

# What Is The Cost Of Storage?

A CIOview White Paper  
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## What Is The Cost Of Storage?

### What Is The Cost Of Storage?

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Storage is the AFLAC duck of information technology. Before AFLAC rolled out its pervasive ads featuring a duck quacking "AFLAC!" in humorous situations, not many knew of the company. Now people know AFLAC is an insurance company, but they are not quite sure of the details.

Storage is a lot like that insurance: until we need storage, we probably won't think about it. Analyzing storage takes foresight, planning, and an in-depth understanding of your needs. Most of all, planning storage is a lot of work. So you've got to haunt people to change their behavior. The most pressing storage questions include

- What is it going to cost you to stay with your current storage environment for the next 3, 4 or 5 years?
- Which group is driving your overall storage costs?
- How would your storage costs change if you moved from a direct attached or networked storage environment to a SAN?
- What if you added virtualization?

Now you easily can answer all of these questions by using TCOnow! for Enterprise Storage. CIOview's storage analysis tool allows storage managers to show the storage costs and options for up to 10 different groups of users. For the first time storage managers now have the ability to show each group how their storage requirements not only impact their cost structure but also how their storage needs shape the options for other groups and the company as a whole. Better yet, TCOnow! for Enterprise Storage allows you to see what your costs will look like if you continue with your current storage design as compared to the cost of moving to newer storage technologies.

Storage is based on three simple concepts:

- Servers that require access to storage to run their applications and keep your organization working
- Storage hardware that holds your data and reads and writes information
- Some sort of technology to interconnect your servers and storage

Trying to express a storage analysis using these three concepts greatly simplifies and focuses everyone on the most appropriate storage solution. Naturally, these three simple concepts mushroom into a much greater set of questions such as:

- What sort of servers do you have? Are they small 32-bit Intel servers running file and print, a large mainframe running a clearing and settlement application, and/or some sort of mixed UNIX environment, etc.? How mission critical are your different applications? How many new servers do you expect to add in the future?
- What sort of storage hardware do you currently have? Do you use \$500 disk drives or have you just purchased a \$2.5 million storage cabinet from a vendor such as EMC, Hitachi Data Systems, or IBM? To what sort of storage hardware might you want to migrate? How fast is your storage growing?
- What sort of technology is in place and what will you use to interconnect your servers and your storage? Do you simply install a disk controller in each server to read directly from a hard drive, do your servers access storage in a redundant array, or do you connect through a series of switches assembled into a Storage Area Network? What sort of technology might you want to use in the future?

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CIOview's TCONow! for Enterprise Storage provides a very simple to use interface for answering these questions in the most painless way possible and in the process illustrating the limitations and strengths of your current storage environment.

Just as important as understanding the concept of storage itself is to be able to determine the best storage type for your unique environment. While you may be tempted simply to say that whatever you have installed now meets your needs and is therefore appropriate, taking a step back and thinking about how your current storage infrastructure will handle new demands in the future can be an illuminating process. By asking five simple questions, you can decide with a reasonable degree of confidence whether your current storage environment is best or whether there is any new sort of storage that might suit you better. Those five key questions include:

- What are the performance requirements of my storage environment?
- What are the data capacity requirements of my storage environment?
- What level of data protection do you need and how do you intend to implement it?
- How do you want to manage my storage?
- What sort of growth expectations do you have for new servers or new storage capacity?

These are vague, open-ended questions that do not have simple cut-and-dried answers. However, TCONow! for Enterprise Storage provides you with a simple interview and inventory section that helps you answer these questions and translate these concepts into technical requirements for items such as:

- How many servers can connect to a storage host adapter?
- How many servers can access a network attached storage device?
- How many and what type of disk drives are necessary?
- What sort of I/O throughput is necessary for performance and what type of storage device can deliver this level of I/O?
- What level of RAID is necessary and how much extra disk is needed?
- Should you use Fibre Channel or IP networks?
- Do you require dual-pathing or single-pathing?
- How many outages should you expect and how long does it take to repair an outage?

The list of exact details is quite long but all of these issues are a direct result of the five key questions listed beforehand. TCONow!'s inference engine and default data either will provide you with an answer for the details or help you arrive at your own details yourself.

Before looking at all of your financial results, it may be worth spending some time understanding each part of your storage environment.



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### Servers

Although this seems counterintuitive at first, your data storage needs actually are not the most important determinant of your storage configuration and costs. Instead, the servers and applications running your business are the key drivers of your storage configuration and costs. While it may seem obvious that your requirements and budget should be based on your business needs, many storage managers and salespeople skip this part of the analysis entirely. Some managers may feel they have good reasons not to complete this portion of the analysis. One can argue that it is not possible to obtain the necessary data from the different line of business groups (or even determine what data to collect). By using default data from actual storage users, TCOnow! for Enterprise Storage provides managers and salespeople with a vast amount of prepackaged information that can help in this data collection process.

So what are the questions you should ask about your servers? CIOview uses the following questions to model your storage environment:

#### How many different groups of servers are there?

- You can choose to divide your server environment into groups of between 1 to 10, so that you can map costs back to particular departments or applications
- As you add more server groups, you typically will see a higher potential benefit from consolidating your storage to one centralized environment

#### What application is each group running?

- You can choose from a variety of pre-set applications that have a whole host of default data points, or you can create your own application profiles
- Default applications include Business Intelligence, Customer Relationship Management (CRM), Document Management, eCommerce, Email, Engineering, ERP (such as SAP, PeopleSoft, or Oracle), File Management, Network/LDAP, Scientific Computing, Supply Chain Management (SCM), Other Input/Output Bound, Other CPU Bound, or a custom Normal, High Priority, or Mission Critical application

#### How many servers are in each group? How many users access each server?

- The number of servers and users in each group should be available offhand or from the IT group responsible for those servers
- If you have more servers in your environment, you may find that your storage requires higher performance and that your cost for Fibre Channel SAN storage may be substantially higher. The more users who access each server, the more important your performance needs may be in your overall analysis
- At the same time, if you have more servers, centralizing with a storage area network or network attached storage may reduce downtime and personnel costs by quite a lot

#### What operating system is each server running?

- You can choose for each group to be running one of a variety of operating systems, including z/OS, OS/390, OS/400, HP-UX, IBM AIX, Sun Solaris, Linux, Windows NT, Windows 2000, Windows 2003, or even Novell NetWare
- One of the most convoluted parts of performing a storage analysis is tracking down which storage devices, storage area network fabric (the switches that connect servers and storage), and software are compatible with what operating system. TCOnow! automatically models all compatibility issues for you and makes sure that your analysis only covers solutions that are technically possible

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### What are the performance and file system characteristics of each application?

- Choose from three levels of performance: normal, high, and super
  - Your performance requirement will have a major impact on how many servers can connect to each storage device, and therefore which portion of your storage environment is performance-driven
  - Very high performance needs and a large number of servers may mean that you have to buy a lot of expensive storage hardware simply to support disk I/O rates although you could theoretically end up leaving most of the storage space empty
- You can choose from three ways that applications access data: a block system, a file system, or a mix
  - While this question may seem complex, many applications have very well defined I/O characteristics. For example, ERP applications typically access blocks of data while a file management application obviously will access files
  - If you access blocks of data you will be limited in your choice of network-attached storage, since TCONow! automatically models this compatibility issue
- You can choose from three file sharing levels: none, some, and heavy
  - A quick survey of your application will tell you whether any file sharing occurs; most applications do not allow file sharing
  - TCONow! will help you determine whether you need file sharing as well as how this influences staying with your current environment against using Fibre Channel or IP storage

### How often do storage issues force you to bring your servers offline?

- You can define how often each server experiences planned downtime and see how different storage environments affect planned outages
- TCONow! provides default data on planned outages for different operating system platforms

### What are your expectations for server growth over the next few years?

- If you intend to add more servers, you may want to use a more scalable storage configuration such as a sophisticated Edge-Core storage area network
- TCONow! automatically will model how your current storage environment will change as you add more servers, as well as how a new consolidated storage environment would grow; this allows you to see if your current configuration is the best design from a future growth standpoint

What sort of results will be directly affected by your answers to the questions above? Simply put:

- The optimal storage device to use for each group of servers
- The storage devices that are compatible with your servers
- Whether you should use Fibre Channel storage, IP storage, or an IP gateway
- The optimal storage area network configuration if you plan to use Fibre Channel storage
- The best type of storage area network hardware to use – for example, 16-port switches against 32 port switches vs 64-port directors
- The storage area network hardware which is compatible with your servers
- The number of SAN adapters needed for your servers and for your storage devices
- Your expectations of planned outages and your planned cost of downtime

## What Is The Cost Of Storage?

### Storage

A discussion of your storage environment's Total Cost of Ownership (TCO) is impossible without also examining your current storage as well as exploring different options for storage consolidation. Typically, discussions of storage either are held at such a high level that any conclusions are grossly inaccurate, or at such a technical level that no business decision can be made. CIOview has seen analyses of storage that range from "The cost of storage is going down by 35% a year so I should simply buy more storage and add it to my existing environment," to "The multipathed I/O rate is x MB/s which means that your storage will have a peak theoretical bandwidth of y MB/s on the crossbar switched backplane."

Neither of these discussions is particularly useful for coming up with a financial number. Instead, TCONow! takes you through a structured interview process for your current storage that looks at key variables where your IT shop might be different from the "average." TCONow! also provides you with substantial drill-down detail into your new storage choices so that you can immediately understand how a certain technical decision will impact your cost of ownership.

To analyze your storage intelligently, you should ask at least the following questions:

#### What type of storage is currently installed?

- You might have just a bunch of disks (known as JBOD) or you may have already implemented some sort of data protection and redundancy such as a redundant array of inexpensive disk (RAID). Alternatively, you might have already purchased SAN storage from a vendor such as EMC, Hitachi Data Systems, or IBM.
- TCONow! lets you model both existing direct attached storage and a storage area network that you may have purchased over the past five years
- You can choose from literally hundreds of storage models from 1999 to 2003, ranging from simple disk drives through EMC Clariion, EMC Symmetrix, Hitachi Data Systems (HDS) 5000 and 7000 series, HDS Thunder, HDS Lightning, IBM FAStT, IBM ESS, and any custom storage device you wish to enter yourself

#### How much storage is currently installed?

- The amount of raw disk capacity is a key metric to estimating your current costs as well as your costs in the future
- TCONow! provides default data on other storage variables that help determine your storage needs, including disk utilization rates, storage disk and device capacities, and storage performance capabilities
- Storage virtualization software may help you improve storage-related variables, such as disk utilization rates. and may help you make better use of capacity and performance driven storage devices. TCONow! automatically models the effect of virtualization on your storage environment

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### What level of data protection do you currently have? What level do you require?

- You are able to choose no RAID, RAID 5, RAID 1, or RAID 10
- You can choose either RAID 1, RAID 5, or RAID 10 for your new environment
  - Your RAID level will affect disk overhead as well as any special disk configuration rules
  - TCONow! automatically configures your RAID based on all appropriate sizing guidelines
- You can choose to implement an offsite data protection strategy such as offsite tape, offsite storage and servers; or choose to run your applications simultaneously in two sites
  - Each data protection and redundancy strategy has varying costs in terms of onsite and offsite hardware, software, personnel, facilities, etc.
  - TCONow! automatically will design your secondary site if you require one
  - TCONow! allows you to view your results on either an on-site, off-site, or combined basis

### What is the cost of your storage?

- Storage cost is typically expressed in dollars per gigabyte
- TCONow! has default data on JBOD, RAID, EMC, HDS, and IBM storage from 1999 to 2003, and can provide you with an estimate of your storage cost if you are not able to find the data
- TCONow! can help you estimate both your initial storage cost (which is necessary to figure out the cost of storage support), as well as the cost of purchasing new storage
- TCONow! has default pricing information on dozens of new storage solutions you may wish to use in a consolidated scenario

### How often do you suffer a storage-related failure?

- Unscheduled application outages due to storage failures can be a substantial component of your total cost of ownership
- Typically organizations will want to estimate their own cost per minute of downtime. TCONow! provides five methodologies:
  - Cost of lost productivity
  - Cost of lost revenue
  - Cost of lost productivity and revenue
  - Custom rate
  - Cost of lost IT productivity
- TCONow! has a built-in availability model for direct attached storage, direct attached RAID, departmental storage devices, enterprise storage devices, and eight different SAN configurations

### What resources are necessary to manage your storage?

- Different types of storage have different systems management economics. Typically, direct attached storage requires more personnel since you must handle storage on each server separately. In contrast, a storage area network can allow you to centralize many of your storage management tasks and even automate some of them
- Estimating your current IT resources tied up managing storage can be a complex task. Therefore TCONow! provides default data on storage management by operating system and type of storage
- Storage virtualization software may help you improve the efficiency of your storage management by simplifying tasks such as copy services, backup and restore, etc.



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### What sort of results will be directly affected by answers to the questions above?

- The optimal storage device to use for each group of servers
- Whether you should use Fibre Channel storage, IP storage, or an IP gateway
- Your new storage configuration including disk type and quantity
- The optimal storage area network configuration if you plan to use Fibre Channel storage
- The best type of storage area network hardware to use – for example 16-port switches against 32 port switches vs 64-port directors
- The number of SAN adapters for your storage devices
- The software necessary to run your storage environment, including any sort of remote copy or virtualization packages
- Your cost of managing storage in both your current and new environment
- Your expectations of unplanned outages and your planned cost of downtime
- The cost of support and maintenance for your new or existing storage

### Server and Storage Interconnection

Regardless of your existing servers or your desired storage configuration, your applications will not run if there is no interconnection between the servers that need data and the storage that houses the data. Interconnections may be very simple, such as a SCSI (Small Computer Serial Interface) controller in a server; may be somewhat more sophisticated, such as a RAID controller installed in a server using some sort of Fibre Channel network involving storage switches and storage directors (in effect large, redundant switches); or may be a very sophisticated storage area network where storage and servers connect to different parts of the network.

What are the questions you should ask to understand your storage interconnection needs and solution? A good list might include:

### How large is your server and storage environment?

- The more servers and storage you have, the greater your potential gains from implementing a storage area network. Conversely, if you have very little storage you simply may want to connect your storage to internal disk controllers in your actual servers
- You can choose to compare a direct connection method to either a Fibre Channel storage area network, IP network attached storage, an IP gateway connected to a Fibre Channel SAN, or a combination of the three

### How fast is your environment growing?

- Upgrading storage capacity is a time consuming process that can be a significant drain on IT resources as well as cause unneeded downtime. Server and storage growth can be handled more easily in a storage area network where storage and servers are separated by multiple layers of switches or directors
- You can choose either a flat connection (direct attached, network attached, or SAN), or select from 4 types of edge-core SANs that allow you to manage server connections and storage connections independently

### What sort of availability and data recovery needs do you require?

- While a direct attached RAID controller can guarantee relatively high storage availability, you still have storage tied directly to a server. Different types of storage area network configurations can guarantee higher availability as you use redundant components or even a remote site

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- If you have lower availability and data recovery requirements, you can simplify your storage environment by connecting servers over an IP gateway or simply direct to an IP network attached storage device

### What operating systems are running your applications?

- Unfortunately, the world of storage is riddled with hardware and software compatibility issues. For example, z/OS and OS/390 mainframes cannot connect to any switches currently on the market. Similarly, midrange servers running OS/400 cannot connect to any directors that currently are available. If you mix z/OS and/or OS/400 with more open systems such as UNIX, Linux, or Windows, your interconnections will use multiple technologies
- TCONow! automatically takes care of different compatibility requirements and sets up ESCON or FICON connections for mainframes, Fibre Channel adapters for midrange and/or open systems servers, and even IP connections for UNIX, Linux, Windows, and Novell NetWare applications
- TCONow! also automatically creates a SAN configuration that takes into account the various switch and director compatibility rules

What results are impacted directly by these questions? The following is not an exhaustive list but does show the importance of your interconnection decisions to your overall storage environment:

- Will you keep direct attached storage; or use a SAN, NAS, or IP gateway?
- Will you use SCSI adapters, RAID controllers, Ethernet adapters, or ESCON, FICON, or Fibre Channel host bus adapters? How many adapters do you need?
- What is the optimal SAN configuration?
- How many and what types of switches and directors will you require?
- How many inter-switch links are necessary in your SAN?
- How will server and storage growth impact planned downtime?
- How often should you expect to suffer interconnection-related unscheduled storage outages?
- How efficiently can your IT staff manage your storage interconnections?

## Results

Getting to the numbers for storage management used to be more elusive and protracted than the electoral process. Fortunately, CIOview's TCONow! for Enterprise Storage is a great deal easier and less painful. TCONow! automatically:

- Designs your storage environment
- Designs your interconnection environment, whether direct attached, SAN, or IP connections
- Estimates your software licensing needs
- Helps you determine the professional services and ongoing IT personnel resources necessary to implement and manage storage
- Models your unscheduled and scheduled availability over time
- Provides an annual cost of support and maintenance based on existing storage and SAN fabric purchased from 1999 to the present as well as any new hardware and software.

TCONow! even takes into account the changing cost of storage, fabric, rent, and wages over time for you. TCONow! lets you auto-generate a 55+ page business case report containing all the assumptions, design information, and cost accounting you used in your analysis. The business case provides details on all default data as well as all cost items down to the cost per kilowatt-hour of electricity or the number of minutes of unscheduled downtime per year. All data is presented with white paper content explaining the assumptions and logic. And to really drive your points home to senior management, TCONow!'s business case report has charts breaking down

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important cost data to allow ease of use and easy understanding. Storage has never been this explainable before.

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### About CIOview

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Established in 1997, CIOview has spent more than five years gathering data from IT customers, IT consultants, and the major hardware and software companies. The result is an industry standard method to measure the business value of IT products. CIOview's TCOnow! and ROInow! software combines customer data with a sophisticated system configuration engine, making it quick and easy for each customer to generate their own business case report.

CIOview has created 55 distinct products all of which use the same desktop player application and a product-specific content module. This provides customers access to a complete portfolio of business case analyzers for all of their IT purchase decisions.

### Where Can You Go From Here?

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- Any other questions? Contact CIOview at [info@cioview.com](mailto:info@cioview.com)  
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