Evaluating IBM's SVC and TPC for Server Virtualization

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Introduction

Many of Evaluator Group's user clients are now migrating applications from standalone, single application servers to virtualized servers using hypervisors such as VMware ESX, Microsoft Hyper-V, and Citrix XenServer. It is typically the case that the servers deemed easiest to virtualize—test and development, print and file serving, and others that host less critical applications—are the first to make the move. Next, IT operational staff members want to begin applying the resulting hardware and energy cost savings to their more critical applications that have already been realized for applications of lesser importance.

However, as IT administrators move forward with these projects, they can encounter a number of unknowns:

How will we measure infrastructure performance while supporting business-critical applications?

- Uncertainty over whether or not the application will deliver at least the same performance characteristics and service levels when embedded within a virtualized server as users experienced prior to virtualization.

Can we improve on the quality of IT services as experienced by the application user?

- Lack of experience in maintaining the QoS levels required for critical applications in virtualized server environments

Will new operational group alignments be required?

- An absence of company-specific policies and processes for managing critical applications in a virtualized server world—the realization of which leads server, networking, and storage administrative teams toward greater degrees of co-operation and we believe, eventual convergence

How do we migrate critical applications to virtualized servers while maintaining application availability?

- Uncertainty over how the actual application migration gets done while minimizing if not eliminating disruption as experienced by the application user

How do we predict the future need for both infrastructure and staffing resources?

- A perceived inability to project into the future the additional compute and management resources that will certainly be needed as the virtualized server environment grows in multiple dimensions that include:
    - The number of virtual machines
    - Storage capacity
    - Network capacity
    - Individual server capacity
    - Resources that will be required for additional applications

All of these issues have critical implications for the storage environment. In spite of storage capacity growth that averages seventy percent per year, many IT administrators have not yet seen a reason to deploy either storage virtualization or storage resource management (SRM) tools. However, we believe that server virtualization creates a new set of cases to be made for implementing storage virtualization technologies and SRM tools before, during, and after migrating critical applications. Here we look at IBM's approach to aligning the storage environment with critical applications running on virtualized servers using IBM' SAN Volume Controller (SVC) for heterogeneous storage virtualization and Tivoli Productivity Center (TPC) for SRM.

IBM's SVC

IBM's SVC aggregates virtualized server access to heterogeneous storage devices. The SVC presents a virtual pool of storage capacity to the hypervisor for use by VMs. Storage capacity appears as one logical device. As such, storage capacity can be centrally managed by IT administrators including those using management consoles like VMware vCenter, and allocated on an as-needed basis.

SVC features and functions of particular interest to virtualized server administrators include:

Non-disruptive migration of data volumes between storage arrays – This is a highly desirable capability when critical applications that require continuous or near continuous availability are migrated from stand-alone to virtualized servers. Data can be migrated from the physical to the virtual server environment without disrupting the functioning of the application while it continues to function.

Support for the attachment and virtualization of heterogeneous disk arrays – Existing disk arrays associated with stand-alone application servers can be virtualized and reused to support virtualized application servers. Acquisition of new and/or replacement storage arrays can be avoided or at least delayed.

Heterogeneous data copy services – One of the major advantages of migrating critical applications to virtualized servers is an ability to cost-effectively cover more applications under the disaster recovery and business continuance umbrella. The requirement to use array-specific copy services to support DR and business continuance plans can also be avoided.

SVC Clustering – IBM supports single SVC clusters of up to eight nodes, scalable in pairs. Clustering of SVC nodes has two major advantages for virtualized server administrators supporting critical applications:

1. As the application environment supported by virtualized servers grows, SVC performance can be scaled non-disruptively by adding pairs of SVCs to the cluster.
2. If one node within a SVC pair fails for any reason including microcode corruption, the other automatically takes the load of both until the failed SVC is brought back online.

Space-Efficient Virtual Disks (SEV) – Often referred to as "thin provisioning," SEV alleviates IT administrators from having to pre-provision heterogeneous disk storage capacity before it is actually used. Under SEV, physical capacity is only taken from the available of unused disk capacity when data is written by the application. This allows administrators to keep pace with the disk capacity demands of multiple applications running on multiple virtualized servers without the time-consuming and error-prone manual processes normally associated with capacity provisioning.

Centralized storage management complements centralized server management – SVC's graphic management console encompasses storage infrastructure configuration, management, and storage services provisioning for an entire virtualized server deployment. (And can be integrated with server virtualization management consoles?) IT administrative groups looking to restructure and consolidate their operational assignments could greatly benefit from a centralized storage management console that could also be integrated with a centralized management console like VMware's vCenter.

Solid State Disk (SSD) and heterogeneous tiered storage support – The SCV now supports flash-based solid state disk in addition to primary and secondary disk tiers that can be composed of arrays from multiple vendors and exhibit different performance characteristics. In that virtualized server I/O patterns can be very difficult to predict, finding a way to automate the placement of data objects (volumes, files, etc.) that optimizes application performance based on the current need of an application can greatly improve the overall efficiency of storage in support of virtualized servers. Using IBM TPC to manage the placement of data objects as controlled by the SVC provides such automation (see below).

TPC

TPC is a suite of SRM applications that work together in heterogeneous server environments to monitor, analyze, and automate the management of heterogeneous storage resources including:

- Storage networks including switching devices and host bus adapters (HBAs)
- Storage devices and subsystems including disk arrays and tape storage infrastructure
- File systems
- Data replicas including clone and snapshot copies, and data replication processes including synchronous and asynchronous copy

TPC features and functions that are of particular interest to IT administrators in the context of server virtualization include:

- SAN fabric configuration and management that is integrated with the virtual machine architecture
- Performance analysis that is correlated with specific VMs and the applications associated with those VMs
- Capacity utilization and forecasting associated with storage infrastructure supporting VMs
- Monitoring, reporting, and alerting functions that are integrated with the virtual server environment and virtual server management consoles

One way to see how TPC can be used in the context of the virtualized servers is to review how these functions can be exploited when migrating applications from non-virtualized to virtualized servers.

Before the migration begins

Administrators interested in TPC should give serious consideration to implementing before migrating critical business applications to virtualized servers. That way, experience is gained prior to migration, reducing guesswork and ensuring a level of competency with TPC that will pay dividends later on.

Using TPC as an infrastructure discovery tool before the migration allows administrators to inventory and document the hardware and networking environment up to the time of the migration. One can measure the performance of the storage environment before the migration and compare that to performance data post migration to see what impact the migration has had on performance. Administrators can also identify potential problem areas and weak links in the network to better ensure minimal disruption during the migration effort.

During the migration

Leveraging the monitoring and reporting functions, administrators can view the storage environment as the migration progresses. Broken connections can be seen almost immediately. Changes to the storage network topology can be remapped as the changes occur.

Ongoing support for the virtualized environment

Applying the reporting and automated management functions delivered by TPC post migration allows administrators to forecast capacity requirements, implement and enforce policy, monitor ongoing performance, and automate responses to changes within the storage environment supporting virtualized servers.

In general, TPC can reduce uncertainty and give administrators an ability to streamline the migration, thereby reducing the overall cost of migration projects. TPC can also give specialized administrative groups a single, consolidated view into the storage environment, eliminating guesswork and disruptive finger-pointing exercises when issues arise. This will equate to increased application availability, performance, and in turn, increased application user productivity.

Integrating SVC and TPC

IBM supports the integration of SVC with TPC. When integrated with each other, SVC and TPC working together can perform a number of additional functions that are of potential value to virtualized server and storage administrators:

Integrated storage tiering using SSD – SVC adds a flash-based solid state disk storage tiers to both primary and secondary disk tiers. TPC can identify “hot spots” within the disk subsystem attached to the SVC and (automate?) the migration of active volumes to a higher performance tier or demoting to a lower performance tier under policy implemented through TPCs management UI.

Management of heterogeneous disk attached to the SVC – TPC maps logical volumes to VMs and reports volumes that have been allocated but are not in use. IT administrators can be continually aware of allocated and free capacity available to existing and new VMs. TPC can also group both physical and storage resources and associate them with user groups – a function that helps IT administrators to apply charge-back for storage resources in a virtualized environment.

Management of data replicas created by the SVC – Copy functions are critical to the testing, disaster recovery, and business continuance functions enabled by server virtualization platforms. TPC for Replication tracks and manages replicas created by IBM FlashCopy, Metro Mirror, and Global Mirror functions.

Enablement of additional and enhanced reporting capabilities – TPC integrates storage environmental reporting functions via the SVC with virtualized server management. Reporting capabilities include:

- Configuration change history
- Current and historical disk utilization
- HBA-to-storage data path monitoring and event notification
- Historical performance analysis and trending

The combination of SVC and TPC demonstrates how virtualizing the storage environment can improve the efficiency and manageability of the overall virtualized server environment. For those potential users who have decided to virtualize the server environment but are unfamiliar with server virtualization platforms, we suggest adopting a phased approach to implementation.

1. Set up a test virtualized server test environment and implement and/or migrate a few lower tier applications to the test environment.
2. Insert the SVC and become familiar with managing this device in the context of the test environment and begin moving the lower tier virtualized server-based applications into production.
3. Install TPC to integrate management of virtual servers with virtual storage and become familiar with how to manage both in concert. At this point, siloed IT administrative groups (dedicated server, network, and storage management teams) may want to restructure themselves in a way that more closely reflects the consolidation and integration that results from progressively moving forward with server virtualization projects.
4. Begin the migration of the more critical applications to the virtualized server world.

SVC, TPC and Cloud Computing

Server virtualization is often characterized as a necessary first step to cloud computing. We note that cloud computing has been overly hyped as a new IT services delivery model. In fact, enterprise IT has always been about the delivery of IT services to application users. What cloud computing offers that *is* different is a model that delivers applications to users faster and with greater efficiency and scalability, and at reduced cost per application user than traditional models. Indeed, if private clouds are to succeed as an application delivery vehicle, they must be able to demonstrate time-to-market and cost efficiencies comparable to those already available from many public cloud-based application vendors like SalesForce.com and Zoho.

We also note that storage performance, availability, reliability, and security remain critical requirements the application environment imposes on storage in spite of continued growth in data volumes. However, the demands of these new models—agility, scalability, and cost efficiency—will force IT administrators to manage their storage environments in ways that enhance their efficiency as administrators, allow them to hold the line on headcount as the environment grows, and above all, deliver application performance and responsiveness to users.

Virtualization and automated management of the storage environment can go a long way toward satisfying those demands, depending on how willing and how comfortable IT operational staff members are with transforming policies and processes that are implemented manually into those that happen

automatically while remaining under the ultimate control of an administrator. The addition of virtualized storage as delivered by products like the SVC, integrated with storage management applications like TPC, allow IT administrators to manage growing storage environments supporting cloud computing with greater efficiency and lower cost per unit of storage.

Conclusion

As products, IBM's SVC and TPC have been evolving over the past decade from point products that perform a limited number of functions and manage specific devices within a storage fabric, to an integrated "solution" capable of delivering sophisticated storage virtualization capabilities and automated management functions. IT administrators can now integrate them with management applications that address other aspects of the virtualized IT infrastructure – vCenter for VMware for example.

The implementation SVC/TPC can be equated to increased administrative efficiency and contribute to an ability to hold the line on staffing while still maintain control over a growing storage environment that supports virtualized servers. But one can also position these tools within the context of an effort to increase application availability which can result in increased user productivity—difficult to measure but nonetheless a factor to be considered. Finally, we note that SVC/TPC can be seen in the context of a growing trend toward consolidated server, networking, and administrative efforts.