrastructure requires highly reliable equipment as well as a strong team of experts to manage it efficiently.

This paper focuses on storage infrastructure, and presents findings from a global survey of more than 1,000 IT professionals. This study will help IT managers benchmark their plans to align with the overall trends in the industry. The first such study was published in 2006, and has since been updated annually. A large number of IT/storage managers have used the information to refine their planning and decision making.

KEY CHALLENGES

IT/storage managers and storage professionals across companies of all sizes face the following mission-critical challenges:

- Managing storage growth
- Designing, deploying, and managing storage in a virtualized server environment
- Designing, deploying, and managing backup, recovery, and archive solutions
- Storage consolidation
- Making informed strategic/big-picture decisions
- Designing, deploying, and managing disaster recovery solutions
- Lack of skilled storage professionals
- Designing, deploying, and managing storage in a cloud computing environment
- Convincing higher management to adopt cloud
- Managing external cloud service providers

Explosive growth in storage requirements, and a widening storage technology knowledge gap across the industry, are making all of the above mission-critical tasks even more challenging.

IMPACT OF CLOUD COMPUTING

The findings of this study clearly indicate a rapid adoption of virtualization and cloud computing technologies. This transformation is impacting the skill sets of their entire technology team. Approximately 50 percent of the managers indicated that their teams have medium to high impact on their skill sets across systems, storage, and networking teams. Moderate impact indicates that these teams need to acquire additional skills, whereas high impact reflects a need to entirely re-skill the team for cloud computing environments.

Currently 53 percent of the storage capacities are in traditional/classic IT environments. A large percentage of this allocation (31 percent) is likely to move to either a virtualized server environment or cloud environment in the next 24 months. Only 42 percent and 18 percent of the managers believe that they have at least half of their teams capable of working with virtualized and cloud environments, respectively.

Migrating to a highly virtualized cloud environment is a significant transformation. It requires a considerable amount of technology and business planning. Over 80 percent of the companies recognize the need for having an in-house team of professionals to lead the planning, design, and implementation of cloud and related technologies.

Since cloud computing requires cross skilled expertise, IT professionals are required to have necessary knowledge across technologies that will be used in cloud infrastructure and services. More than 31 percent of the professionals express that they have the pre-requisite knowledge and skills (O/S, storage, networking, and virtualization) to get trained and become “cloud-ready.”

COMPLEX STORAGE ENVIRONMENTS

Despite the differences in industry segments and the data center size, there is a strong consistency across companies in terms of the technology deployed, storage management practices, and challenges.

Nearly all critical data is now stored on external disk storage subsystems. The average usable capacity is approximately 1.3 PB (up 35 percent year over year) which is typically spread across multiple sites. Growth in storage requirements, larger capacity disks and subsystems, and affordable pricing have all led to large storage configurations. Over 51 percent of responding companies now have 100 TB or more usable storage to manage. Over five percent of the companies now manage 10 PB or more usable storage.

Storage subsystems, SANs, and backup/recovery technologies are most commonly implemented, followed by NAS, DAS, and replication technologies. Technologies such as storage virtualization and cloud (private and public) have started to emerge strongly in these companies as well. Storage virtualization is implemented at 45.3 percent and cloud at 21.3 percent of the represented companies.

Each of these storage technology segments is unique, offering their own specific business and operational value. Each requires a different set of skills for effective design and management. Lack of knowledge and expertise in a specific segment can lead to under-deployment of one or more of these technologies.

CRITICALITY OF STORAGE AND THE NEED FOR FORMALIZED STORAGE GROUPS

Storage infrastructure is mission-critical. Losing storage in a catastrophic situation can severely damage a customer’s business. When a disaster does occur, information on storage subsystems can be lost permanently unless a well-designed recovery mechanism is planned and implemented.

In addition to reliable equipment, a well-structured storage group of highly skilled professionals is critical to build and maintain a high-performance, high availability storage infrastructure. Increasing number of companies have recognized this need and have created formal storage management groups. Today over 65 percent of the represented companies have formal storage management groups—up from approximately 50 percent in 2006-2007.

Storage groups are responsible for overall planning, design, implementation, monitoring, administering, managing, and operations. While the structure of the group, titles, and roles may not be standardized, responsibilities and tasks are common across companies.

Based on IT/storage manager feedback, approximately one-half of existing storage teams can manage SANs, backup and recovery, and storage subsystems. However, only 40 percent of the existing storage teams are adequately prepared to manage NAS, local replication, and remote replication. The emergence of virtualization and cloud technologies has placed new training and development requirements on storage managers and IT professionals. Only 25 percent of the teams are strong on virtualization and only 7 percent are considered strong on cloud.

THE STORAGE TECHNOLOGY KNOWLEDGE GAP

Participants in this study and their companies have very aggressive plans to hire storage professionals in the next 12 months. Their forecasts indicate more than a 30 percent (up from 22 percent last year) expansion of their existing staff.

Although managers prefer to hire experienced or certified storage professionals, a severe shortage of such skills in the marketplace is causing managers to resort frequently to internal recruitment. The skills gap continues to widen as organizations adopt virtualization and cloud computing.

The shortage of experienced storage professionals, and the lack of storage technology education in the marketplace and in academics, have restricted the growth of information storage and management functions. EMC® has taken the lead and has initiated storage technology education by collaborating with numerous leading universities.

RECOMMENDATIONS AND CONCLUSIONS

Based on the findings of this study, IT managers and storage managers must ensure that:

- They evaluate the impact of virtualization and cloud computing on the skills of their storage and other technology teams, and plan for them to acquire new relevant skills in virtualization, cloud, or related domains.
- Skills assessments and development of IT/storage professionals are top priorities to address growth and transformation.

The serious shortage of skilled storage professionals also creates attractive opportunities for the next generation of IT professionals and for those looking for a different career in a challenging, high-growth, and dynamic industry.

EMC'S RESPONSE AND INITIATIVES

EMC recognizes the need for more highly-skilled professionals in its customer base and across the entire IT industry. EMC conducted this study to identify deficiencies in the storage industry and to ascertain how we can contribute to addressing these challenges.

The following key initiatives offer options for storage managers and professionals to acquire or improve their skills to benefit their organizations:

EDUCATION SOLUTIONS

- Cloud Architect and Data Center Architect 'open' Curriculum
 - Cross domain Cloud Architect training and certifications
 - Storage domain Data Center Architect training and certifications
- Information Storage Technology 'open' Curriculum
 - Unique offering in the industry; leads with concepts and principles
 - Covers all segments of information storage and management technology
 - Adopted by a large number of universities worldwide
 - Information Storage and Management book
- EMC Technology-specific Learning Paths
 - Helps leverage extensive capabilities for EMC technology and solutions
 - Comprehensive coverage for all segments of EMC technology
- EMC Proven™ Professional Certification Program
 - Quality assurance, formal validation, and recognition
 - Option of 'open' and EMC technology specialties

All of the above education solutions are available globally via EMC Education Services to EMC customers, partners, and employees.

To address the widening knowledge gap in the industry, the following exclusive resources were introduced. They enable non-EMC users, as well as university students, to take advantage of the storage technology ‘open’ curriculum to build a successful career in this high-growth industry.

EMC ACADEMIC ALLIANCE PROGRAM

Information storage and management ‘open’ curriculum for students in colleges and universities, targeted to help build a highly skilled pool of future storage managers and professionals.

INFORMATION STORAGE AND MANAGEMENT BOOK

We offer one of the most comprehensive books on information storage and management in the industry. It is a “must have” addition to any IT reference library. Written by EMC storage experts, the book takes an ‘open’ approach to teaching information storage and management, focusing on concepts and principles—rather than product specifics—applicable to all IT environments.

1. INTRODUCTION

The unprecedented growth of data, its increasing importance, and business’ dependence on digital information are leading to larger and more complex information storage environments that are becoming more challenging to manage. From the perspective of data availability and protection, the information storage infrastructure is the most critical component of an overall IT infrastructure. It plays a key role in making applications work efficiently, both locally and across multiple sites. With the increasing complexity and criticality of storage, highly skilled and focused storage groups are as mission-critical as the technology being deployed.

This paper summarizes a global research study that was conducted to gain knowledge about how companies are meeting these challenging requirements. These findings will assist IT/storage managers to compare and correlate their plans with the overall trends in the industry. Even though each company has unique requirements, this information will be helpful in building stronger and more efficient storage management teams. Stronger storage management teams will, in turn, lead to more robust storage infrastructures.

The first such study was carried out by EMC in 2005-2006, and has been updated once a year since then. The updates and revisions for 2011-2012 include:

- Most current information via a global survey of 1,024 managers (19 percent) and storage professionals (81 percent)
- Information on data centers and processing centers instead of the entire enterprise
- A focus on usable storage capacities instead of installed raw capacities
- Further details related to storage groups such as job titles, tasks and responsibilities, and hiring plans
- Emergence of cloud and its impact on skill sets

Global trends are identified in areas related to:

- Technical environments and emerging technologies
- Management challenges
- Practices for building storage management groups
- Options for acquiring more or better storage skills
- Migration of data to virtualized and cloud environments

The study was conducted between January and February of 2011. We used comprehensive surveys and reached out to thousands of storage professionals to assemble and compile this information.

The study included:

- All major geographies and industry segments
- EMC users as well as those using storage solutions from other vendors
- Large, medium, and small enterprises

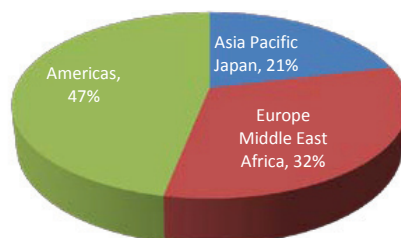


Figure 1—Geographic distribution of participants

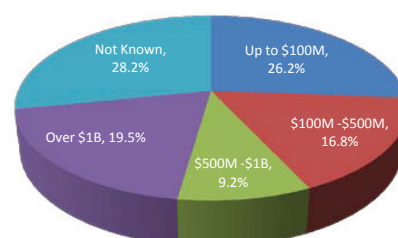


Figure 2—Annual revenue of companies represented

2. CHALLENGES FACED BY IT/STORAGE MANAGERS

IT/storage managers and storage professionals identified the following activities and constraints as their key challenges. These challenges are common to both large enterprises as well as SME (Small and Medium Enterprises) sectors of the industry.

Challenges Identified by IT/Storage Managers and Professionals
Managing storage growth
Designing, deploying, and managing storage in a virtualized server environment
Designing, deploying, and managing backup, recovery, and archive solutions
Storage consolidation
Making informed strategic/big-picture decisions
Designing, deploying, and managing disaster recovery solutions
Lack of skilled storage professionals
Designing, deploying, and managing storage in a cloud computing environment
Convincing higher management to adopt cloud
Managing external cloud service providers

Table 1—Most important activities/constraints identified as challenges by managers and professionals

Each of these activities is on-going at various levels in each of the companies. Activities such as backup/recovery have been in practice for decades; still the professionals believe that they are not doing enough or not performing these activities well.

Table 2 summarizes the input from managers and professionals. When compared with last year’s responses, an additional 6 percent of organizations are facing the challenge of managing their storage growth. Organizations have indicated that their second biggest challenge is to “design, deploy, and manage storage in a virtualized server environment.” In addition, about 22 percent of participants cited cloud as becoming an important technology to tackle.

2011–2012	2010–2011	IT / Storage Managers and Professionals
77%	71%	Managing storage growth
47%	47%	Designing, deploying, and managing storage in a virtualized server environment
41%	53%	Designing, deploying, and managing backup, recovery, and archive solutions
39%	45%	Storage consolidation
38%	38%	Making informed strategic/big-picture decisions
35%	45%	Designing, deploying, and managing disaster recovery solutions
22%	23%	Lack of skilled storage professionals
10%	New in 2011-2012	Designing, deploying, and managing storage in a cloud computing environment
9%		Convincing higher management to adopt cloud
3%		Managing external cloud service providers

Table 2—What keeps them awake? Pain points in order of priority identified by managers and professionals

Primary reasons for not executing many of these activities to the desired levels are:

- Explosive growth in data creation and storage requirements—managing storage growth impacts associated challenges such as backup and recovery, consolidation, and disaster recovery.
- Storage professionals’ knowledge and skill gaps—lack of skilled storage professionals impacts the ability to execute to the above challenges and make informed strategic decisions.
- Emerging technologies such as virtualization and cloud—increasing deployment of virtualization across the industry has an impact on how IT tasks are carried out in a traditional operational environment. This further widens the skills gap.

2.1 IMPACT OF CURRENT ECONOMIC SLOWDOWN

Market improvement in 2010 resulted in a positive impact on the re-skilling requirements of storage teams. Managers having to re-skill their entire team was reduced to 9.4 percent from 11 percent. Also only 54 percent of managers reported that their team requires additional skills compared to 56 percent the previous year. Overall, the improved market had a slight positive impact on the skill set of these teams.

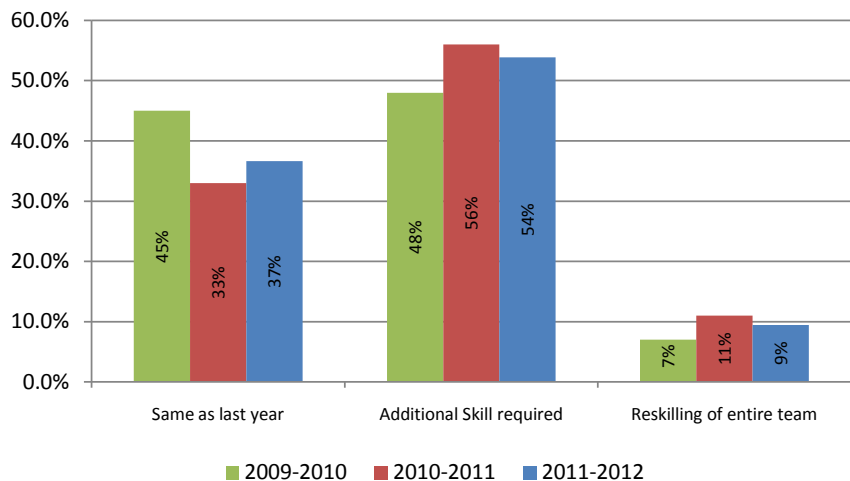


Figure 3—Impact of current economic climate on the required storage skills

2.2 IMPACT OF CLOUD COMPUTING

Managers have indicated that cloud computing is impacting the skill sets of their entire technology team. Approximately 50 percent of the managers indicated that their teams have had medium to high impact on their skill sets. Moderate impact indicates that these teams need to acquire additional skills, whereas high impact reflects a need to entirely re-skill the team for cloud computing environments.

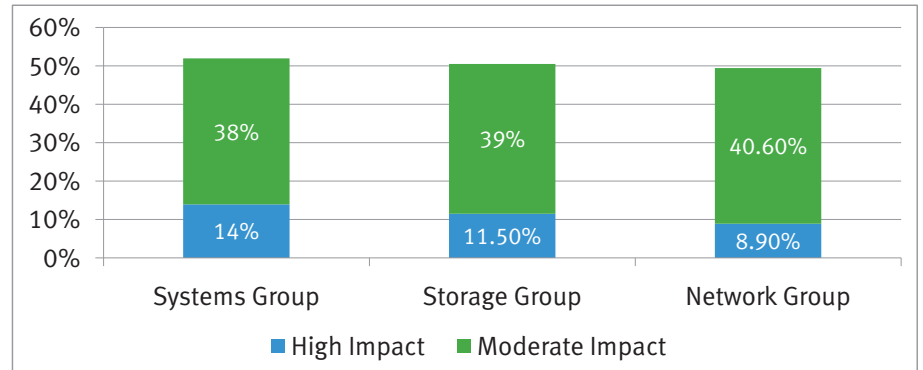


Figure 4—Impact of cloud computing on the IT team

3. COMPLEX STORAGE ENVIRONMENTS

This study sought to determine the similarities and differences among storage infrastructures. The responses reveal that data centers across the Americas, Europe, and Asia have deployed very similar storage solutions, including hardware and software. The sizes vary based upon business requirements, or in some cases a particular vendor may have a stronger presence in a given environment. However, on the whole, the deployed technology and challenges are very similar.

- 75 percent of the organizations surveyed have more than 20 TB usable storage and about 51 percent of the companies have 100 TB or more usable storage to manage.
- Companies with over 1 PB usable storage increased from 17 percent to 20 percent in 2011-12. This represents a 17.6 percent year over year growth rate.
- Nearly 5 percent of the companies have crossed the 10 PB mark in their usable storage capacity.

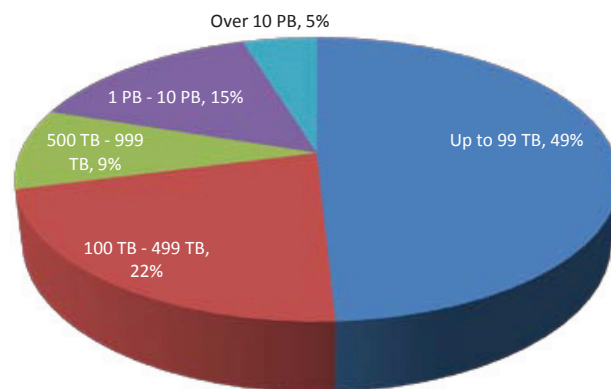


Figure 5—Distribution of storage capacity across represented companies

Average installed usable capacity is 1.3 PB. Similar calculations with last year's (2010-11) data shows an average capacity of 1.16 PB, reflecting an increase of 35 percent year over year in (average) installed usable capacities per company. This high rate of growth in storage demand causes the number one challenge for the IT/Storage managers—managing storage growth.

3.1 STORAGE TECHNOLOGY SEGMENTS

Storage technology deployment and its importance to the data center aligned with general market trends for each of the storage technology segments.

- Storage area networks (SANs), backup/recovery (B/R), and storage systems were identified by the participants as the top three important technologies for their organizations.
- Storage virtualization and storage technology for cloud are emerging with 28 percent and 12 percent in importance, respectively.

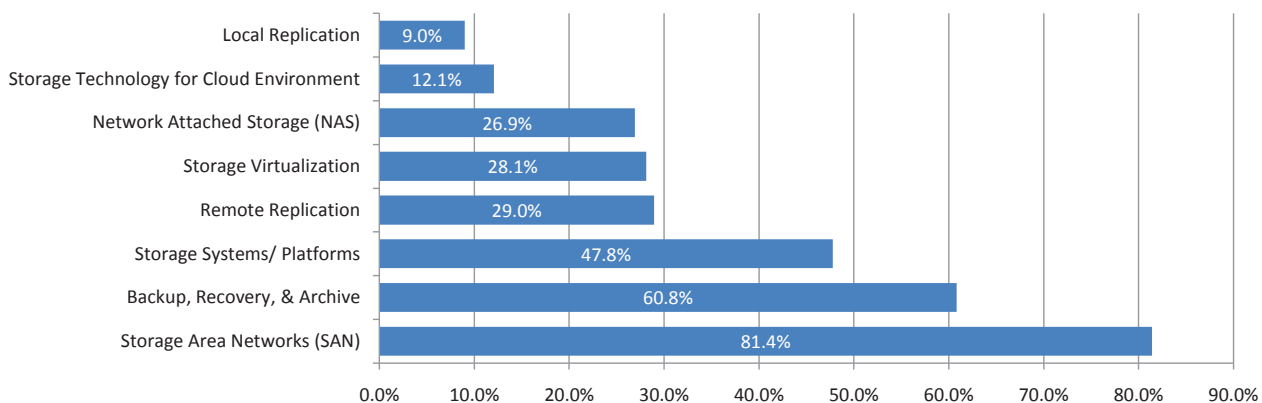


Figure 6—Storage technology segments and their relative importance

Each of the technology segments is unique, bringing its own specific business or operational values. For example, SAN and NAS provide connectivity options with unique functionality, while BR and replication technologies provide options for information protection against planned and unplanned outages. Technologies which enable cloud computing continue to generate significant interest.

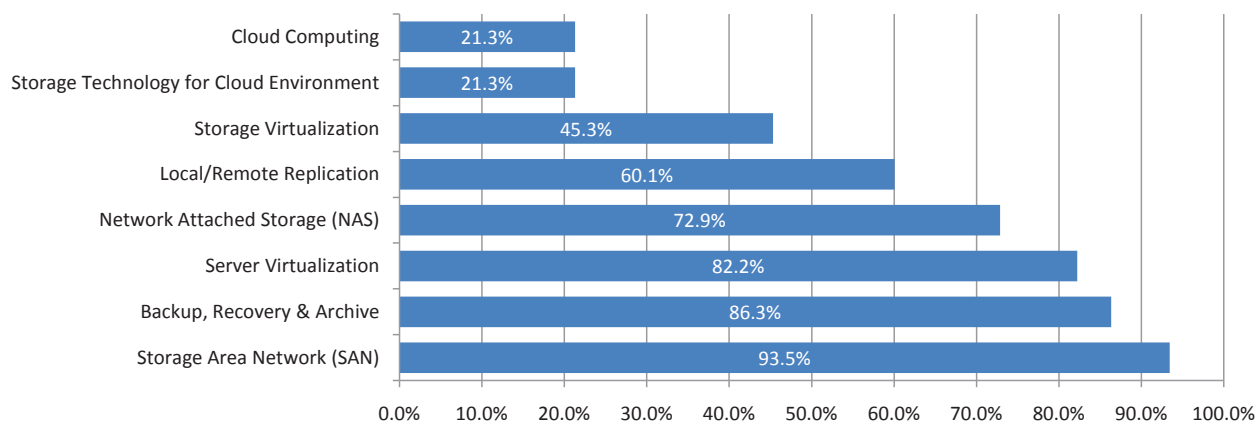


Figure 7—Most common storage technology segments implemented

Emerging technologies—such as storage virtualization and cloud computing—are gaining a significant install base. Based on the participants’ feedback, 45 percent of the companies have implemented storage virtualization, while 21 percent have cloud technologies implemented as part of their IT environment.

3.2 DATA MOVEMENT TO VIRTUALIZED AND CLOUD ENVIRONMENTS

Participants have indicated that their organization is planning to move data to virtualized and cloud environments from classic data storage environments. Currently about 53 percent of data is in a classic environment. During the next 24 months, about 30 percent of data in classic environments is expected to be moved to a virtualized/cloud environment. The highest growth, 69 percent, is expected in internal/private cloud.

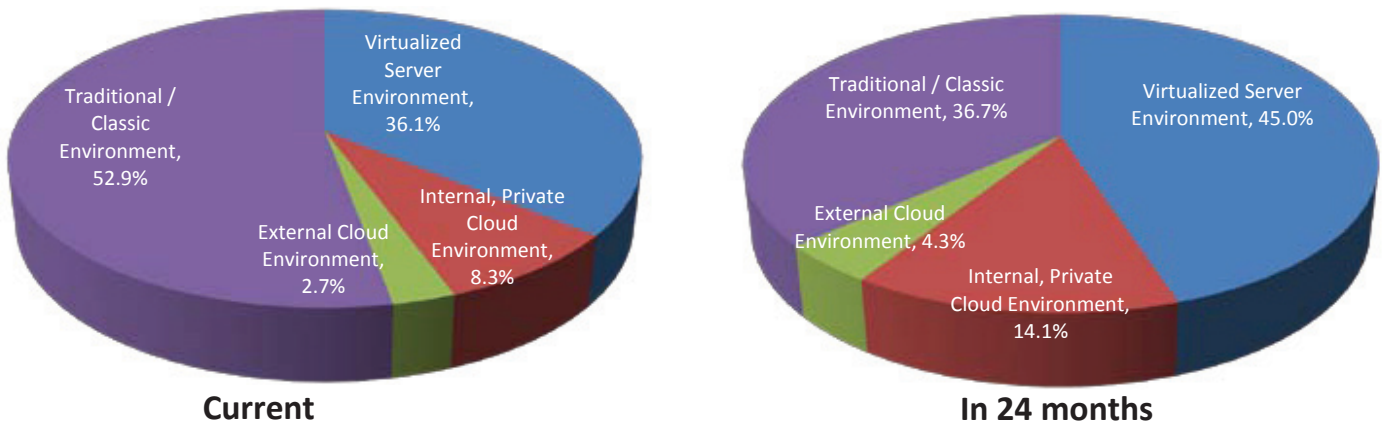


Figure 8—Data movement to virtualized and cloud environments in 24 months

Even though organizations are planning to move a substantial amount of data to virtualized and cloud environments, only 18.5 percent of managers have indicated that at least 50 percent of their team possess the necessary skills to design, deploy, and manage storage in a private cloud environment; whereas 42 percent of the managers (companies) indicate that they have at least half their team capable of working with virtualized environments (Figure 8.1).

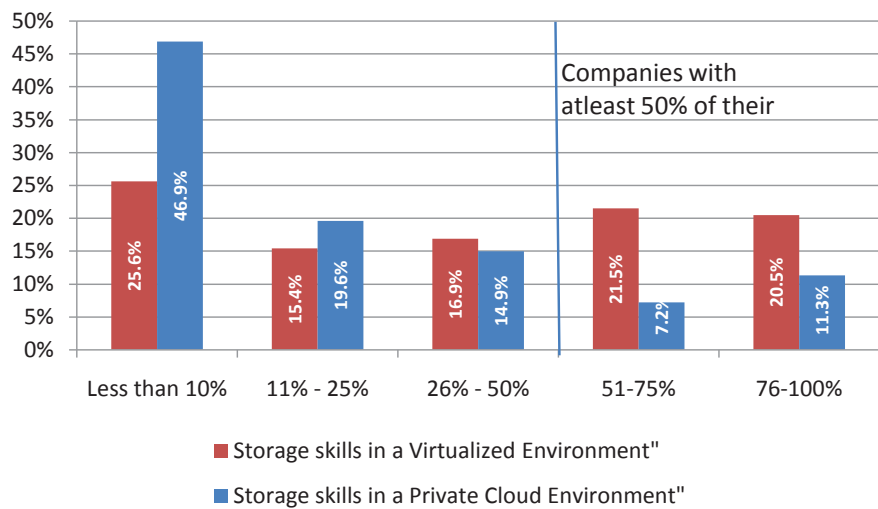


Figure 8.1—Manager's view of their storage team's skill set in virtualized and cloud environments

Migrating to a highly virtualized cloud environment is a significant transformation, requiring a considerable amount of technology and business planning. Companies recognize the need for having an in-house team of professionals to lead the planning, design, and implementation of cloud and related technologies.

More than 80 percent of managers indicate that they need in house skills for designing virtualized and cloud environments. In addition, more than 55 percent of storage professionals have indicated that cloud has impacted their current skill set, requiring a level of re-skilling.

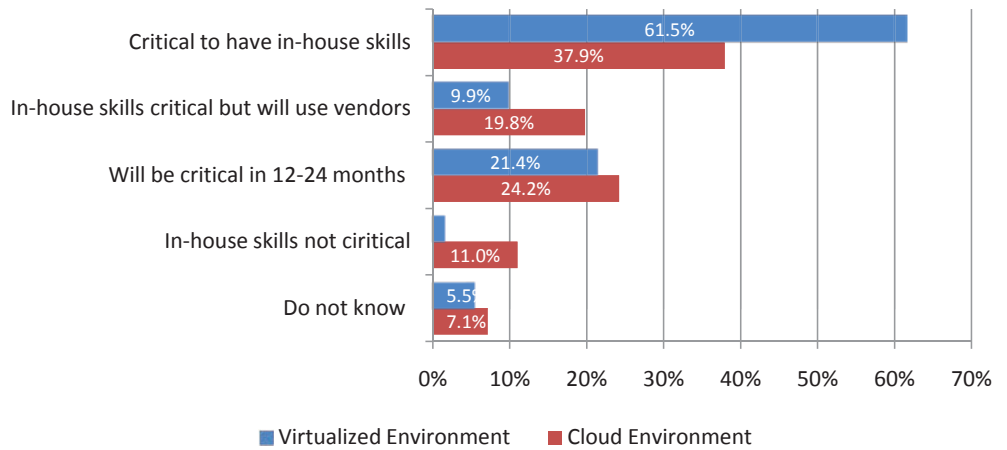


Figure 8.2—Organizations’ requiring design skills

Since cloud computing requires cross-skill expertise, IT professionals are required to have necessary knowledge across technologies that will be used in cloud infrastructure and services. 21 percent of the professionals indicated that they possess the required level of skills across all core infrastructure technologies (Figure 8.3). At the very least, it can be said that 31.5 percent of the professionals have the pre-requisite knowledge and skills (O/S, storage, networking, and virtualization) to get trained and become "cloud-ready."

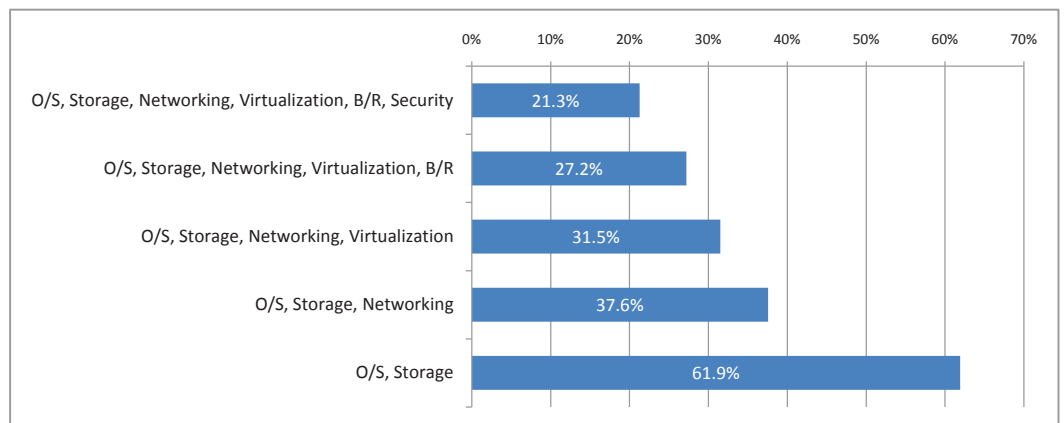


Figure 8.3—Cross-domain skills of professionals

4. FORMALIZED STORAGE GROUPS

Storage infrastructure is mission-critical, and a significant part of infrastructure budgets is allocated to storage-related products and services. A well-structured storage group of highly skilled professionals is key to building and maintaining high-performance, highly available storage infrastructures.

Job titles and descriptions of dedicated storage professionals are evolving. The following are the most common job functions deployed by the studied organizations:

- **Storage Manager**—Manager of the formalized storage team or used interchangeably for Storage Administrator
- **Storage Administrator**—Responsible for day-to-day administration, provisioning, configuration management, monitoring, availability management, and so on

- **Backup and Recovery Administrator**—Responsible for day-to-day backup- and recovery-related operations
- **Storage Architect**—Responsible for capacity planning, technology planning/design, and process management
- **Disaster Recovery Administrator or Business Continuity Administrator**—Responsible for disaster recovery, backup and recovery, planning, implementation, and management

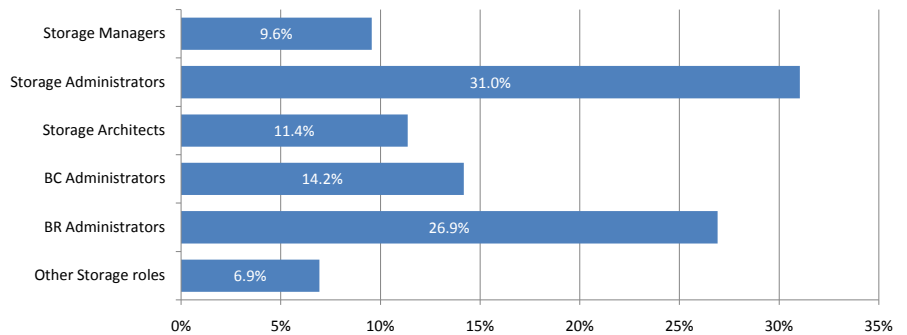


Figure 9—Distribution of storage-related functions

With the advent of storage virtualization and cloud computing, the industry is expecting the expansion of core skills of storage professionals to include systems and networking skills.

4.1 RESPONSIBILITIES

Storage groups are responsible for the overall planning, design, implementation, monitoring, managing, testing, and operation of all components in the infrastructure. Interactions with IT/storage managers and professionals resulted in the list of activities/tasks for which they are responsible (Table 3).

The list encompasses various job functions, including storage administration, architects, DR administration, B/R administration, and so on. Percent time captured for each of the activities highlights the effort involved, and possible importance of the tasks. This list could be used as a tool to define responsibilities of the storage group and individuals.

When compared with the results from the 2010-2011 study, though there are minor variations in the percentages, in general, the priorities and time distributions remain very similar. A new finding in this study reveals that storage groups are spending about 2.6 percent of their time on cloud related activities.

Storage Group—Tasks and Responsibilities	Percent of Time Spent
Design and/or participate in the design of the storage infrastructure	12.3%
Integration of the storage infrastructure, databases, and applications	12.3%
Managing the implementation of the storage infrastructure	11.6%
Storage provisioning	11.6%
Backup, recovery, and archiving of information/data	11.4%
Monitoring of the storage infrastructure	8.4%
Troubleshooting	8.4%
Storage capacity planning	6.7%
Evaluating storage technologies from different vendors	5.9%
Storage related reporting and analysis	5.2%
Other storage related activities	3.8%
Design, discussion, and planning of storage in cloud environment	2.6%

Table 3—Typical tasks and responsibilities of storage teams and percentage of time spent (last 12 months)

Another equally important dimension of these responsibilities is their alignment to different storage technology segments. Skills and processes are required to manage these tasks against expected expertise in one or more assigned “specialty” or storage technology segments.

Figure 10 illustrates the percent of time spent in the last 12 months by key technology segments implemented. Compared to the previous year, the percentage of time spent by the storage group on storage virtualization increased from 4.5 percent to 6.9 percent, and on cloud from 1.2 percent to 3.1 percent. This indicates that both virtualization and cloud technologies are making inroads into organizations.

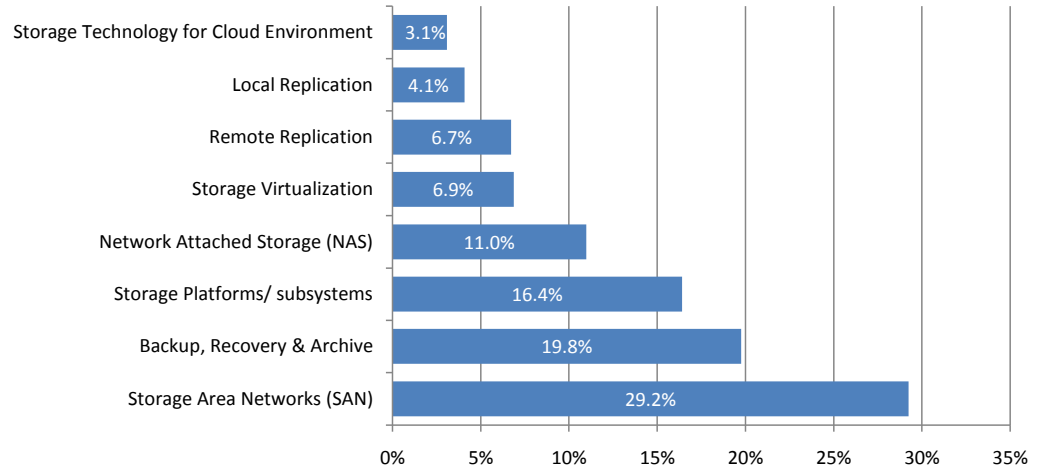


Figure 10—Percentage of time spent by storage teams by storage technology segment (last 12 months)

4.2 STORAGE GROUP SKILLS AND PERFORMANCE

Even though 65 percent of participants indicated that their companies have dedicated storage teams, analysis of IT/storage managers’ assessments of skill levels leads to the conclusion that only about 40 percent of their teams are well skilled to carry out their responsibilities on core storage activities. Only 13.2 percent of their team has necessary skills to design storage for cloud environments.

This is a key challenge for storage managers because it underscores the very real skills gap in their teams. Sub-optimal skills yield sub-optimal storage deployment. On the other hand, a well-skilled team will lead to higher productivity, better technology deployment and management, and optimal utilization of existing staff.

Figure 11 illustrates the overall rating of the storage teams against identified tasks and responsibilities (see Table 3). Strong, moderate, and weak bars indicate the level of expertise within overall storage teams in the represented companies.

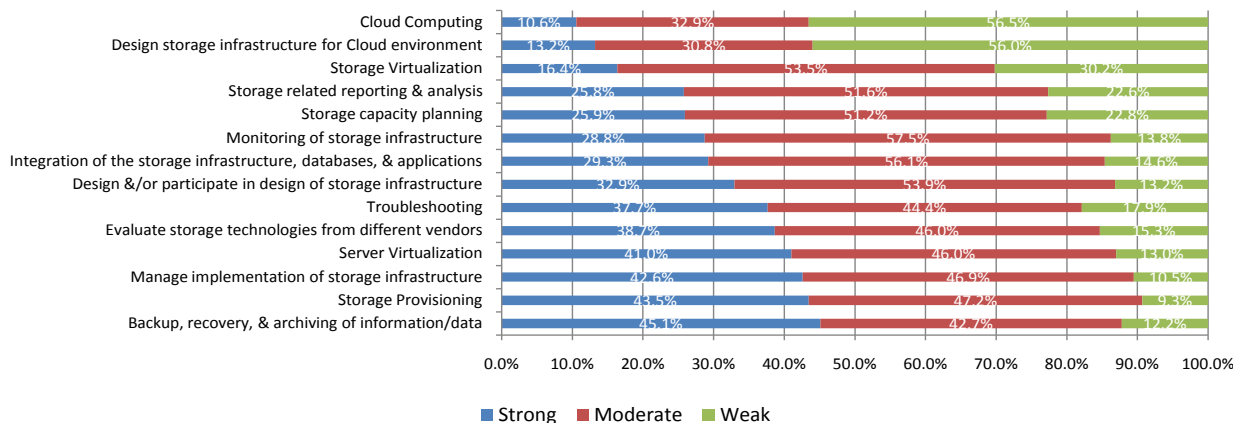


Figure 11—Ability to execute tasks; skill levels of storage professionals to carry out their tasks and activities

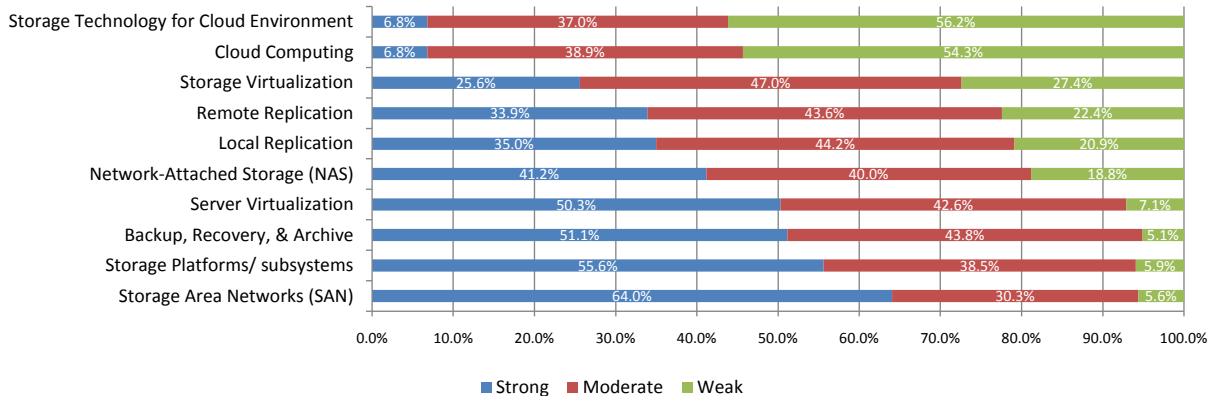


Figure 12—Competence by storage technology segments

Figure 12 maps skill sets of the storage teams against the important technology segments. Team skill levels in SAN, backup/recovery, server virtualization, and storage subsystems are rated high while skills in NAS, remote replication, local replication, and others are rated low. Most companies have very limited skill-sets in emerging technologies such as storage virtualization and cloud technologies. A correlation between ability to execute tasks (as shown in Figure 11) and competence in relevant technology segments (from Figure 12) will paint a clear picture of the effective competence of the storage group. Detailed assessment of each individual within the group is required to ascertain strengths and weaknesses for each task and related technology segment.

4.3 SOURCES FOR HIRING AND DEVELOPMENT

The most significant challenge faced by IT/storage managers is the shortage of skilled storage professionals in the marketplace. In fact, lack of skilled storage professionals is the most serious industry challenge.

Considering the aggressive hiring requirements and plans, the lack of skilled resources becomes a serious bottleneck. Figure 13 highlights the level of hiring requirements across the industry. The hiring plans indicate staff growth of more than 30 percent (last year was 22 percent), requiring hiring, training, and deploying capable storage professionals.

In addition, organizations are planning to hire cloud professionals both in architecting and administration areas. Once again, this trend highlights the impact virtualization and cloud technologies have on the organizations.

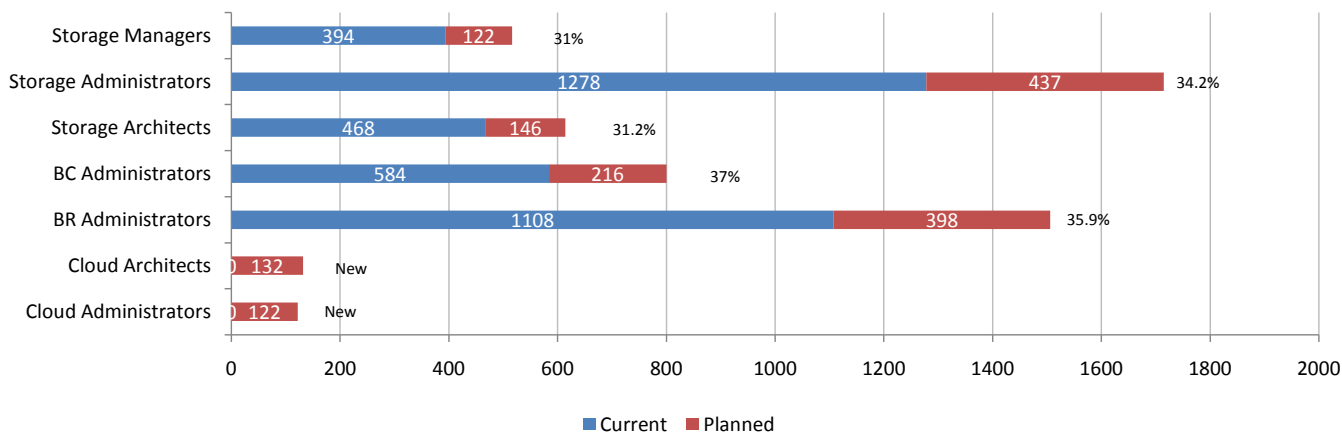


Figure 13—Hiring requirements for next 12 months

Figure 14 shows the preferred hiring options. The majority of managers prefer to hire experienced professionals to reduce the learning period and risks associated with hiring new employees, followed by internal transfers or appointments. The next-best alternative, indicated by 62.5 percent of participants, is to hire certified individuals.

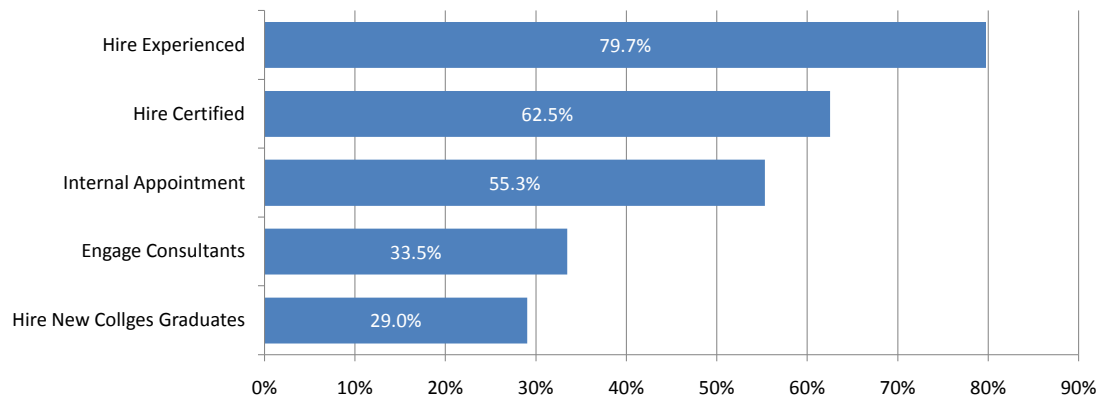


Figure 14—Managers' preference for hiring or acquiring storage skills

There is a shortage of skilled manpower in the industry. Capable, experienced, and skilled individuals are usually not available to be hired. Major factors for this skills shortage include lack of storage technology education in the marketplace and in academia. EMC has taken the lead and successfully introduced storage technology curriculums (and certification) in hundreds of universities as well as in the open market via public classes. However, a lot more needs to be done in the industry to convert this industry-wide bottleneck into lucrative employment opportunities for aspiring professionals.

Given that there exists a scarcity of certified or well-skilled storage professionals in the market, managers frequently resort to internal recruitment. Often internal recruitment involves moving an existing valuable employee who has different expertise (such as operating systems, databases, and so on) but has limited storage technology knowledge, which creates a knowledge gap in both technologies.

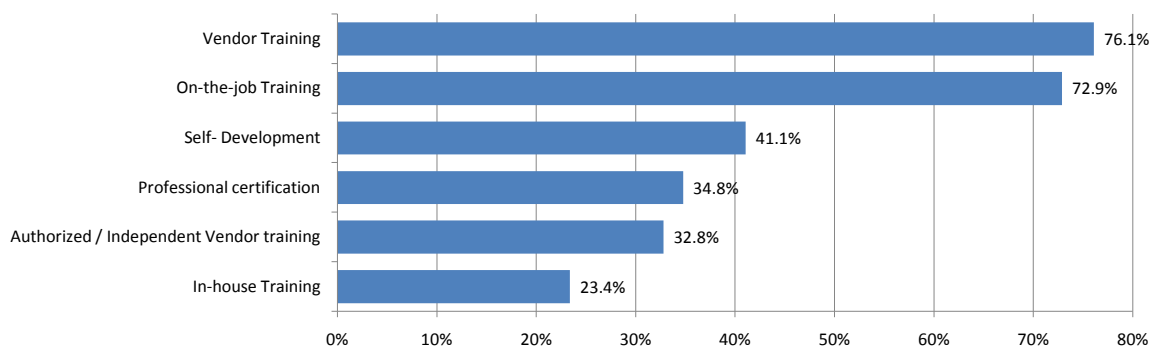


Figure 15—Most trusted training sources for development of storage skills

Preferred sources of storage training and development include technology vendor training, on-the-job training, and self-development by reading manuals, followed by training provided by authorized/independent IT training companies and training for certifications.

On-the-job training, technology vendor training, and self development by reading manuals typically cover usage and management of products and technology that is either already implemented or is in the process of being implemented. In addition, there is a need for wider and deeper training focusing on underlying technology concepts, planning, design, and management. This will enable storage professionals to independently and more efficiently design and deploy storage infrastructures that fully leverage the capabilities of all applicable storage technology segments.

5. RECOMMENDATIONS AND CONCLUSIONS

From the perspective of data availability and protection, the information storage infrastructure is the most critical component of an overall IT infrastructure. It plays a key role in making applications work efficiently, both locally and across multiple sites. With the increasing complexity and criticality of storage, highly skilled and focused storage groups are as mission-critical as the technology being deployed.

This study underscores a widening knowledge and skills gap in this fast-growing industry.

A high-quality hiring and placement decision is possibly the most important challenge faced by IT/storage managers today, exacerbated by the shortage of experienced or certified professionals.

Due to a lack of comprehensive storage technology education in the industry, most storage professionals have relied on on-the-job training, vendor product training, and self development. Though probably adequate for day-to-day administration, a lack of broad and deep knowledge hampers the ability to make informed strategic decisions and to proactively plan, design, and manage storage infrastructure.

Well-constructed, comprehensive, and strategic plans must be efficiently implemented to meet the challenges of managing multi-site, multi-vendor environments.

- Companies without formal and focused storage management groups must evaluate this mission-critical requirement.
- Companies with dedicated storage teams must carefully analyze skills requirements and current skill levels of their teams.
- Companies must develop specialized experts in each of the storage technology segments they have deployed.
- All organizations must evaluate the impact of virtualization and cloud computing on the skills of their storage and other technology teams, and plan for their move either as Cloud Architects or Domain Architects.
- Storage technology vendors should develop knowledge and skills in the industry when they introduce new technologies.
- Leading universities, colleges, and training providers must include storage technology courses in their IT and CS curricula to offer their graduates career opportunities in this industry. The next generation of IT professionals, or anyone looking for a different career path, have a great opportunity to learn the skills and meet the demands in this high-growth, dynamic environment.

6. EMC'S RESPONSE AND INITIATIVES

EMC Education Services conducted this study to identify and address the challenges faced by managers in the storage industry.

The following key initiatives offer options for storage managers and professionals to acquire or improve their skills to benefit their organizations.

EDUCATION SOLUTIONS

- Cloud Architect and Data Center Architect 'open' Curriculum
 - Cross domain Cloud Architect training and certifications
 - Storage domain Data Center Architect training and certifications
- Information Storage Technology 'open' Curriculum
 - Unique offering in the industry; leads with concepts and principles
 - Covers all segments of information storage and management technology

- Adopted by a large number of universities worldwide
- Information Storage and Management book
- EMC Technology-specific Learning Paths
 - Helps leverage extensive capabilities for EMC technology and solutions
 - Comprehensive coverage for all segments of EMC technology
- EMC Proven™ Professional Certification Program
 - Quality assurance, formal validation, and recognition
 - Option of ‘open’ and EMC technology specialties

All of the above education solutions are available globally via EMC Education Services to EMC customers, partners, and employees.

To address the widening knowledge gap in the industry, the following exclusive resources have been introduced. They enable non-EMC users, as well as university students, to take advantage of an information storage technology ‘open’ Curriculum to build a successful career in this high-growth industry.

EMC ACADEMIC ALLIANCE PROGRAM

- Information storage and management ‘open’ Curriculum for students in colleges and universities, targeted to help build a highly skilled pool of future storage managers and professionals
- Introduced in mid-2006, this program has helped establish alliances with hundreds of universities in several countries

INFORMATION STORAGE AND MANAGEMENT BOOK

We offer one of the most comprehensive books on information storage and management in the industry. It is a “must have” addition to any IT reference library. Written by EMC storage experts, the book takes an ‘open’ approach to teaching information storage and management, focusing on concepts and principles—rather than product specifics—applicable to all IT environments.

For more information on the programs, offerings, alliances and partnerships, visit EMC.com/training.

ABOUT THE AUTHORS

Alok Shrivastava is Senior Director, EMC Education Services. Alok is the architect of several of EMC’s successful education initiatives including the industry-leading EMC Proven Professional program, industry readiness programs such as EMC Academic Alliance, leading the development of the Information Storage and Management Book, a unique and valuable reference resource on information storage technology, and recently EMC Proven Professional Cloud Architect and Data Center Architect training and certification programs.

Alok provides vision and leadership to a team of highly talented experts and professionals who develop world-class technical education for EMC employees, partners, customers, and other industry professionals.

Prior to his success in education, Alok built and led a highly successful team of EMC presales engineers in Asia-Pacific and Japan. Earlier in his career, Alok was a systems manager, storage manager, and a backup/restore/disaster recovery consultant working with some of the world’s largest data centers and IT installations. He holds dual Masters degrees from the Indian Institute of Technology in Mumbai, India and the University of Sagar, India. Alok has worked in, and held a unique passion for, the information storage technology field for most of his 29-plus year career in IT.

G Somasundaram (Somu) is director of EMC Education Services, leading worldwide industry readiness initiatives. Somu is the architect of EMC's open storage curriculum, aimed at addressing the storage knowledge gap that exists in the IT industry.

Under his leadership and direction, industry readiness initiatives such as the EMC Academic Alliance program continue to experience significant growth, educating thousands of students worldwide on information storage and management technologies.

Key areas of Somu's responsibility include, guiding a global team of professionals, identifying and partnering with global IT education providers, and setting the overall direction for EMC's industry readiness initiatives. Prior to his current role, Somu held various managerial and leadership roles within EMC as well as with other leading IT vendors. He holds a Masters in Engineering degree from IIT Bombay as well as an undergraduate engineering degree from Anna University, Madras, India.

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