



**A Practical View:
Applying ITIL[®] to Storage
Service Management**

EMC Education Services

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Introduction

Many recent IT magazines contain articles that reference ITIL® (Information Technology Infrastructure Library) and how it can be used to better manage information technology. This should not come as a surprise since ITIL has been widely adopted by companies worldwide as an effective means of improving IT service quality and ensuring alignment and integration between IT and the business. Such articles often include imposing block diagrams, parables about increasing process efficiency and effectiveness, and endless advisories on continuous improvement. Dry paragraphs of process terminology are, apparently, a prerequisite when invoking the ITIL mantra.

Applying ITIL in the real world can be a confusing and frustrating experience. The ITIL framework offers high-level best practices that can be applied to any environment or technology. While the underlying process is straightforward, it is difficult to translate into practical use and many organizations struggle even with where to begin.

In this paper, we examine how to plan an ITIL implementation to create and manage a storage service. We will introduce design and management concepts and conclude with select best practices to support this strategy. This paper is intended for those who work within IT management and have responsibility for storage infrastructure and operations. It can best be used by those who are somewhat familiar with ITIL basics, who have an interest in adopting an ITIL service strategy, or for those who just want to learn more about ITIL.

Viewing Storage as a Service

Viewing storage as a service within the ITIL framework gives us a new perspective. Who is the customer if storage is the service? The business is the customer. With that in mind, the IT organization is expected to deliver required services in the most cost-efficient, well-managed, high-performing way possible.

What does the business really want from storage? The answer is enough storage to contain all information necessary to support the work of the business, delivered accurately when it is needed, and at the right cost. That usually means all the time, in today's 24/7/365 world.

This isn't easy. From a storage service perspective, there is a utility attribute of storage and information. Information is a strategic business asset that must be protected. IT must be accessible in forms that are useful to the business. That may include supporting mobile access and offering security measures to ensure data integrity and protection from any form of data attack. This increases the warranty attribute of a service, implying that necessary performance will be delivered securely and with sufficient continuity. The customer expects stability—and nothing less is acceptable in today's IT environment.

From an IT perspective, a storage infrastructure that delivers this level of service involves familiar tasks: capacity planning, managing incidents and problems, managing change, managing security, complying with regulations, and so on. But the business is not interested in how we deliver storage; they just want the service to perform as agreed. Deliver information consistently and on time and the business will value both its utility and warranty characteristics.

Casting storage as a service is important to achieve a successful ITIL strategy. If storage is a service, we define value from the customers' perspective and manage to their priorities. Whether you then choose to build your own storage service or outsource it to a service provider, your focus remains on providing business value.

Planning a Storage Service

ITIL's service management lifecycle begins with developing customer relationships to design, establish, and maintain a collaborative environment. In this paper, we assume that our storage service team interacts directly with business stakeholders and that we have agreed upon a service-level agreement (SLA). Alternately, your customer may be another group within the IT organization that maintains the overall service relationship with the business using their own SLA. In these cases, we form a relationship with the IT group, and define terms of the service with an operational-level agreement (OLA).

A storage service simply means providing enough storage, all the time, at the right cost. In storage infrastructure terms, this means meeting business requirements for storage capacity and availability. Note that capacity also includes performance, so the storage infrastructure needs to deliver enough IO throughput to keep the business' web users happy so they can spend money faster. We will discuss storage performance later in this document.

Planning a Service Catalog

We need to work with our customers to define what they need from the storage service in order to effectively support their business functions. We document these requirements in the service catalog documents and describes the IT services that are available to the customer. Availability is the first storage service-level requirement (SLR). As you might expect, the entry may read:

- **Storage is available 99.99 percent during scheduled service periods.**

Service periods encompass an entire business work cycle, including any critical processing windows. Securing agreement with the customer about explicit schedules, including allowances for any routine maintenance, will eliminate misunderstanding and unrealized goals.

You and your customer must clearly define storage availability. Does availability mean that an application server can access logical storage definitions? Yes. It also means that storage is maintained at the projected capacity and performance levels. Can your current storage infrastructure deliver on the percentage of availability defined above? Have you employed adequate data protection methods? Have you performed a component failure impact analysis (CFIA) to determine weak points? How about recovery from data corruption? It is important to avoid committing to service levels that exceed your infrastructure capabilities. Consider re-evaluating service-level expectations if your infrastructure is unable to support them, or propose improving the infrastructure to facilitate achievement of business requirements.

Capacity provides an expected level of performance. Application and database staff calculate the anticipated average and peak IO workloads for the storage infrastructure. Consider the next service-level requirement:

- **Storage performance will sustain 3,000 customer web transactions per minute during planned service periods (IT translation: 3,034 IOs per second of average size of 250 KB).**

This level of performance might be appropriate during peak or holiday seasons. But how can you be sure? Data flow may fluctuate by season, by month, even by day in certain industries so it is critical to develop an understanding of the underlying business cycle. Benchmarking is one key practice to establish a performance baseline. Collect all available data about the current workload. Track and trend it with reliable data collection tools and then analyze the data during an entire business cycle. Observe the rhythms of storage usage and ensure that your storage infrastructure is prepared to perform to those variable requirements. Calculate the maximum throughput that your storage infrastructure is capable of delivering (or subsets of the infrastructure, based on available tools). Again, do not commit to a service level that is not achievable given the current IT infrastructure.

Planning for Storage Growth

Let's say that you can deliver storage service consistently and reliably. Your customer is satisfied, right? No. They always want more; more storage to hold more information to support future business plans. Market expansion, mergers, acquisitions, new regulations, and new ways to mine existing customer data will translate into new demands for IT resources, particularly storage.

As a start, we need enough storage to satisfy demand for the next one to two years, based on trending and business projections. That raises the proactive aspect of capacity management. You need to work with the customer to forecast how much storage will be required. These projections may not be accurate initially; but an ongoing dialog with the customer will drive the refinement of capacity projections. The application and database staff should participate in these discussions to assist with translating business plans into gigabytes and IO transactions.

Customers typically underestimate their needs so plan to have more storage available to manage unanticipated usage spikes or an emergency need. One guideline suggests having at least 10-25 percent more usable storage available than has been forecasted for any specific point in time. (Be sure to allow for any data protection overhead, such as RAID or mirrors.) Again, setting service-level requirements will set goals to help manage capacity effectively.

- **No service outage due to storage capacity shortage, dependent upon monthly storage forecast and procurement cycle.**
- **Maintain a minimum of 25 percent capacity above allocated capacity, dependent on monthly storage forecast and procurement cycle.**

Note that conditions have been set for these service-level requirements. The storage service cannot provide endless capacity, and we rely on the customer to forecast future business needs. The customer must actively participate in this process so that the storage service team has adequate time to anticipate, acquire, and prepare the storage infrastructure.

Planning Storage Service Management

Establishing availability of storage enables the storage service team to commit to additional service-level requirements. Application and database groups are keenly interested in storage provisioning. Whether manual, automated, or a combination, meeting the need for additional capacity means making storage available quickly; especially when ongoing storage allocation is critical to business success.

The ability to modify the storage infrastructure without introducing errors or disrupting an application is critical to the operation of any business. Human error is the leading cause of downtime and we tend to disrupt systems at points of change. These unplanned interruptions demonstrate that people and process trump technology when it comes to supporting production environments and further supports the prescriptive use of ITIL practices.

Storage provisioning falls under change management. Monitoring of provisioning and how it tracks to projected growth is also an input to capacity management.

Planning for Change

Additional service-level requirements are necessary to set customer expectations regarding how accurately you can modify storage service to meet their required volume of changes. These involve provisioning or more complex storage modification tasks, and again, the goal is to enhance consistency and commitment. Here is an example.

- **Improve current implementation success rate of 95 percent on first attempt.**

Do you think that your storage operation could meet this requirement? How accurately have you performed storage changes in the past? How many times has a storage change caused unplanned application downtime? Where could you find the raw data to perform a measurement of this type? An incident management system would be a good start and could be mined for detail on incidents related to storage changes.

It is important to recognize that IT people and process aspects are more important than any new technology. To meet expected storage service levels you must develop comprehensive change procedures and ensure that your staff executes them correctly.

Employing a release management strategy is also critical to effectively manage change within a storage infrastructure. Large collections of storage components must be technically compatible to function properly. Compatibility is also required for timely vendor support. Consider creating a release unit with clearly defined elements, such as hardware levels, microcode levels, and server software levels for all storage components such as arrays, SAN switches, and servers.

Limiting the variations of the release unit will speed acquisition and implementation, reduce errors during change and troubleshooting, and pave the way for storage tiers and the benefits of information lifecycle management.

Your maintenance schedule must be coordinated with the staff responsible for managing servers, as many of the components in the release unit may be under their direct control (such as storage IO adapters and software drivers).

Planning for Standard Changes

Many storage infrastructure changes are routine. Allocation or de-allocation of storage volumes to a server should follow documented procedures. The time required to fulfill such changes should be captured within service-level requirements. Some examples include:

- Assignment of storage volume(s) to a specific host in a SAN within three days
- Installation of a new NAS filesystem within three days
- Restore of a complete SNAP copy of a filesystem within eight hours

For most organizations, “days” refer to business working days. As with all the examples listed within this paper, this list is not comprehensive or all-inclusive. You will likely define different or additional requirements to meet your company’s unique business needs.

Standard changes, like those listed above, will probably be of more interest to application and database groups than to business users since those groups control the actual placement of data on allocated storage.

Additionally, consider limits such as the overall number of requests fulfilled within a certain time period (that is, 10 per week or five per week). Limits regulate the flow of work within a storage service team, and ensure that you do not exceed staff capabilities. If your customer needs more work to be performed, additional staff or support tools may be required. Demand management techniques can also be employed within an operations process to curtail business demands for IT resources.

Planning for Storage Incidents and Problems

You might be concerned about the more reactive aspects of storage management. Maintaining storage availability involves responding to service exceptions. Many more incidents and problems are initially attributed to storage when compared to those that are caused by storage.

Incident management ranges from initial notification to rapid recovery. For larger or persistent issues that require in-depth analysis, problem management identifies the root cause of a problem and presents an accurate solution. Again, consider a few sample service-level requirements to clarify storage service expectations.

- Priority level 1 incident response in 15 minutes
- Priority level 1 incidents resolved within 30 minutes
- Priority level 1 problems resolved within 8 hours

These requirements challenge a storage service team to quickly assign resources to a storage incident and use all necessary resources to restore service, analyze the incident, and correct problems. The storage service's actual response to these requirements is tracked by the service desk since the customer will not typically be responsible for measuring and verifying adherence to these requirements. Delivering on these targets supports the availability requirement we considered earlier, greatly affecting customer value and perception of the storage service.

Does your staff understand support procedures? Are contact lists updated and easily accessible? Have you reviewed service contracts with storage vendors to identify how to engage and escalate storage incidents and problems?

You may know the answers to these questions. If so, you are already well on your way to applying ITIL. If you do not know the answers, you must find out. Assess, plan, improve, and measure your internal processes to reinforce the consistency necessary to meet targets.

Applying Storage Service Management Best Practices

So far, we have used service-level requirements to define a storage service. These targets are not chosen arbitrarily, but are negotiated to achieve a balance between customer need and what a storage service can deliver. The ability to deliver is based on the underlying storage infrastructure and the organization's process maturity.

A storage service orientation requires a shift in both individual and organizational behaviors. It doesn't matter where your organization is in the continuum of service implementation. When it comes to staff performing work, they are executing tasks within a process. ITIL processes are a good starting point, especially those that will help to deliver service-level requirements. These generic processes need to be applied and tuned to your specific operation, which is no small undertaking.

IT service management consultants and storage service providers have contributed to the development of major processes to support a storage operation. In most cases, these groups have collated their experience into detailed storage management best practices, as ITIL recommends. These practices typically include explicit process tasks and procedures, policies, and measurements, as well as clearly defined roles and responsibilities for the majority of ITIL processes.

Since storage service providers consider these best practices a competitive advantage, they often will not share them easily (or inexpensively). Nonetheless, engaging them can speed an IT organization's transition to a service orientation in less time, with less risk. Here are some common practices to increase your understanding.

Best Practices for Developing a Storage Service Strategy

- A storage service works best when the IT and business negotiate requirements and deliverables. Business meets storage through applications. Focus on applications and databases throughout the strategy and design phases because of their relevance to storage capacity and availability requirements.
- Mine current storage and broader IT initiatives to gain insight into business requirements that will define storage service-level requirements.
 - Existing ITIL adoption projects may have already developed a service catalog (or service specification that would contain customer requirements already translated into IT terms).
 - Business continuity or disaster recovery plans contribute to the development of a service catalog by providing an inventory of applications, their criticality to the business, and their dependence on other components and services.
 - Vendor business analyses for prior storage infrastructure acquisitions can provide insight into business links, longer-term storage projections, and a storage infrastructure strategy.
- An ITIL project will benefit from both top-down and bottom-up strategies. The storage service team can contribute significantly to a bottom-up approach, as data about the current storage configuration can be examined, and the team can determine how it is utilized by existing applications.
- Gather information regarding storage infrastructure capabilities to populate your configuration management system (CMS). Assess storage infrastructure capabilities and supporting processes, and identify any infrastructure or process weaknesses. Then apply storage management best practices tuned for your operation in a pilot project.
- Apply ITIL strategy and process to your greatest pain points first. This typically means stabilizing the management of storage incidents, problems, and changes. This will quickly lead to questions of capacity and availability. Wherever possible, adopt a long-term service lifecycle strategy to avoid point solutions that don't integrate well or require excessive rework.

Best Practices for Developing Storage Service Management Processes

- Effective processes should include policies that guide development and execution, clearly identify roles, ownership, and responsibilities for process tasks, list tools to support process execution, and measure and report outcomes that will be used to validate or invalidate process effectiveness and efficiency.
- When designing a process it is imperative to consider tools. Tools not only reduce the effort to execute a process, but they will also likely affect the steps and flow of information within a process. For example, automation will greatly reduce the effort to gather, trend, and produce reports on storage configuration and capacity. In addition, the storage industry is now displaying a promising set of new products geared towards federating data sources to support directions recommended by ITIL configuration management.
- Measurement is the only way to determine overall process effectiveness. Measure to ensure that service-level requirements are being met and that the level of effort expended to reach those requirements does not generate unanticipated costs. Measuring, reporting, reviewing, and analysis must be built into the processes for optimal management. Pilot key performance indicators (KPIs) and adjust them based on pilot results. For storage, measurements regarding storage allocation and performance are critical in both reactive and predictive service management.
- Availability management focuses on more than just storage hardware and software. The range of data protection methods is broad and may include local and remote redundancy, fast recovery features, and so on. The process to develop accurate requirements based on business need is beyond the subject of infrastructure. Select the right product mix by tying technology directly to service-level requirements to narrow options and control costs.

EMC Corporation, an EXIN Accredited Training Provider (ATP) and platinum member of itSMF, has built its own library of storage management best practices from years of experience providing IT service management consulting and storage managed services in its role as a world leader in storage products and services. Your organization can leverage these best practices to build and manage your own storage service.

ITIL for Storage Service Management Workshop is instructor-led training offered through EMC® Education Services as part of an open ITIL curriculum. This course explores with students the detailed tasks, policies, measurements, as well as clearly defined roles and responsibilities for major ITIL processes tailored to support a storage operation. Reviewing and practicing processes in the class immerses students in how to apply storage best practices to their own storage environments, as well as providing solid examples and templates for such a process exercise. EMC can also provide supplementary training and consulting services to help you implement IT service management objectives for your organization.



- Variations in storage service-level requirements for availability and capacity blend with the concept of tiered storage. Data for critical applications can be placed on arrays with the highest levels of data protection and less-critical applications onto infrastructures with less capability. These tiered service levels can be referenced in the service catalog, and discussed with customers for new or existing applications. This approach works well within financial chargeback models, especially those based on the amount of storage provided.
- Restrict the configuration of major storage infrastructure components (such as arrays and SAN switches) to no more than three variations of a release unit within a storage tier to reduce support costs. This will streamline the tasks to acquire, set up, allocate, manage, and repair these components. This approach also reinforces an overall release management process.
- Change management is one of the most difficult processes to execute. Honest risk assessment, adequate preparation, and sufficient validation testing are chronically under-supported. Additional focus in these areas can avoid unplanned incidents and rework, especially when reviewing change from a storage architecture perspective.
- All storage changes should be logged in the configuration management system. Supporting information should include the change justification, scope, and participants. Also include links to change plans, backout plans, and any other related data, such as incident or problem tickets. Finally, a before- and after-image of all changed configuration items should be captured. This detail can contribute to speedy analysis of an incident that may be related to an earlier change. The log can also contribute to building a library of procedures that consistently achieve intended consequences.
- The amount of work to implement standard changes (such as provisioning storage for a server) needs to be measured and incorporated into staff workload estimates. It is not uncommon for large sites to have dozens of change requests per week.
- Managing incidents and problems requires current and accurate storage infrastructure information. Information also needs to be quickly accessible when a service level is degraded. Again, storage management tools will be required to respond quickly and accurately. Better yet, tools to generate alerts when approaching incident-causing conditions (such as a filesystem full or IO saturation condition) can build support for a predictive strategy to identify and respond to error conditions before they occur.
- Continuously improve storage management processes and ensure that key performance indicators (KPIs) are aligned with business goals and requirements.

Conclusion

Applying ITIL best practices can benefit a storage operation as long as principles are well understood, properly applied, and relevant to the business. A service orientation is the starting point, but needs to be defined by realistic requirements that are based on customer requirements, available infrastructure, and staff capabilities. Success requires a sustained relationship with the customer and strong communication within the storage team, coupled with a strategic view of the storage infrastructure and the processes that support it. Securing help to plan the transition may be your first important decision.

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