VERITAS™ CommandCentral Service Process Automation

PROCESS AUTOMATION IN THE STORAGE SUPPLY CHAIN

A Different Approach to Storage Management

Author
Tad Lebeck
Introduction .................................................................................................................................................. 3
Process automation in the storage supply chain .......................................................................................... 4
  Automating the storage supply chain: It's a distributed problem ............................................................... 4
  Storage Operations involve more than capacity provisioning ................................................................. 5
Heterogeneity and change are facts of life .................................................................................................... 7
Advantages of Process Automation Technology ......................................................................................... 8
  Process oriented use model .......................................................................................................................... 8
  Process oriented implementation .................................................................................................................. 8
  Process oriented architecture ...................................................................................................................... 9
Getting Started: A Practical Approach to Implementation ......................................................................... 11
  Think big, start small, scale fast .................................................................................................................. 11
  Map process and management model from the application to the array ................................................... 12
  Automate the repetitive before the complex ............................................................................................. 12
  Don’t automate what you do, automate what you would do .................................................................. 13
Summary .................................................................................................................................................... 13
INTRODUCTION
Automation of tasks, policies and workflows has emerged at the top of the industry pundit agenda as the "next big thing" in storage management. In part, the enthusiasm for automation is the storage industry’s answer to the broader IT industry initiatives for on-demand or utility computing. In part, it is a natural step in the maturation of the storage management landscape, as the market for storage resource management (SRM) tools becomes increasingly crowded and commoditized. Most importantly, however, it is recognition of the fact that while classical monitoring, discovery and planning disciplines are an important part a storage management framework, the real money is spent or saved through efficient, compliant operations.

As many analysts have noted, even the most modest deployment of automated storage operations will allow you to:

• Set and continuously improve measurable goals
• Quantifiably improve the process to achieve these goals
• Enforce compliance with the policies that drive resource optimization and appropriate service levels

These benefits can be achieved in a number of areas. Today, automation is typically equated with capacity provisioning and positioned as a natural extension of SRM. In this limited arena, automation can deliver substantial improvements in storage utilization and staff productivity. Automation has an even greater potential impact, however, when applied outside the SRM domain. Here, automation can perform and audit execution of data movement, protection and recovery operations, providing the framework to certify critical data is where it is supposed to be, and that it can be recovered according to defined timetables.

To truly capitalize on automation you should be prepared to view automation as more than just the provisioning of storage capacity; and think outside the box in your approach to implementation. As Michael Peterson of Strategic Research observes: "Leading companies are taking a very different view of storage management. They see their applications as service consumers, and their operations and infrastructure as a storage supply chain. They want to make technology and operational complexity transparent and are focused on process automation in the supply chain to take cost and risk out of service delivery." To this end, you must take a page from the way companies have successfully implemented line-of- business applications: Adopt an iterative, process-oriented approach to your automation initiative.

1 ESG (Storage Process Automation), the Yankee Group (Storage Automation), and Michael Peterson’s Strategic Research Corp. (Storage Operations Management) have all recently weighed in with comprehensive reports on the subject.
This paper will: 1. Examine the scope and nature of the process problem in the storage supply chain, 2. Discuss the advantages of process automation technology over traditional SRM-centric and scripting solutions in addressing these issues, 3. Outline a practical approach for implementing an automation initiative.

**PROCESS AUTOMATION IN THE STORAGE SUPPLY CHAIN**

Automating the storage supply chain: It’s a distributed problem

In a process oriented view one must deal with user tasks and system processes in workflows that migrate across multiple platforms, and involve staff in different administrative organizations, locations and shifts. For example, to successfully provision a specific class of storage capacity to a specific application, three departments may be involved, each owning control of the operational tasks and policy decisions for their respective infrastructure in the overall process.
Figure 1. Typical provisioning process

Storage Operations involve more than capacity provisioning

Storage processes include data management as well as capacity provisioning. Think information storage—not just capacity management, but filing and retrieving information when and where it's needed. Processes and policies dealing with replica management, backup / recovery and DR are key components of the storage supply chain. These processes are typically initiated outside the storage administration function, though they often involve the storage group in a direct or supporting role, and can be tightly aligned or integrated with provisioning.

For example, creating a database clone using array-based replication is a repetitive process executed for test, point-in-time data analysis, or instant recovery. Here, the process is driven by database administration and involves both the instantiation of DB instances, tightly integrated with the creation and release of mirrored/replicated volumes.
Other data management processes such as backup or file based replication are less likely to involve provisioning tasks and supporting SAN management /SRM decision support tools. Likewise, their workflows may not involve storage administration.
Heterogeneity and change are facts of life
Storage resource and data management requirements change as the business evolves or applications mature. Over time, groups will wish to upgrade or replace the infrastructure or management tools in their domain. During ongoing operations, decisions must frequently be implemented on-the-fly in response to unforeseen application needs. Across the storage supply chain, these requirements and rate of their change will often be dictated by people or events external to the storage organization. From a process perspective, operational practices must also change to accommodate these dynamics.

Systems management approaches have been traditionally focused on monitoring of status across the infrastructure topology. Data about state, utilization and performance are collected in a central repository & presented via an administrator console for event notification, data correlation and analysis. This “single pane of glass” approach has served well in storage management, providing the storage manager a consolidated view as to what’s out there and what happened. Many of these tools have added integrated wizards or applications for provisioning infrastructure controlled by the storage administrator. This model however, is not well suited when extended to users other than the storage administrator, and controlling the actions and workflows inherent in automating the entire storage supply chain. More often than not, automated operations that have been deployed in the data center, have been implemented through scripting.
ADVANTAGES OF PROCESS AUTOMATION TECHNOLOGY

Process automation technologies are available today that provide a significant, and necessary, improvement over both scripts and monitoring-centric solutions. Besides the obvious benefit (in the case of scripts) of substituting vendor-supported software for handcrafted code, storage process automation solutions can manage the distributed process execution required by today’s networked storage environments. In addition, they provide a substantially improved process management model that matches organizational realities.

Process oriented use model

Like single console management tools, process automation solutions support the model of expert user with master control of an entire process. But process automation solutions extend this notion to support workflows involving multiple users across the supply chain, each with different roles and different levels of skill or control authorization. For example these solutions enable:

- Encapsulation of single tasks or complex processes for use and reuse by others.
- Role-based delegation of policy definition, process definition or execution control
  – allowing users in different organizations to manage their respective portions of an end-to-end process.
- Delegation of on-the-fly policy decisions to authorized users across a process.
- Ability to organize and publish automated processes the way each individual in the supply chain views their job.

Process oriented implementation

Most importantly, solutions architected for process automation support rapid and iterative deployment, starting with single task automation and evolving to more complex workflows that implement an organization’s specific operational practices. They also provide the capability to incrementally change, enabling continuous improvement of previously deployed processes.
Unlike monitoring-centric management tools, process automation solutions offer a range of development options to enable iterative change as requirements evolve.

- Visual tools that enable the administrator to model and implement user and system tasks, policies and workflow, as an automated process.
- Library of discrete tasks and pre-defined automated processes that model industry best practices. These can be deployed as-is or assembled/customized in the visual environment.
- Professional development environment to extend the process library through creation of custom process steps

Process oriented architecture
Automation solutions must support the secure, recoverable execution of system processes in a workflow that migrates across multiple, distributed platforms. These IT processes should be managed with the same “mission critical” approach as the line of business applications they support. To this end, solutions designed for automation offer features such as:

- Encrypted communications between the automation engine and its respective managed elements.
- Process state management to enable restart, recovery and rollback
- System enforced and user extensible audit history capturing user task, process and system call/return parameter detail.
In addition, storage operations must successfully complete in the dynamic context of schedules, system changes and other operations that compete for system resources. Process Automation solutions offer several advantages here over traditional approaches:

- Asynchronous process execution across multiple platforms, allowing execution to start, pause, stop/restart based on conditions or human intervention.
- Fine-grained process control allowing a range of process execution from single step/checkpoint to full end-to-end continuous execution.
- Process look-ahead or pre-flighting support to check for system availability prior to execution—avoiding unmanaged process failure or incomplete system changes.

Finally, process automation solutions are specifically architected to accommodate the diversity and change of process and technology inherent in storage operations. Key advantages include:

- Abstraction of process automation logic from the underlying infrastructure and element managers. This allows introduction of new technology to the environment without disruption to the management processes used to deliver infrastructure services to applications.
- Flexibility to allow a single instance of automated process logic to be configured at run time to fit multiple process scenarios. This allows the solution to evolve without waiting for major release upgrades.
GETTING STARTED: A PRACTICAL APPROACH TO IMPLEMENTATION

Conventional wisdom states that “you must know what you have before you automate”, implying that an automation initiative should follow implementation of your monitoring/SRM framework. In fact, many simple tasks or even complex operations in the storage supply chain are executed independently of data provided by SRM. (eg: replica management, backup, database tuning/test) In addition, storage practices requiring decision support from SRM data are executed whether or not an SRM “tool” is in place. Many data centers employ run books defining these operations and their associated policies in detail. All of these operations can benefit from the consistency enforced through automation. To this end, one should view process automation as a separate, complementary initiative to SRM. Nowhere is it written in stone that one should follow the other. The benefits of process automation can accrue separately, or in parallel with, deployment of monitoring-centric tools. There are several key practices however, that are common to most successful process automation implementations. And it is not surprising that these closely follow those found in successful line of business application deployments:

- Think big, start small, scale fast.
- Map process and management model from the application to the array.
- Automate the repetitive before the complex.
- Don’t automate what you do, automate what you would do.

Think big, start small, scale fast

Global implementations are high-risk implementations. Select a portion of a single, well-understood process, automate, learn, iterate and evolve. Set clearly defined, quantifiable and realistic objectives. Show success early, repeat every 60-90 days. For example, start by automating on-demand reporting of system status. This is a straightforward process that does not involve analysis or policy decisions to be made during execution.

Responding to requests for information from management or administrators in other departments can be an oft repeated distraction for storage administrators. Encapsulating the commands and logic for cross organization report generation as reusable services can support common requests for information. These can be published to information requestors for use (and re-use) in a self-service model. It’s hardly lights out, policy-based automation, but implementing self-service here has a major impact on productivity and responsiveness.

Once you’ve demonstrated initial success and polished the self-service model, follow that by incrementally rolling out services that support policy-based system configuration or data management. Not only will automation deliver improvements in productivity and quality of operations, but it can also provide the framework to enforce/audit policy and service-level compliance.
Another start-small example is the case of a retail bank where the operations staff regularly omitted a simple step to record the configuration of the Volume Manager before making modifications. This made configuration recovery following failures a long and difficult task. By encapsulating and automating the volume change functions, and including an initial step to record the volume manager configuration prior to each change, recoveries were reduced to a simple (automated) process. These clearly defined, encapsulated tasks could be delegated to authorized operators with certainty that best practices would be followed. The bank was able to build on this by automating tasks at all levels of their storage management operations, storage arrays, file systems and applications, eventually integrating them to evolve toward end-to-end automation of more complicated processes.

Map process and management model from the application to the array
When you select a process area for automation, it is important to consider the service path all the way to the application. Although you may not automate the entire process from the outset, this effort will provide not only a roadmap for future automation but establish priorities, measurement criteria and definitions for key process management elements such as:

- Most repetitive/time consuming process steps
- Highest exposure for error, and respective impact
- Organizational handoffs/breakpoints in the process
- Policies
- Roles/owners of process and policy control
- Assignment/delegation of authority
- Notification, approval and escalation procedures
- Audit requirements
- Service model— Request/respond, self-service etc.

Automate the repetitive before the complex
One school of thought states that repetition increases the closer a process is to the application it serves. Look outside the traditional domain of the storage administrator. Often, these tasks are associated with data movement or protection, or encompass provisioning steps performed by system administrators or database administrators (DBAs), after LUNs have been assigned to a host.

Database cloning is a highly repetitive operation that is an excellent candidate for automation. Sequential tasks to create or copy files for testing or data analysis on pre-provisioned storage infrastructure can be reduced to single operations, eliminating repetitive work (or rework) for the DBA. Over time, these operations can be extended to integrate on-demand creation and management of mirrored copies or remote replicas to affect multi-site backup and recovery practices. Here, automation addresses the more complex task of supporting collaborative operations between storage, systems and
database administration staff. And again, it provides the framework to certify execution of all local and remote operations, ensuring that data availability standards are met.

**Don't automate what you do, automate what you would do**

In many cases, automating a current practice merely repeats the sins of the past with greater efficiency. Evaluate and model process improvements that are made possible through automation. Be prepared to evolve and change your policies accordingly. Think: How would I operate if the only way to manage my storage infrastructure was through automation? This brings us full circle to auto-provisioning. Many organizations pre-provision storage on monthly schedules, or weekly at best, begging the question: Why automate something I do once a month? The answer, of course, is you wouldn’t.

This common practice is a major inhibitor to realizing the benefit of a shared storage model. The practice of pre-allocating and dedicating storage to individual applications is an artifact of the operational complexity involved in real-time provisioning. By containing complexity, while ensuring policy compliance, automation allows you to operate differently. If it only takes minutes to correctly respond to a storage request, why wouldn’t you provision on demand? By allocating storage based on need, as opposed to forecast, you can avoid an unnecessary build-up of over-provisioned storage. In addition, you can incrementally reduce re-provisioning thresholds and service response times as confidence in your operational procedures increases.

**SUMMARY**

For years, IT organizations have invested in enterprise software to automate business operations such as production, distribution and customer care. The result: Greatly improved quality and responsiveness of business execution. Managing the IT infrastructure that serves these systems however, remains a labor-intensive and fragmented process. Pursuing the same benefits accrued from business process automation, companies are now seeking to integrate and automate the critical IT process of managing their storage operations. Today’s automation technology can provide the platform for immediate and continuous process improvement across your storage supply chain. To truly capitalize on automation you should be prepared to view automation as more than just the provisioning of storage capacity; and think outside the box in your approach to implementation. You must take a page from the way companies have successfully implemented line-of-business applications: Adopt an iterative, process-oriented approach to your automation initiative.