Defining And Measuring IT Efficiency: Maximizing Return On Storage Investments

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Executive Summary

Businesses are looking for ways to boost their bottom line and preserve resources to reinvest in innovation. Improving IT efficiency is a logical first step to saving time, money, and resources. Storage is one of the largest line items in most IT budgets, making it one area where driving change can have a significant impact on overall IT efficiency.

Enterprise storage is a critical-path IT function that looks after one of every firm's most important assets: its data. Running out of capacity to store data is a critical failure that can grind the business to a halt. Application development, rollout of new customer services, and even the ability to collect revenue and complete customer transactions depend on having adequate storage capacity to capture these transactions. Conversely, having too much storage capacity on hand means that the firm spent too much on storage. IT budgets are always under pressure, so overspending in one area means that other key categories of investment lose out. All this is complicated by the need to have available storage in a variety of geographies, performance levels, and workload types.

In January 2011, NetApp commissioned Forrester Consulting to help determine the best metrics of measuring efficiency. Forrester sees the balancing act of having just enough capacity and performance capability without overspending as the heart of efficiency. Efficiency is critical in all aspects of IT, but it is especially so in storage, where growth rates of data, cost of acquisition, and cost of operation are high — as are the risks associated with data loss, inadequate performance, and unavailability. Storage efficiency can be measured in three different areas — people, process, and technology — each which have clear metrics that show how effectively the firm is delivering an efficient environment. Unfortunately, many firms have a limited understanding of storage efficiency, measurement is immature throughout the industry, and strategies for improvement tend to be poorly implemented.

Many firms manage their storage environments in constant fear of highly visible and potentially career-limiting outages. While poor cost efficiency is bad and improving it would garner positive recognition, any risk of reducing service quality for the sake of cost-cutting is seen as unacceptable. For years, this risk has caused most firms to put efficiency on the back burner and to sacrifice cost for performance and availability. However, the tight economic times of the last several years, combined with technology advances that make safe efficiency improvements more attainable, have made the goal of reducing cost without jeopardizing performance or availability more of a reality.

This document is intended to explore some of the current perceptions around how to effectively measure efficiency in your IT environment, particularly in high-impact areas like storage efficiency, and how to promote consistent best practices in defining, measuring, and improving efficiency. To do so, Forrester has surveyed more than 200 respondents and conducted 20 in-depth interviews with individuals who have deep knowledge of the enterprise storage environments in which they work. For detailed information on the demographics of these respondents, please see Appendix C.

Key Findings

Forrester's study yielded three key findings:

- **Efficiency matters.** There's a great deal of talk among infrastructure and operations professionals about IT and storage efficiency. The main reason is its huge financial impact. Regardless of industry, size, or level of maturity, all of the firms Forrester interacted with for this project, as well as in other interactions, agreed that efficiency is a critical success factor for IT.

- **Improved visibility is the first step toward improved efficiency.** While it's clear that organizations care about efficiency, most seem to have a limited ability to measure and improve it. The remedy to this is a focus on reporting and visibility, either through packaged tools or homegrown utilities and processes.

- **Perceptions of efficiency vary widely.** The definitions of IT and storage differ from organization to organization, and even within most firms, depending on whom you talk to. It is important that organizations have a clear understanding of the meaning and goals of efficiency to make the hard changes needed to enjoy the benefits of a truly efficient environment.

IT Efficiency Has A Big Impact On The Bottom Line

Many organizations are looking to save time, money, and resources. Improving the overall efficiency of their IT environment enables many organizations to be more flexible and adjust to new market dynamics. At the same time, it can boost a company's bottom line. A good place many start to improve IT efficiency is storage efficiency because it's one place where small changes can yield big results.

Although many storage components have declined in price over the last several years, the total cost of deploying enterprise-class storage remains high. With high data growth, complex software, ever-increasing performance requirements, and demands for constant availability, storage can be expensive and represents a material and often growing portion of the overall IT budget. There are infinite variables in how firms deploy it. Making good decisions about people, process, and technology can help firms meet their business needs without overspending. Initiating changes that reduce raw capacity consumption, increase utilization, or shift the media mix toward denser, lower-cost options can dramatically reduce the cost of storing data. However you define storage efficiency, improving it makes good business sense. Some of the data regarding the impact of storage efficiency include the following:

- **Storage represents a significant and often growing portion of the total IT budget.** In Forrester's Enterprise And SMB Hardware Survey, North America And Europe, Q3 2009, respondents reported that on average, 17% of IT budget went to storage. This was up from the 2007 number of 10%, which indicates that storage typically represents a growing portion of IT spending. It also indicates that it is by no means a trivial expenditure. Paying attention to the decisions made in storage purchasing, consumption, and configuration has a material impact on the bottom line of any firm's IT spending and overall economic efficiency (see Figure 1).

- **Spending on storage appears to be holding steady or growing.** Respondents to this survey on storage and IT efficiency said that, for the most part, they will spend the same or more on storage this year compared to last. Thirty-nine percent of respondents said they expect to spend more, and 42% said they would spend the same as last year. This contradicts popular notions that storage has become cheap and is not worthy of careful consideration. While the price of disk drives has indeed come down, mainly as a result of continued increases in density, the high rates of data growth, the increased requirement for constant operational availability, and more widespread access to data appear to have offset these component cost reductions. In the end, enterprise-class storage remains an expensive proposition, which means it merits careful consideration (see Figure 2).

- **Data growth is significant but hard to predict.** Growth of data is a huge factor in storage environment planning and a huge driver of cost increases. Data grows for a wide variety of reasons: more customers, more lines of business, denser file formats, richer data sets collecting more information, mergers, acquisitions,

application enhancements, etc. Whatever the reason, data sets rarely shrink, and requirements for high performance and availability rarely decline. Given the uni-directional nature of data growth, advanced tools, and processes that can reduce the impact on storage capacity, consumption of these external factors is even more important. In terms of how much data is growing, the responses in this survey vary but tend to be on the lower end of the scale. Forrester's anecdotal information indicates that the average across all industries is between 30% and 40% per year, but most respondents to this survey indicated their growth at between 11% and 20% or 21% and 30% (see Figure 3). This could be indicative of lower actual growth or some degree of understatement due to incorrect assumptions, the common difficulty with forecasting, or just wishful thinking. A data growth rate of 20% is still significant though, and Figure 4 shows a model of the growth of 100 TB of primary data and the associated backup capacity over five years at 30% rate of data growth for a sense of perspective on the impact of data growth over time. Whatever the real number is, these compound growth rates all produce significant increases that are challenging and costly to accommodate.

- **Improving efficiency can cut IT costs significantly.** Forrester has spent a great deal of time talking with storage users and modeling the cost impacts of specific storage decisions. Improving storage efficiency can have a huge impact on the overall cost structure of the IT environment. The main ways to improve efficiency are to buy less storage, to buy less costly storage, or to spend less managing the storage deployed.

    o   To buy less storage without changing demand patterns, firms need to:

        ▪   improve utilization

        ▪   use more thin copies of data, or

        ▪   eliminate redundant data.

    o   To buy less costly storage without sacrificing performance and availability, firms need to better understand their data. This will help them make good decisions about the appropriate media, protection and performance choices that meet the business requirement at lowest possible cost.

    o   To cut the costs of operation, firms should consider:

        ▪   the ease of use of the products they buy

        ▪   the level of consolidation of their environment

        ▪   the level of consistency across their environment.

- **Efficiency requires a careful balance between performance and cost control.** Storage represents a critical piece of any firm's ability to effectively and safely run its business and protect one of its most valuable assets — its data. For years, just getting enough performance and reliability from storage systems has been a struggle. However, with constant improvements in systems and tools, storage devices have caught up to the needs of most firms and most workloads. Now the hard part comes in deciding which data is performance sensitive and which is not. Using fast storage for data that is infrequently accessed or otherwise not particularly performance sensitive doesn't improve application experience. It just increases cost. However, many firms are still stuck in the old way of thinking where constant performance improvement is the primary goal. When we asked respondents to select from several statements about the performance needs in their storage environment, most say that they need more,

and many say that they have enough (see Figure 5). While sacrificing needed performance capabilities is not an option, Forrester believes that the time has come for a more realistic view of actual requirements. Interviewees point to instances of environments that have more performance capabilities than are really required — which pushes up the cost of storage and reduces overall IT efficiency. One interviewee summed this up well with a statement that echoes what Forrester hears from many shops: "[We] probably have more performance than we need, but corporate culture would prefer having excess performance even if costs more." Another stated, "We have more performance capability than we need — we could easily move data to a lower tier of performance than we use today with no negative impact and save significant money." Being more effective in aligning real needs with deployed system capabilities will help to significantly improve efficiency and reduce IT costs without negatively impacting application performance requirements.

Figure 1

IT Budget Spend On Storage Continues To Increase

"How much of your firm's IT budget will go to storage?"
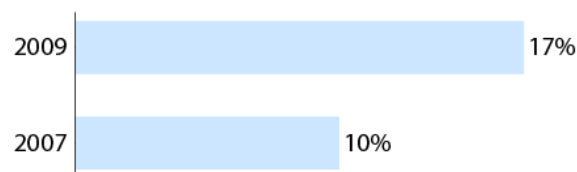
2009	17%
2007	10%

Base: 1,435 decision-makers at North American and European SMBs and enterprises (2009)
Base: 896 executives at North American and European SMBs and enterprises (2007)

Source: Enterprise And SMB Hardware Survey, North America And Europe, Q3 2009; Enterprise And SMB Hardware Survey, North America And Europe, Q3 2007, Forrester Research, Inc., 2011

Figure 2

Spending On Storage Is Holding Steady Or Increasing For Most Firms

"Do you plan to spend more or less on storage this year as compared to last year?"

Response	Percentage
More	39%
Less	13%
The same	42%
It's unpredictable	5%
Don't know	1%

Base: 214 senior-level IT/security decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of NetApp, January 2011

Figure 3

No Matter How It Is Perceived, Annual Data Growth Rate Is Significant

"What average annual data growth rate do you estimate for your storage environment over the next year?"
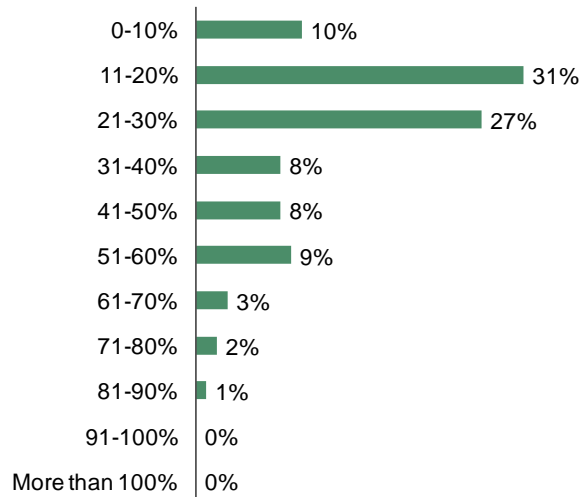
Growth rate	Percentage
0-10%	10%
11-20%	31%
21-30%	27%
31-40%	8%
41-50%	8%
51-60%	9%
61-70%	3%
71-80%	2%
81-90%	1%
91-100%	0%
More than 100%	0%

Base: 214 senior-level IT/security decision-makers
(percentages may not total 100 because of rounding)

Source: A commissioned study conducted by Forrester Consulting on behalf of NetApp, January 2011

Figure 4

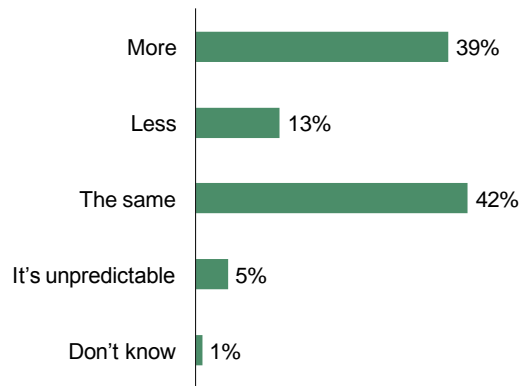Expectations For Future Growth Of Data Increase
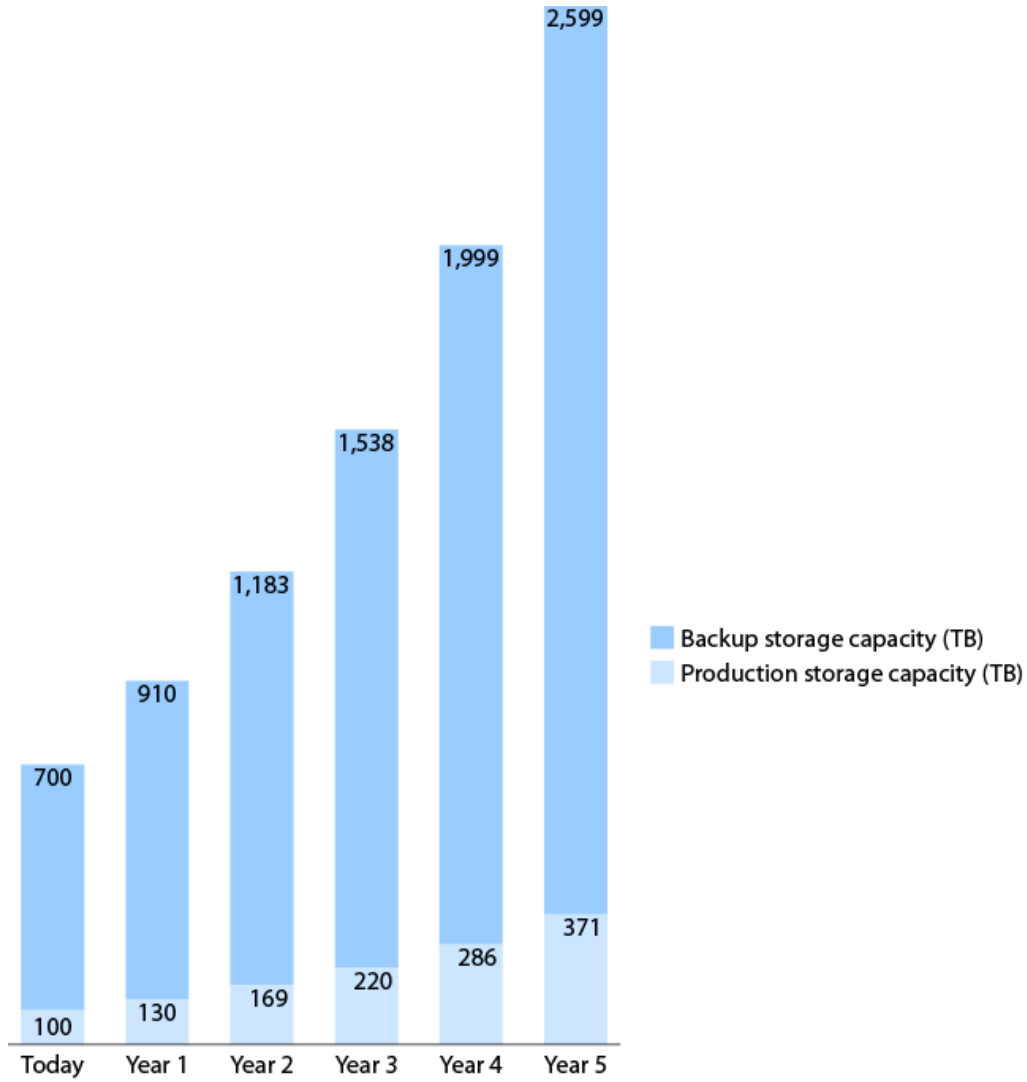
Base: 1,435 decision-makers at North American and European SMBs and enterprises (2009)

Base: 896 executives at North American and European SMBs and enterprises (2007)

Source: Enterprise And SMB Hardware Survey, North America And Europe, Q3 2009; Enterprise And SMB Hardware Survey, North America And Europe, Q3 2007, Forrester Research, Inc., 2011

Figure 5

Firms Overestimate Their Need For Performance As Well As Their Ability To Measure It Precisely

"Which statement do you feel best reflects the state of performance in your storage environment?"

We have a need for improving the performance of many of our workloads	37%
Performance is tuned properly for the majority of applications within our storage environment	35%
We have more performance capability than we really need in our storage configurations given the requirements of our workloads	19%
We don't really measure performance, but we don't have major problems that appear to be performance related	8%
We don't really measure performance, but we have problems that we suspect could be fixed with improved performance capabilities	2%

Base: 214 senior-level IT/security decision-makers
(percentages may not total 100 because of rounding)

Source: A commissioned study conducted by Forrester Consulting on behalf of NetApp, January 2011
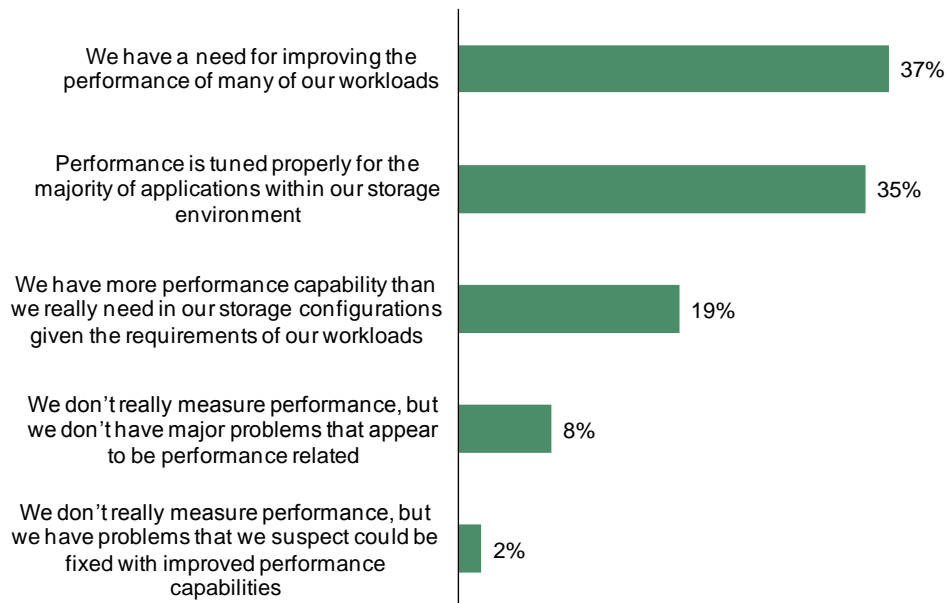
Perceptions Of IT And Storage Efficiency Vary Widely

Conversations about efficiency are all over the map. Some point to improving availability, performance, and data protection as key aspects. Others apply more traditional concepts of efficiency like utilization, cost, just-in-time provisioning, and more. Given the improvements in the ability to deliver high performance and availability from modern IT systems and software, a focus on bringing the costs down in the face of continued data growth should be increasing in importance. But most firms aren't yet there, primarily because of the high visibility and anxiety associated with outages and slowdowns. One interviewee for this paper said that "Outages are much more visible than cost to our CIO". This is a common theme. Most firms spend too much on storage out of fear. But smart firms need to begin to better understand the drivers of efficiency. More granular and accurate analysis will help firms deliver an environment that has effective performance — at the same time as it helps enable a better cost structure than is typical today. Some of the differing perceptions of storage efficiency include the following:

- **Purported satisfaction with efficiency contradicts the urgency of improvement.** While 75% of survey respondents say they are satisfied with the efficiency of their storage environment, 55% say that improving the efficiency of their storage environment is a critical or high priority. These two statements don't really add up, but that is part of the contradiction that's endemic to the industry. Raising the alarm that a given storage environment
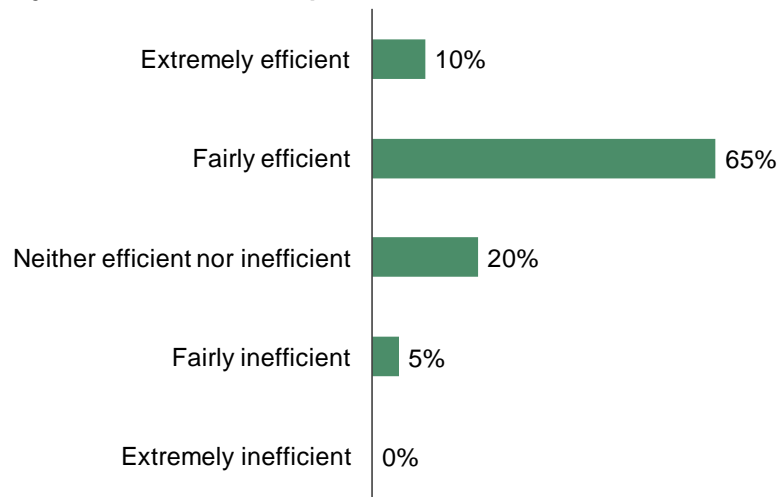
is not efficient is not a popular decision — it can make the current leadership look like it hasn't done an effective job. This makes survey results skew to the positive, when respondents try to put a favorable light on the efficiency of their environment. However, the contradiction doesn't have to be a negative one. Storage processes and technologies have changed dramatically over the years. Where it was necessary to deploy excess performance and high physical redundancy in the past to get adequate performance and availability, it is no longer the case today. Firms should accept the fact that they may have inefficient environments today. They should embrace a new focus on the opportunities for improvement and cost reduction. Efficiency improvements can gain positive recognition for storage directors who can bring them about, but this can only happen when there is wider understanding of the cost of inefficiency, and when more light is shed on key efficiency metrics within storage environments. Unfortunately, in most firms today, outages are far more visible than efficiency issues, reducing the perceived urgency for real improvement. Figures 6 and 7 show the data on satisfaction with efficiency and priority for improvement, respectively.

- **People are still locked into old ways of thinking about efficiency.** In the survey, availability and performance rank high in key efficiency categories, while utilization and disk density rank lowest. This reflects the continued fear of any change that may cause an outage or a slowdown. Organizations should recognize that many of the storage efficiency tools and processes available today can be deployed safely and effectively. They should focus their attention on rolling them out with good reporting, testing, and consistent processes for efficiency improvements without degradation of environment quality. Efficiency is about striking the balance of just enough performance and availability at the lowest possible cost. Improving efficiency requires a laser focus on selecting the right level of service, using the right metrics to measure waste within the environment, and moving toward best practices. Figure 8 shows the data on respondent priorities with regard to categories of efficiency.

- **A focus on total cost of operation is critical for effective efficiency improvement.** In this survey, 61% of respondents admitted that they don't base their storage decisions on total cost of ownership (TCO). Based on Forrester's experience with a wide variety of firms on this topic, those that do base decisions on TCO struggle to get the results they are hoping for. Accurate TCO analysis is a complicated discipline which requires a balance between lofty goals and pragmatic approaches, as well as lots of practice and focus on consistency. Since the cost impact of storage decisions is so significant, measurement needs to be a key part of decision-making. But aiming at too complex an analysis is likely to confuse the issue rather than lead to better decisions. Start with analysis of clearly defined and measurable metrics that focus on the cost differences between several courses of action. The best practice is to define and evaluate scenarios of potential actions. Firms should then measure all of the relative costs of each of the scenarios using consistent assumptions across each scenario to accurately evaluate the impact to TCO of each potential scenario. Getting better at TCO analysis takes time, but it's a step that all firms should take and will help to prioritize the efficiency improvements that will yield the greatest impact. Figure 9 shows the respondent data about use of TCO analysis in decision making.

- **Firms focus too much on discounts and not enough on long-term cost.** Firms generally spend a great deal of time comparing storage technologies and negotiating discount percentages, but they are blind to the longer-term impacts of the decisions they make. One part of the total cost of storage is how much you pay for each GB. But how much you pay to run it, and how efficiently you use the storage capacity you have bought, are much bigger pieces. While firms say they are willing to spend more upfront to get better long-term results, this is often not the case in reality. All storage is not created equal. The effectiveness of advanced software tools in allowing utilization improvements through things like thin provisioning, deduplication, and snapshots; the effectiveness of enabling low-cost, high-density media; and the reporting capabilities — all have a massive impact on the bottom

line. Firms need to get serious about focusing on the long-term impact of the tools and processes they use, rather than focusing on the upfront cost, which is a relatively minor factor in long-term, sustained efficiency. Figure 10 shows the data about willingness to spend more upfront to get better efficiency results.

Figure 6

Monitoring Storage Efficiency Is Critical To Performance

"How efficient is your firm's storage environment?"
(Here, efficiency is defined as 'the accomplishment of or ability to accomplish a
job with a minimum expenditure of time, effort, and resources')

Extremely efficient	10%
Fairly efficient	65%
Neither efficient nor inefficient	20%
Fairly inefficient	5%
Extremely inefficient	0%

Base: 214 senior-level IT/security decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of NetApp, January 2011

Figure 7

Storage Efficiency Is Said To Be A High Priority For Most Firms

"How high a priority is improving the efficiency of your firm's storage environment?"
(Here, efficiency is defined as 'the accomplishment of or ability to accomplish a job
with a minimum expenditure of time, effort, and resources')

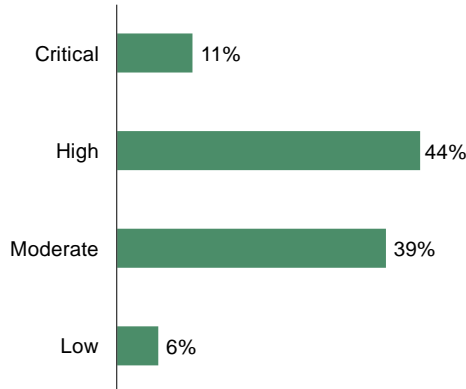|	
Critical	11%
High	44%
Moderate	39%
Low	6%

Base: 214 senior-level IT/security decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of NetApp, January 2011

Figure 8

Areas Of Focus Within Efficiency Priorities Vary Widely

"On a scale of 1-5 (with 1 being 'Not at all important' and 5 being 'Definitely important'), how important are
the following with respect to whether or not they are key indicators of IT efficiency?"

■ 1 = Not at all important ■ 2 ■ 3 ■ 4 ■ 5 = Definitely important

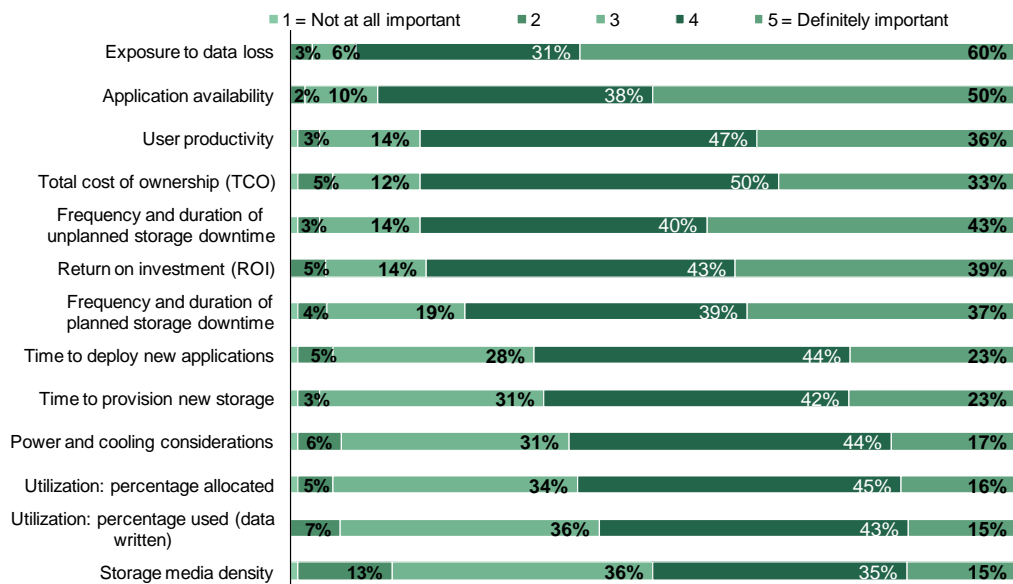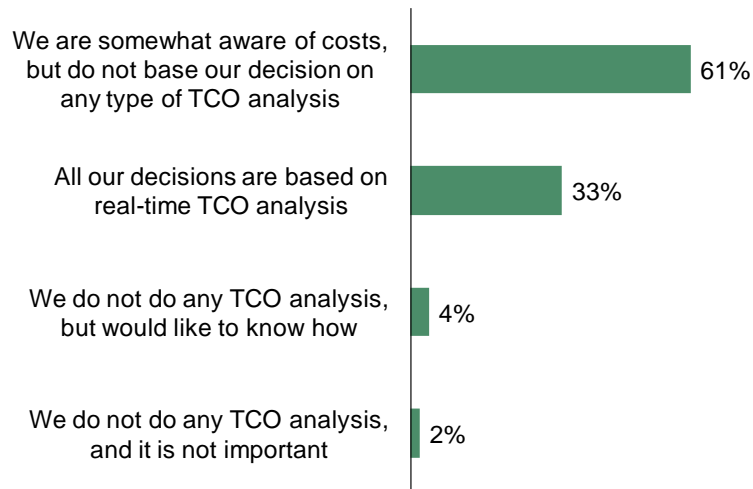|	1	2	3	4	5
Exposure to data loss	3%	6%	31%		60%
Application availability	2%	10%	38%		50%
User productivity	3%	14%	47%		36%
Total cost of ownership (TCO)	5%	12%	50%		33%
Frequency and duration of unplanned storage downtime	3%	14%	40%		43%
Return on investment (ROI)	5%	14%	43%		39%
Frequency and duration of planned storage downtime	4%	19%	39%		37%
Time to deploy new applications	5%	28%	44%		23%
Time to provision new storage	3%	31%	42%		23%
Power and cooling considerations	6%	31%	44%		17%
Utilization: percentage allocated	5%	34%	45%		16%
Utilization: percentage used (data written)	7%	36%	43%		15%
Storage media density	13%	36%	35%		15%

Base: 214 senior-level IT/security decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of NetApp, January 2011

Figure 9

Most Firms Admit They Don't Base Their Decisions On TCO

"How effective are you at measuring total cost of ownership (TCO)?"

|	
We are somewhat aware of costs, but do not base our decision on any type of TCO analysis	61%
All our decisions are based on real-time TCO analysis	33%
We do not do any TCO analysis, but would like to know how	4%
We do not do any TCO analysis, and it is not important	2%

Base: 214 senior-level IT/security decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of NetApp, January 2011

Figure 10

Long-Term Efficiency Outweighs Upfront Costs, At Least In Theory

"Would you be willing to pay more upfront in order to cut costs in the long run?"
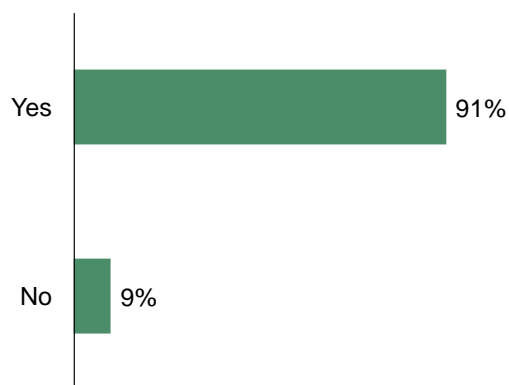
Yes	91%
No	9%

Base: 214 senior-level IT/security decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of NetApp, January 2011

Improved Visibility Into People, Process, And Technology Metrics Is Key

Few firms have a consistent ability to accurately see and measure their IT or their storage environments. Basic questions about inventory are difficult to answer in most IT environments. More complex questions about who uses how much, performance requirements, and utilization are far harder. While this is an endemic problem across all of IT, it is especially acute in storage where management tools are less mature and not as widely adopted. Part of the problem is the complexity of environments. Many storage management tools can't monitor storage from multiple vendors. Another part is the complexity of the measurement itself, particularly where there are many ways to measure each possible metric and different ways to interpret the results depending on what's being measured. Consistency and accuracy are critical here, so Forrester recommends investing in a good understanding of both the basics of efficiency measurements and how to get data that is actionable and correct.

Effective Reporting Is The First Step Toward Efficiency

Reporting tools in IT have limited adoption and success, and storage is probably the discipline with some of the least mature capabilities for reporting. Storage reporting is problematic for many environments with frequent instances of shelfware — well-intentioned purchases of costly software that don't deliver the desired results. Effective reporting on big and complex storage environments should be seen as more than just the purchase of a tool. Instead, they should be viewed as a comprehensive process of analysis. Tools must be customized to get the right data from the environment. Readers of the report must invest time to understand what they are looking at and to choose the appropriate action. Some of the specific issues include the following:

- **People overestimate their ability to effectively measure.** In the survey, 86% of respondents said they are satisfied with the automated tools they have to measure efficiency, yet anecdotal evidence and interview data tell a different story. In Forrester's experience talking with firms in a wide variety of industries, sizes, and geographies, most people can't measure the right things and don't really understand the results of the measurements they make, nor do they know what to do about it. One interviewee stated, "Our biggest barrier [to improving storage efficiency] is not having reporting tools to monitor growth." Another stated, "A focus on accurate capacity and performance-reporting capabilities is our path to increased storage efficiency — we need to avoid trial and error and guesswork." These sentiments reflect the general lack of visibility in the industry, but strangely, few environments seem to prioritize spending or focus on reporting tools that could help them grow more efficiently. It's true that reporting tools can be expensive and hard to deploy effectively, but the value of managing based on facts is tremendous. Forrester recommends starting small with reporting and finding ways to gather consistent data on a narrow set of metrics as an initial step. Even using custom scripts and tools as a starting point makes sense. You will gain valuable experience on what the data means and how to work with it, which would increase the likelihood of success of a subsequent investment in a packaged reporting tool (see Figure 11).

- **Limited performance analytics increase storage costs.** Effective storage relies heavily on having enough performance capabilities to satisfy the needs of all the applications running on the system. A significant application slowdown is basically equivalent to downtime, so firms generally use great care to make sure they have enough performance configured. Unfortunately, without accurate and timely reporting and the knowledge to interpret the reports, most firms end up using trial and error to assign resources to application workloads. If an application owner doesn't call to complain, then it must have a robust enough configuration. There isn't a good

way to confidently identify configurations with too much performance. As a result, firms regularly spend too much on more performance than they need with no appreciable benefit other than perceived reduced risk of outage.

People Metrics Measure The Staff Efficiency Of Your Environment

Operational expense (opex) is a huge part of IT spending, especially true in storage. Some estimates put annual opex as equal to, or greater than, the amount spent on capital such as hardware and software, so it's definitely worthwhile to keep a close eye on it. As staff is the most significant component of opex in most environments, making sure that you have the right staffing levels is a key to measuring and optimizing efficiency. The key people metrics include:

- **Staff efficiency measured by TB/Full Time Equivalent (FTE).** Staff and other operating expenses represent a huge portion of the overall cost of running an enterprise IT environment, so careful attention should be paid to how many people it takes to run the environment. The measurement is simple, but the associated action is much more difficult. To measure staff efficiency in storage environments, many use TB/FTE, which divides the total raw TB in the environment by all the people that it takes to run that environment, including contractors and managers. For any people that split their time between storage and other tasks, use the estimated portion of their time that goes toward storage activities. Generally, this metric is done for primary storage, with a separate measurement for backup and archive tiers. For large environments, the best practice number is somewhere in the area of 150 TB and above, but this varies widely based on environmental differences and scope of responsibilities. Remember that staff efficiency is a tough balancing act with hard-to-hire resources. The ultimate goal is high-quality management, so make any changes gradually and carefully. An environment with a very high number for TB/FTE may be sacrificing service quality or paying too much in hardware to get to the high staff efficiency number, so don't assume that higher is always better. Think about realigning staff in a plan-build-run framework to get the best cooperation and results.

- **Training levels ensure that you have well qualified people in place.** Measuring training is not really a quantitative exercise. What is clear is that service quality depends on people having the right skills to do their job well. While there's no hard and fast ratio, it's worth looking at seniority levels, percentage of staff trained in each vendor's product set, and so on. Look for a good balance of top-level architects with high levels of training and junior staff that can manage day-to-day tasks and learn deeper skills on the job.

Process Metrics Measure How Efficiently You Manage The Storage Service

Running IT with tightly defined processes ensures that your operations have consistent means of operations, which significantly reduces errors and variability. Storage particularly benefits from adherence to defined processes as the risk of outage is so high. Metrics that look at process effectiveness are critical elements of overall IT and storage efficiency. The key elements include the following:

- **Provisioning time measures how long it takes to deliver service.** Storage is one piece of the overall IT delivery process, and attention to the time that it takes to provide storage is a key piece of the puzzle. When storage provisioning times are too long, they slow down overall application delivery goals. They also cause internal customers to request more capacity than they actually need, reducing efficiency. Measuring and improving the provisioning time of storage are key goals for storage and overall IT efficiency.

- **Incident metrics look at the reliability of the storage service.** Incidents are events where some failure in the storage components causes negative impact to the user of the service. Tracking and understanding incidents is critical to reduce their frequency and to improve service quality. Incidents should be tracked with a variety of metrics including overall count per period, incidents per change, and subsets of incidents by service type and severity. Incident response time and resolution time should also be tracked, as they indicate how effectively the team deals with incidents when they do happen. There is no specific best practice goal for incident counts — eliminating them is nearly impossible, but the less frequently they occur, the better. Tracking incidents over time and striving for continuous improvement are the goals here.

- **Customer satisfaction metrics look at the overall perception of quality.** Measuring adherence to process is important, but looking outside of IT management teams to the ultimate customer of the service is a critical piece of measuring efficiency and effectiveness. Especially as external cloud options gain maturity and popularity, it is critical to ensure that consumers of an internal service feel that they are getting good value and having their needs met effectively. Periodic surveys and interviews, and closer touchpoints will help engender better communication and indicate whether the storage team is focusing on the things that matter most to the consumers of the service they provide.

Technology Metrics Measure The Efficiency Of The Systems Deployed

Most people think of IT and storage efficiency solely in technology terms, so some of the most impactful and carefully measured metrics of efficiency fall in the arena of technology. There's a great deal to measure and good value in doing so, but focusing on a clear understanding of the meaning of each metric and best practices for measuring and evaluating the metrics is critical. Some of the most meaningful technology efficiency metrics include the following:

- **Utilization tells you how efficiently you use what you purchase.** Enterprise storage systems require redundancy and capacity overhead to provide the reliability and performance capabilities that they are designed for. Because of this, every TB that you buy provides a smaller amount of usable capacity due to system and RAID overhead. You need copies of the data to provide high availability and backups and archives. You also always need a cushion for future growth that prevents you from filling up all the space on hand. But the gap between raw capacity purchased and how much data can be written to it varies. The way to measure how efficient you are with regard to this gap is called utilization. There are many ways to measure utilization, and each has a different purpose.

  - Capacity allocation shows you how much of your usable storage is assigned to servers. There is always a buffer between what is purchased and what is assigned, and this ratio shows how big that buffer is. Capacity allocation is in control of the storage department and is a factor of how efficient the team is in using what it buys. Increasing capacity allocation improves efficiency, but can limit flexibility or jeopardize the ability to meet future needs with existing capacity if not done properly.

  - Capacity consumption shows you how much of the capacity that is allocated is actually used. Once capacity is allocated to lines of business, it's generally up to them to determine how much of it they use. Storage departments can work to identify low utilization within allocations through reporting and chargeback/memoback, but it requires cooperation and communication to improve this category of utilization. The impact is high though, so the effort in most organizations is worth it.

o Logical utilization represents the difference between what servers think they have allocated for their use and the physical capacity used to deliver it — which can lead to a metric value greater than 100% with the use of virtualization features such as snapshot copies, thin provisioning, or deduplication.

- **Media ratios look at the breakdown between high and low performance storage.** Most data in IT environments is rarely accessed and not particularly performance sensitive. Once data has been stored for a long period of time, its access frequency usually drops off significantly. To improve efficiency, firms should see their environments composed of slower, cheaper storage for data that is less frequently accessed and wherever it does not limit application performance requirements. Unfortunately, many environments struggle with getting this right. If your environment is composed mainly of high-cost, high-performance storage media, you're probably spending too much. There are many different ways to think about tiers of service, but the goal should be less than 100% of media deployed being high performance. A good best practice baseline is around 20% high-performance Tier 1, 40% mid-performance Tier 2, and 40% low-performance Tier 3 or archival storage, but this can vary significantly based on the workloads being served. Good media mix decisions always start with a strong understanding of the requirements of the workloads in performance terms. This generally comes from reporting and analytics tools that show access patterns of data aimed at identifying bottlenecks or over-configuration in terms of performance. The interventions in those cases would be increased performance to resolve bottlenecks, or de-tuning to save cost in cases where configurations have too much performance capability and therefore are too costly.

- **Scale-up-per-array measures consolidation within the storage environment.** Managing many arrays is harder than managing a few consolidated ones. Modern storage systems are capable of providing enough performance and scalability to manage hundreds of TB within a single array. When firms use distributed purchase decision-making processes, have too many vendors or silos of storage, or are using storage that is too old and incapable of effective consolidation, their scale-up-per-array can be too low, hurting the overall efficiency of the environment. Scale-up-per-array is easy to calculate — add up the total TB in the environment and divide by the number of arrays in use. In a big environment, scale-up-per-array should be well above 100 TB. In a smaller environment, it is likely to be lower, especially if there are fewer than 100 TB present. An eye toward the fewest number of arrays — preferably from a single vendor — is going to provide an environment that is easier to manage and more cost-efficient.

- **Copy count measures redundancy of primary data.** Redundancy is a key requirement to avoid losing data. There are many different ways to configure this redundancy and new technologies such as snapshots that reduce the amount of capacity required to get this reliability. In the past, you needed a RAID 1 copy, a local replica, a remote replica, and a backup replica as a bare minimum to keep data safe. This could lead to 10 or more copies of each primary volume, increasing cost many times. Technologies and processes that allow you to safely protect data without spawning off all of these copies can have a huge impact on a firm's bottom line. Space-efficient snapshot and clone (writeable snapshot) technologies are excellent tools to help reduce the need for thick copies of data while retaining the ability to use and protect data. To evaluate your efficiency with regard to copies, divide the total capacity of storage associated with a given primary volume by the size of that original volume. A copy count of three or higher is fairly inefficient, but naturally the evaluation of efficiency depends on the technology you use and the protection goals for the data.

Figure 11

The Majority Of Firms Are Satisfied With Their Current Reporting Tools

"Are you satisfied with the automated tools your firm has in place to consistently measure the efficiency of your firm's storage environment?"
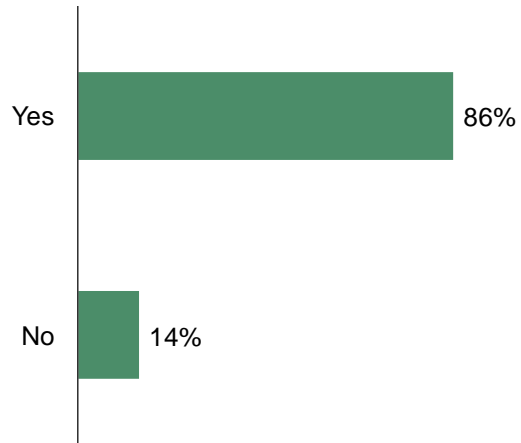
Base: 214 senior-level IT/security decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of NetApp, January 2011

KEY RECOMMENDATIONS

It's clear that IT efficiency matters tremendously to the bottom line of every company. Storage represents a critical and significant portion of IT spending, and improving the efficiency of your storage environment can go a long way toward improving the overall efficiency of your IT environment. However, making it happen is not easy. There are many potential interventions to make, and each one carries some risk related to changing the environment or not realizing the intended benefits. For the best possible outcome and the most significant improvement, focus on the following objectives related to improving storage efficiency:

- **It takes the focus of an empowered individual to drive efficiency goals forward.** Understanding and improving efficiency is a long-term process that goes beyond any one tool or product. It's a complicated discipline with many decision points and tradeoffs to make. Efficiency is not something that will happen on its own; it requires dedication and hard work. Forrester often recommends nominating one individual to be an efficiency champion or czar, empowered with accurate reporting capabilities and the power to drive behavior toward improved efficiency. This position requires a combination of technical and communication skills: an understanding of the technical drivers of efficiency, as well as the ability to explain them to stakeholders and prioritize and drive projects forward that can have a big impact. Without such a champion, it's unlikely that real efficiency improvement will occur.

- **Measure the results, don't just buy the feature.** There's a great deal of attention from storage vendors on efficiency-focused tools, but real improvement won't come just from buying a tool. Whether it's thin provisioning, snapshots, deduplication, or any other technology, it takes a solid understanding of the way the tool works and how to use it to get the desired results. The effectiveness of these tools varies widely as well, so don't assume that you will get the results you're looking for just because a vendor can check the box in the RFP. Even if you have the right tool, the way you deploy it and measure results will make or break the impact of the change. Go beyond just the technology and make sure that you have the right people and processes in place to safely and effectively deploy new tools and realize the benefit of improved efficiency and lower cost.

- **Understand your baseline and requirements before you make changes.** There are lots of ways to measure and improve efficiency, but every environment is different. Each workload has a different growth and performance pattern, and choosing the right efficiency intervention is key to getting real results. Make sure that you don't get caught up in the hype of popular tools in the industry. Rather, understand your own real needs and prioritize the changes that will make the most difference without causing harm to the reliability of the system.

Appendix A: Methodology

In this study, Forrester conducted an online survey of 214 senior-level IT decision-makers with knowledge of their storage environment and interviewed 20 organizations in North America, Europe, and Asia Pacific (APAC) to evaluate the best metrics for storage efficiency. Survey participants included decision-makers in manager/director/VP roles (58%) as well as CIOs (26%) and a mixture of server administrators, IT generalists, architects, etc. Interview respondents were offered $100 gift cards as a thank you for time spent on the survey. The study began in November 2010 and was completed in January 2011.

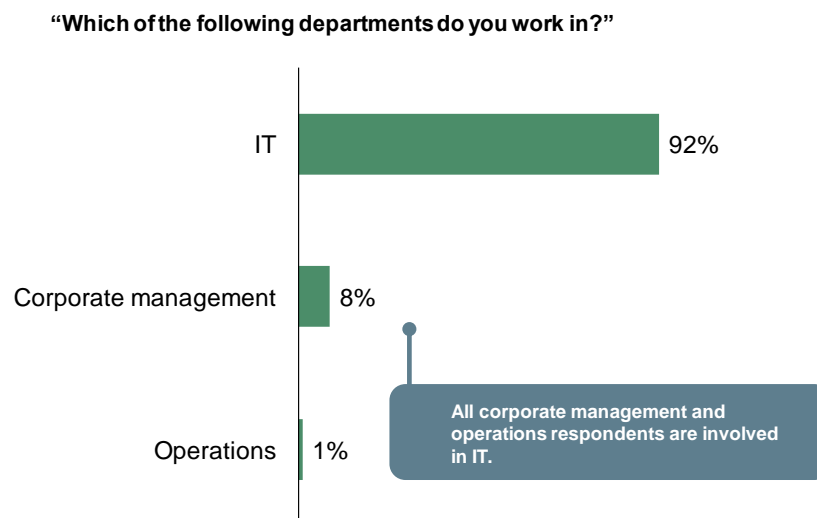# Appendix B: Supplemental Material

Related Forrester Research

"How Efficient is Your Storage Environment," Forrester Research, Inc., October 22, 2009

"Controlling Storage Cost Amid High Growth," Forrester Research, Inc., February 3, 2010

Appendix C: Demographics/Data

Figure 12

All Respondents Were Involved In IT

"Which of the following departments do you work in?"

IT — 92%

Corporate management — 8%

Operations — 1%

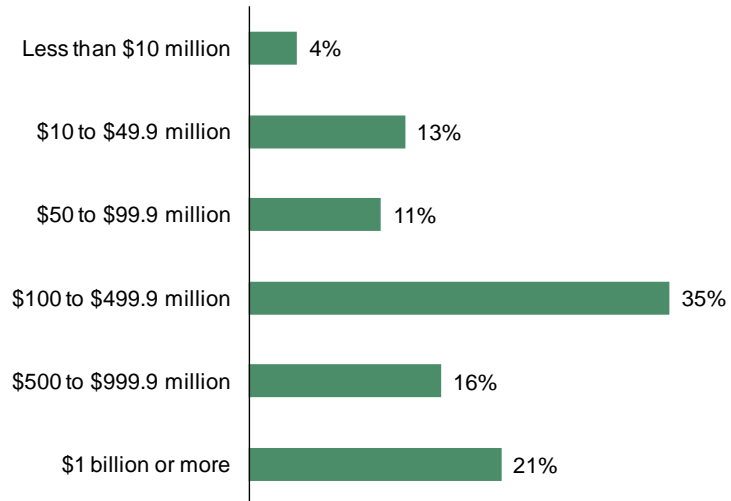All corporate management and operations respondents are involved in IT.

Base: 214 senior-level IT/security decision-makers

(percentages may not total 100 because of rounding)

Source: A commissioned study conducted by Forrester Consulting on behalf of NetApp, January 2011

Figure 13

Forrester Surveyed A Wide Spectrum Of Company Sizes

"Approximately what is your firm's current annual revenue?"

Revenue	Percentage
Less than $10 million	4%
$10 to $49.9 million	13%
$50 to $99.9 million	11%
$100 to $499.9 million	35%
$500 to $999.9 million	16%
$1 billion or more	21%

Base: 214 senior-level IT/security decision-makers

Source: A commissioned study conducted by Forrester Consulting on behalf of NetApp, January 2011