State of Ohio IT Best Practice

x86 Server Virtualization

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1.0 Purpose

This document details a set of industry best practices and suggestions from experienced state agency IT practitioners to consider when deploying server virtualization on x86 servers.

2.0 Background

These best practices were developed by the Server/Storage Virtualization and Consolidation Work Group (SSVC WG). The SSVC WG was formed by the Multi-Agency CIO Advisory Council (MAC) Enterprise Technical Architecture Subcommittee (ETA SC) to develop enterprise technical architecture and best practice recommendations for server and storage virtualization and consolidation.

3.0 Best Practices

Practice	Rationale
Keep complexity within your environment to a minimum	Good complexity is diversity that adds business value, while bad complexity is diversity that adds no value. Complexity drives the Total Cost of Ownership (TCO) of a server environment higher. Good complexity provides benefits while bad complexity wastes resources. When feasible use like systems for virtualization.
Periodically determine the total and available capacity of the server environment	Monitoring the total and available capacities of the server infrastructure allows making the most efficient use of existing resources to support requests for additional service.

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Practice	Rationale
Control server sprawl	Server sprawl can result from the ease of deploying a new server in a virtualized network. Put measures in place that require a chain of command approval process which includes a written request with a justification for all servers to be submitted to proper authority, reviewed, and approved before staff is able to deploy the new server. The request should include resource requirements (CPU, memory, drive space), OS and applications needed, and lifecycle of the server. Review server lifecycle quarterly, semi-annually or annually. Limit the number of staff capable of creating virtual servers.
Verify ESX pathing after a Storage Area Network (SAN) migration	Sometimes when modifications are made to a SAN supporting virtual servers, the ESX views the pathing differently, even though the SAN identifier remains the same.
Manage your virtual machine (VM) lifecycle	VMs created for temporary purposes will live a long life unless the farm is managed. VMs typically should have a lifecycle with an end date. This should be managed to ensure that VMs no longer being used are shut down and deleted from storage.
Choose one virtualization technique and corresponding vendor for your environment	Heterogeneous, or external, storage virtualization is an appliance, notably used in larger IT environments and/or those with a variety of different manufacturers or various models of disk resources with different performance characteristics. It presents a view to a host server of a single disk storage array even from one or more physical disk arrays. Choose one virtualization appliance and corresponding vendor for your environment.
Determine maximum utilization for the virtualization platform and then evaluate candidates' utilization profiles to determine if the virtualization hardware platform's capacity is adequate	Continuous monitoring of a virtualization platform's utilization helps to ensure meeting current and future service level agreements. Run VMware's Capacity Planner to help determine this. Pay particular attention to the type and amount of RAM being used. RAM tends to be the bottleneck.
Support enough I/O modules to provide physical segmentation of networks	Include enough modules, Network Interface Cards (NICs) or Host Bus Adapter (HBAs), to have redundant (x2) connections to each of your physically segmented networks, such as SAN, demilitarized zone (DMZ), Intranet, Extranet, etc. This is sometimes a limiting factor on blade chassis deployments; however I/O virtualization products can also help overcome this obstacle.

Practice	Rationale
Make use of external storage technologies such as a SAN or Network Attached Storage (NAS) to store virtual machine files whenever possible	The benefit of hosting several server instances on a single physical server with internal storage can become a detriment if the hardware becomes inaccessible. The use of dedicated attached storage, along with virtual machine management technologies, allows the ability to quickly move virtual machines among additional virtual hosts, thereby mitigating the impact of a host failure.
Implement a default partition size in ESX	Be careful to set the swap partition effectively. VMware ESX will default to sizes for Linux partitions unless you manually change it. Consider installing ESX through a cluster and set the swap file to 1600MB, which permits the service console RAM to be set to 800MB. This approach slows or stops swapping.
Implement a storage tiering approach	Purchase cost-effective storage based on priorities and a data risk assessment. Not all data needs to be on the most expensive storage. Put data on the least expensive storage possible while maintaining necessary reliability and performance.
Implement a storage segmentation strategy	Don't put all environments on the same storage / SAN solution. Separate test / development and production if possible to eliminate any chance of resource contention. Every host should be able to trace at least two data paths to a storage unit, through separate switches and storage device channels to eliminate single points of failure.
Virtualize Virtual Center (VC)	This approach saves a physical serve and also enables a snapshot of VC prior to upgrades and changes.
Implement VMware Consolidated Backup (VCB) for backups	Consider installing a standalone server to act as VCB with access to virtual machine file system (VMFS) volumes. This avoids accidental initialization of volumes which causes data loss.
Develop backup strategies and methods to take advantage of virtual machine capabilities	Using virtualization improves the speed and efficiency of backup and restore processes and contributes to lowering cost.
Utilize virtual multi-network, switch-trunked architecture to consolidate physical network connectivity	Consolidation of workloads with low bandwidth network needs using the virtual network switch can save needed PCI slots; permits rolling maintenance and switch restarts without downtime.
Dedicate at least one virtual server to a testing environment	This allows thorough testing of applications, patches and updates targeted for virtual environments without impacting production as well as providing a safe environment for such things as administrator training.
Investigate the use of physical to virtual (P2V) and virtual to physical (V2P) capabilities provided by the virtualization vendor	Using these capabilities streamlines the migration from a physical machine to a virtual machine. Be aware that if a server is using a Microsoft Original Equipment Manufacturer (OEM) license there are additional challenges to the P2V process that can be addressed if planned ahead of time.

Practice	Rationale
Manage your VM snapshots	Manage snapshots and limit their usage. Unmanaged snapshots can consume disproportionate volumes of storage. Consider limiting snapshots to 30 days and routinely crawl the volumes for snapshot files that need to be removed.
Know your licensing models	All vendors are not created equal. Some will go to great lengths to determine how to realize the greatest profit from customers who utilize virtualization. Before finalizing your architecture know how the vendors will license their products on your virtual farm and then develop an architectural balance between performance, redundancy and cost savings.
Alter NIC settings at the port group layer to set failover priorities to the individual NIC	Set permissions for fault tolerance (FT) and VMotion to prefer an alternate network connection to the one the VMs are configured to use in order to keep traffic from interfering with each other.

3.1 Revisions of these Best Practices

The Enterprise IT Architecture and Policy group of the Office of Information Technology will conduct a biannual review of these best practices and related server virtualization technologies. Changes will be published in these best practices.

4.0 References

Section 125.18 of the Ohio Revised Code (ORC) provides the State Chief Information Officer the authority to coordinate and superintend statewide efforts to promote common use and development of technology by state agencies.

5.0 Procurement Guidance

None

6.0 Definitions

None

7.0 Related Resources

None

8.0 Inquiries

Direct inquiries about these best practices to:

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Ohio IT Best Practices can be found on the Internet at: www.ohio.gov/itp.

9.0 Document Revisions

August 2010	Original version of the Server Best Practices

10.0 Attachments

None