Module – V
Virtualization Management

Management life cycle - managing heterogeneous virtualization environment – customized and modifying virtual machines – virtual machine monitoring – management tools.

Introduction

- Virtualization has brought many benefits to organizations, both in terms of **ease of use and flexibility in deployment**.
- As result organizations have generated a lot of virtual machines (**growth + 20% on average each year**).
- However, companies have generally not accompanied this growth by adjusting the organization: **no decommissioning process**, **no guidance indicators for virtualization**, …(**no VM lifecycle**)
- This constant **increase in the number of VMs increases the risk as well as the costs.**
- To avoid falling into this category, it is important to manage the full life cycle of the VM (its creation but also the steps that will allow the decommissioning).

Introduction

- One of the advantages of virtualized environments is the ease of management of servers.
- A virtualization administrator can easily provision new virtual machines but, **if this is not well controlled and maintained, it might finish with overloading your host machines and storage equipment**.
- Having a clear Life Cycle of VMs in your virtualization environment helps avoiding similar situations

Introduction…

- XYZ is a Web Applications development company that does development for its customers.
- XYZ developers frequently request for new servers to develop or test developed applications.
- XYZ is using a virtualized server environment

Introduction…

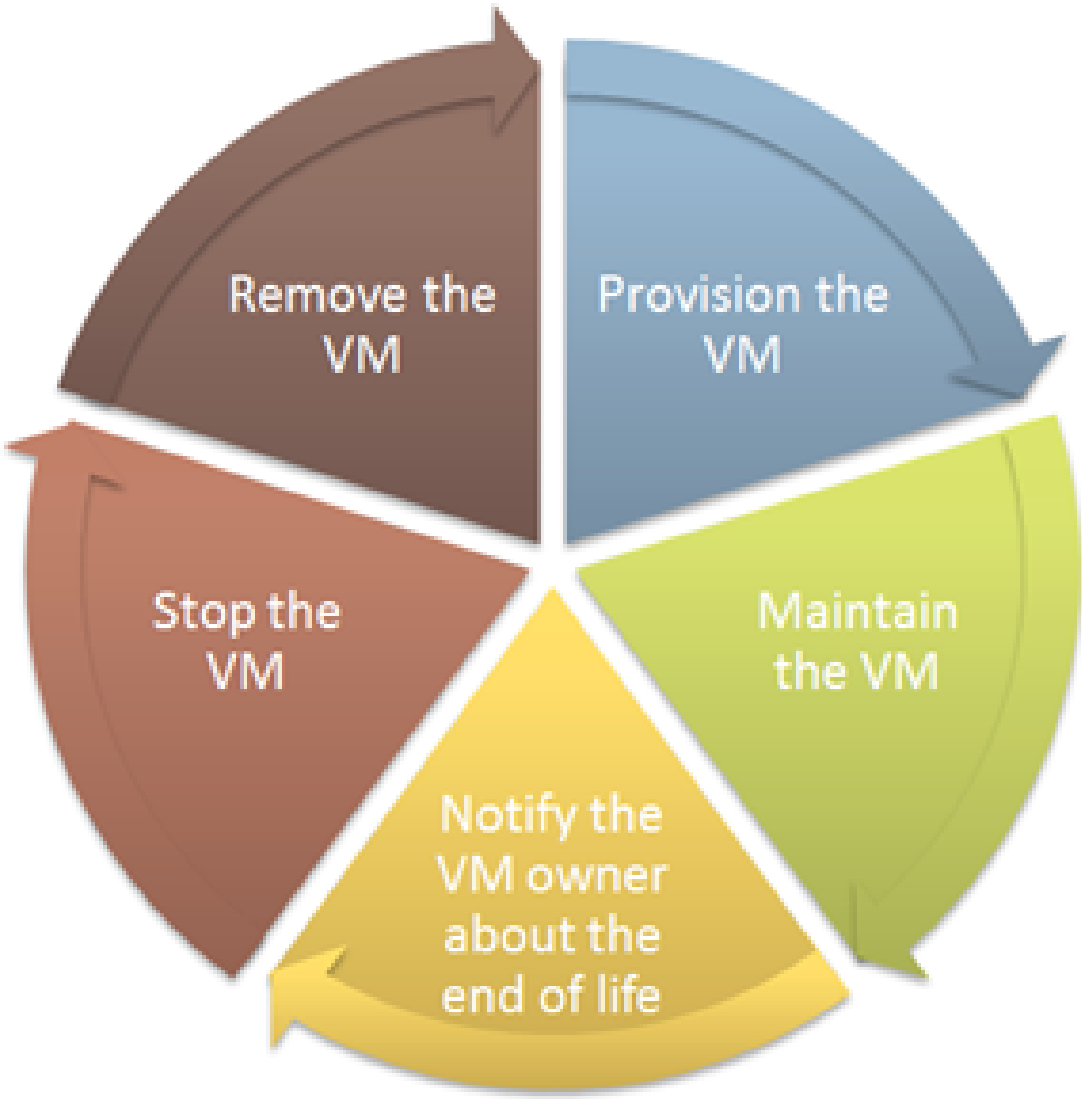
- The administrator provides new virtual machines when developers request for them.
- However, he has difficulties to follow-up with the developers if they still use the provided VMs or not and the Hosting servers became overloaded due to the increasing number of provisioned virtual servers.
- The administrator would like to **implement a Life Cycle management** where a virtual machine will be **automatically deprovisioned** at the end of its Life.

Introduction…

Requirements

- When a virtual machine is about to reach its end of life, an **e-mail notification** will be sent to the virtual machine owner informing that the virtual machine will be switched off soon
- When a virtual machine **reaches its end of life**, the virtual machine will be stopped through the management software and an e-mail notification will be sent to the virtual machine owner
- When a virtual machine exceeds one (1) month after its end of life and the owner have not requested for

VM Life Cycle



Virtual machine lifecycle management

- **Virtual machine lifecycle management** is the class of management that looks at the life cycle of a virtual machine from the viewpoint of the application vs one focused on roles within an organization.

- A number of major software vendors, including Microsoft and Novell, have begun to release software products aiming at simplifying the administration of larger virtual machine deployments.

Environmental characteristics

Virtualized environments are fundamentally different from physical environments in architecture and capabilities.

The flexibility they provide is derived from three fundamental characteristics:

- **Time**: Over time, the topology of the environment changes with machines coming online and others going offline.
- **Motion**: Unlike physical servers, virtual machines easily relocate around the data-center.
- **Transparency**: With no physical presence, virtual machines cannot be seen, identified, touched or often, missed.

Virtualization Solution

- Virtualization may answer the toughest problems of the enterprise IT infrastructure and bring tangible business

Issues

•Underutilized hardware, data centers run out of space, increasing power costs

•System administration brings increasing cost of operations and is usually co-located with servers

•High-availability service level

Virtualization Solution

•Reducing equipment, facilities, and operating costs, achieving storage and energy efficiency

•Reduced system administration requirements, effective coordinating management and operations across virtualization environment

•Enhancing business continuity metrics by improving system manageability and security

VIRTUALIZATION MANAGEMENT LIFECYCLE

P2V Conversion

- Windows / Linux systems or selected disks / volumes VMware ESX Server / Workstation
- MS Hyper-V Server / Virtual Server / Virtual PC, Citrix XenServer

VM Monitoring

- Tracking the state of virtual infrastructure
- Processes control within VMs
- Viewing content of VM disks
- Notifications, conditional events

VM Optimization

- Removing redundant data
- Resizing partitions
- Compacting sparse disk images
- Increasing perfomance
- Rich reporting & statistics

V2V Conversion

- Clone to dissimular hardware
- Cold device driver installation technology
- Bare metal conversion using Windows PE

Quick Application Unfolding

- Install an app into a VM
- Grab the changes
- Quick apply to other VMs

V2V Conversion

- Take one virtual system
- And clone it to other virtual system
- Offline conversion for better perfomance

VM Backup / Restore

- Backup to a local / network storage
- “Hot” or “cold” backup

VM storage optimization

- The **automated tracking process** of over-allocated and possible outages VM storage enables clients to manage their existing storage more efficiently.
- After potential storage savings are estimated it’s time for **rightsizing and fixing VMs** which are running out of storage.

Optimizing VM performance

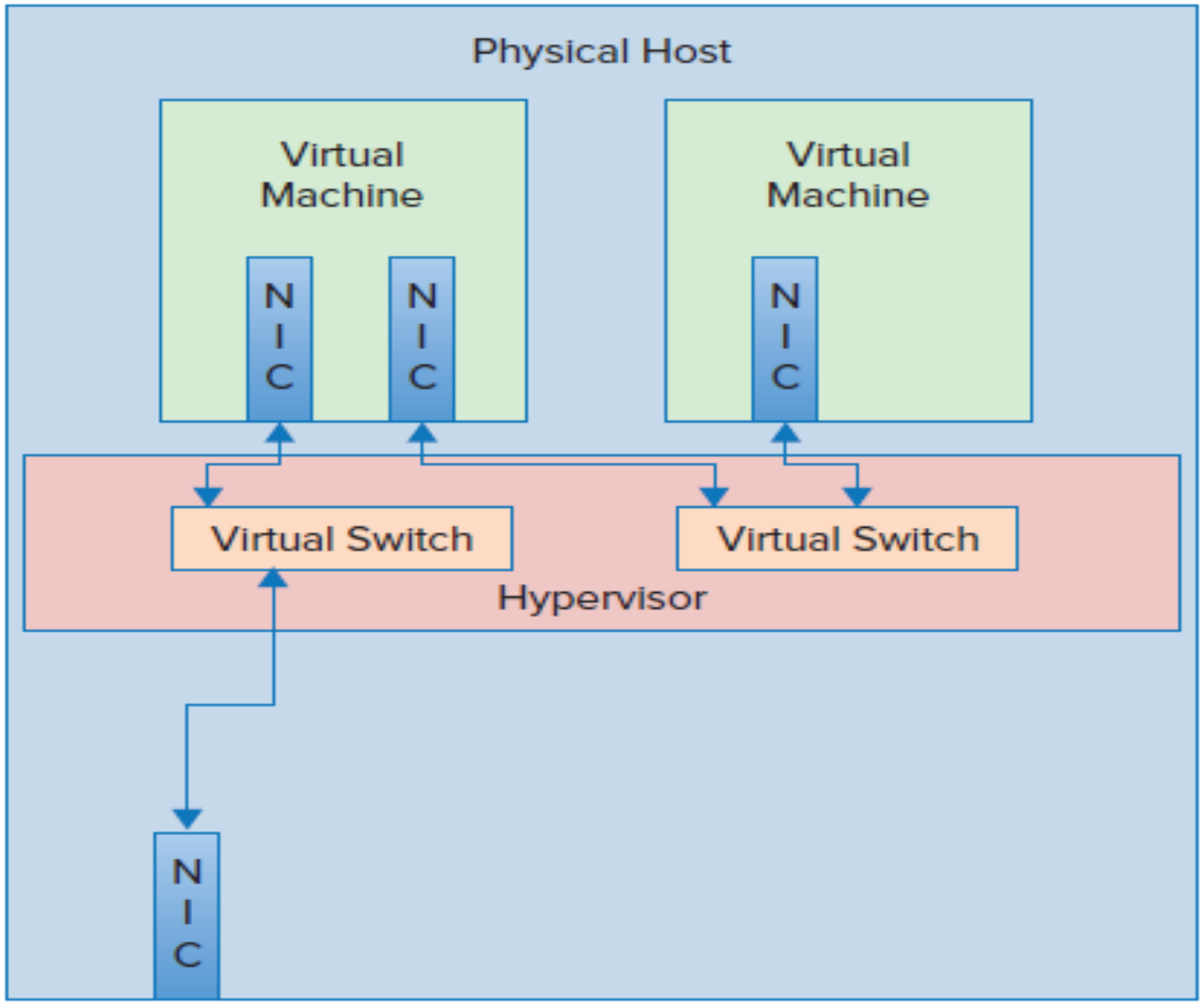
- With the virtual machine performance going up, **more virtual machines can be squeezed onto a host server**, thereby achieving **higher virtual machine density**.

VM rightsizing automation

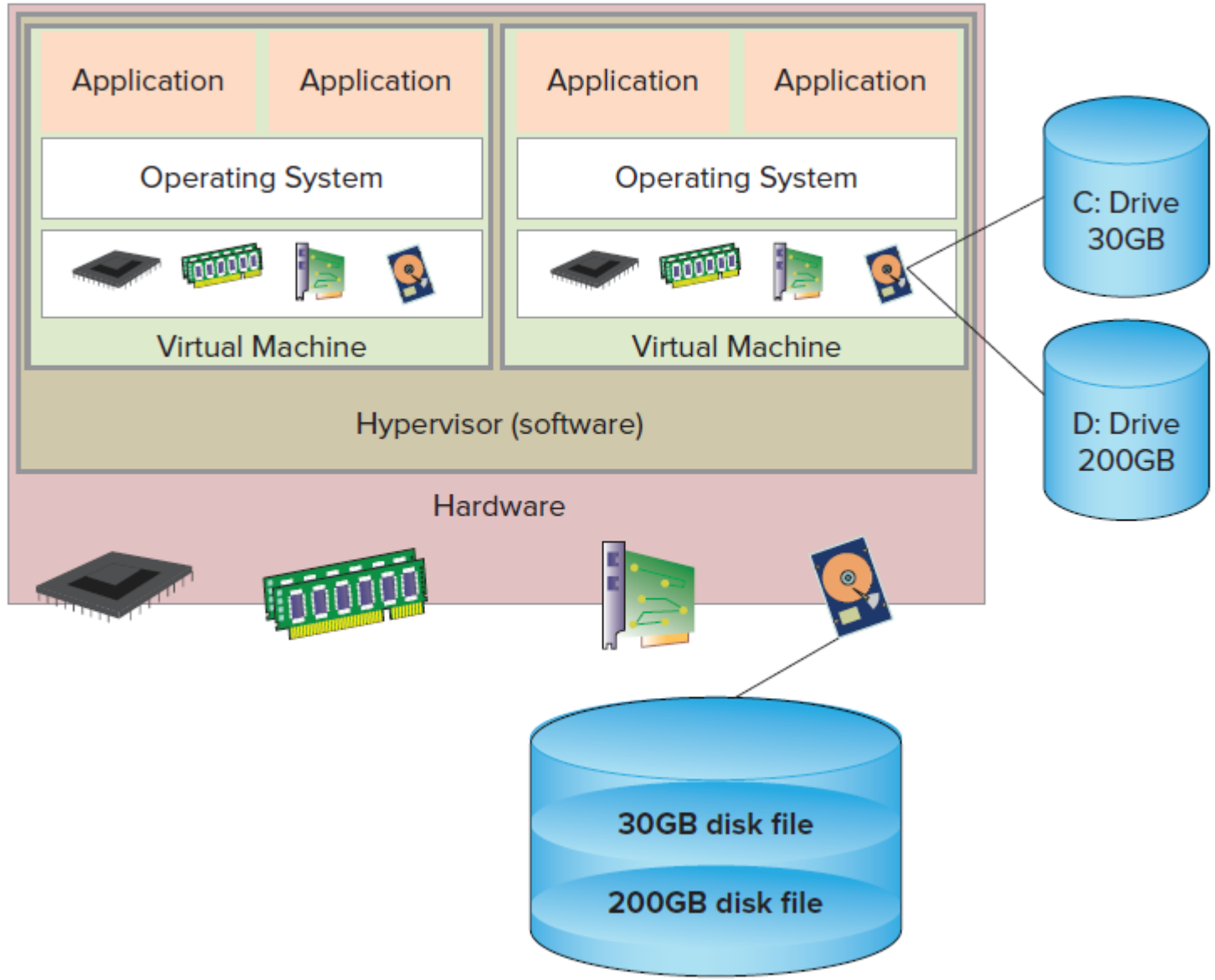
- To reach better performance, the custom virtual appliance initiates a series of **virtual machine reconfigurations (rightsizing)** which continuously adjust to **dynamic virtual infrastructure conditions**.

- **Examining CPU in a Virtual Machine**
  - The single CPU VM can schedule a single CPU’s worth of capacity. The host does not reserve a CPU solely for the use of a particular VM; instead, when the VM needs processing resources, the hypervisor takes the request, schedules the operations, and passes the results back to the VM through the appropriate device driver.
- **Examining Memory in a Virtual Machine**
  - A virtual machine is allocated a specific amount of memory, and that is all that it can utilize, even though there might be orders of magnitude more memory available on the physical machine. you can merely reconfigure the amount and the VM will have access to the added capacity, sometimes without even needing a reboot
- **Examining Network Resources in a Virtual Machine**
  - Each virtual machine can be configured with one or more network interface cards. The hypervisor supports the creation of a virtual network that connects the virtual NICs to a network that is composed of virtual switches inturn to physical NICs

VM-to-VM
communications can occur across a virtual switch and never leave the physical host. If a second VM’s virtual NIC connects to a virtual switch, and that switch is not connected to a physical NIC, the only way to communicate with that VM is through the first VM,



- **Examining Storage in a Virtual Machine**
  - Virtual servers need storage to work with. those “drives” are merely carved out regions of disk space on a shared storage device, and the hypervisor manages the presentation to the VM
  - As a virtual machine talks to a virtual SCSI disk adapter, the hypervisor passes data blocks to and from the physical storage. That actual connection, from the host to the storage, whether it is local storage on the host or on a storage area network (SAN), is abstracted from the virtual machines.


Application
Application
Application
Application
Operating System
Operating System
Virtual Machine
Virtual Machine
Hypervisor (software)
Hardware
C: Drive
30GB
D: Drive
200GB
30GB disk file
200GB disk file

- **Understanding How a Virtual Machine Works**
  - The hypervisor becomes the transporter and regulator of resources to and from the virtual guests it supports. It achieves this capability by fooling the guest operating system into believing that the hypervisor is actually the hardware
  - When a program needs some data from a fi le on a disk, it makes a request through a program language command, such as an fgets() in C, which gets passed through to the operating system.
  - The operating system has fi le system information available to it and passes the request on to the correct device manager, which then works with the physical disk I/O controller and storage device to retrieve the proper data.
  - The data comes back through the I/O controller and device driver where the operating system returns the data to the requesting program.

- # Working with Virtual Machines
  - ## Understanding Virtual Machine Clones
    - If you need a new server, you can clone an existing one. The process involves little more than copying the fi les that make up the existing server. Once that copy exists, the guest operating system only needs some customization in the form of unique system information, such as a system name and IP address, before it can be instantiated.
    - Tools that manage virtual machines have provisions built in to help with the customizations during cloning, which can make the actual effort itself nothing more than a few mouse clicks
  - ## Understanding Templates
    - A template is a mold, a preconfigured,preloaded virtual machine that is used to stamp out copies of a commonly used server
    - The difference between a template and a clone is that the clone is running and a template is not
  - ## Understanding Snapshots
    - Snapshot, a capturing of a VM’s state at a particular point in time
    - unrolling all of the changes that have been made since that time.
    - A snapshot preserves the state of a VM, its data, and its hardware confi guration. Once you snapshot a VM, changes that are made no longer go to the virtual machine. They go instead to a delta disk, sometimes called a child disk. This delta disk accumulates all changes until one of two things happens, another snapshot or a consolidation, ending the snapshot process

- **Understanding OVF**
  - Open Virtualization Format (OVF). OVF is a standard, created by an industry-wide group of people representing key vendors in the various areas of virtualization
  - create a platform and vendor-neutral format to bundle up virtual machines into one or more fi les that can be easily transported from one virtualization platform to another
    - Format 1
      - The OVF template creates a number of fi les that represent the virtual machine, much as the virtual machine itself is composed of a number of fi les
    - Format 2
      - OVA, which will encapsulate all of the information in a single file.

Virtual Server Management

- Virtual server management is the act of **managing virtual servers** and **monitoring their performance in real time**.
- A virtual server management solution helps
  - effectively identify and solve performance issues,
  - optimize resource utilization,
  - prevent hardware failure, and
  - maintain virtual servers at peak performance.

The challenges of virtual server management

- Enterprises run multiple applications and operating systems on fewer resources.
- Virtual servers come with a load of benefits ranging from
  - reduced hardware expenses,
  - faster provisioning and deployment,
  - improved disaster recovery and
  - energy savings
- Challenges:
  - VM sprawl
  - Network traffic congestion

VM sprawl

- There are a lot of advantages to deploying virtual machines (VMs) in an enterprise.
- However, after an increased use of virtualization, it becomes difficult to manage these accumulated VMs, and together these VMs significantly **drain computing resources**.
- VM sprawl thwarts any advantage from virtualization and may even require businesses to **make further investments into physical hardware**.

Network traffic congestion

- In an attempt to achieve maximum utilization of hardware resources, companies will often **consolidate multiple VMs onto a single server**.
- Since most servers come fitted with a **single network interface card (NIC) port**, this **consolidation causes increased traffic**.
- **Workloads sensitive to network latency** may report errors or even crash.
- This may prove to be an expensive affair that can be best avoided with the help of a proper virtual management solution.

Server hardware issues

- Server virtualization provides **high flexibility** in terms of **business continuity and disaster recovery.**
- However, underlying physical resources can still be **negatively impacted** by the consolidation of virtual servers.
- Virtual server management helps maintain these resources at **optimum utilization** as well as **monitor their health and performance**.

Virtualization Management Tools

What?

- Virtualization management tools are **designed to administer** the operations and processes of a virtualization environment.
- The number of virtual machines running in the data center can reach hundreds and thousands.
- For this reason, it becomes imperative to have visibility into the virtualization environment **to understand the overall performance and health of the system**.

What do Virtualization Management Tools Do?

- The primary tasks performed by these tools are **to check** to make sure that all virtual machine software and hypervisor versions are **up to date**.
- They also **establish and maintain connectivity** across the environment, and monitor the performance of each virtual machine.
- They do this by, for example, allocating more memory or processing power to right-size virtual machines for **optimal performance**.
- Virtualization management tools are also required **to identify the root cause of any problems.**

What do Virtualization Management Tools Do?

- They do this by **analyzing the application, server, virtual and storage layers** to **troubleshoot issues**.
- Increasingly, virtualization management tools are being asked **to handle more strategic management tasks.**
- For example, they are required **to identify usage patterns** and help to **predict future virtualization infrastructure bottlenecks and resource limits**.

Third-party virtualization management tools

- Today there are many third-party vendors that pick up the slack by delivering feature-rich applications.
- These apps go beyond the **basic tools supplied by virtualization** vendors and include **security, monitoring, reporting, backups and automation**.
- Although many of the best virtualization management tools are expensive, there are also many **lower cost and free tools** available as well that can help make virtualization management easier.

10 essential virtualization management tools

1. RV Tools from Robware.net (free)
2. PowerShell from Microsoft (free)
3. Citrix Essentials from Citrix (paid/free)
4. vControl from Vizioncore (paid)
5. VMC Management Console from Reflex Systems (paid)
6. Migrate from PlateSpin and vCenter Converterfrom Vmware
7. iSCSI SAN Software from StarWind Software and OpenFiler from Open Source(paid/free)
8. vCenter Mobile Access from VMware (free)
9. Veeam Backup and Replication (paid)
10. ESX Deployment Appliance from Herco van Brug

1. RV Tools from Robware.net (free)

- For VMware environments, this handy little free application is **written in Microsoft .NE**T and leverages the VMware SDK's to collect information from vCenter Servers and ESX/ESXi hosts.
- It supports both VI3 and vSphere and displays a wide variety of valuable information in a simple row-column spreadsheet-like interface.
- This application is frequently updated with many new features and is a must-have for any VMware administrator's toolbox.

2. PowerShell from Microsoft (free)

- For VMware ESX/ESXi and Microsoft Hyper-V environments, PowerShell is a free extensible command-line shell and associated scripting language developed by Microsoft.
- Used to help automate common administration tasks and provide information about your Microsoft and VMware environments.
- Commonly used in Windows environments, PowerShell can also be used for virtualization management in VMware and Hyper-V environments using special add-on libraries that give PowerShell access to the VMware (PowerCLI) and Hyper-V (PowerShell Cmdlets for Hyper-V) APIs.
- PowerShell is fairly **easy to install** and use, and some great scripts are available for free.

3. Citrix Essentials from Citrix (paid/free)

- For Citrix XenServer and Microsoft Hyper-V environments, Citrix Essentials is an application with separate versions for Hyper-V and XenServer that adds some powerful virtualization management capabilities and features to each.
- **For both versions, it adds features like dynamic provisioning services, stage and lab management, workflow orchestration and StorageLink technology for array integration.**
- For XenServer, it adds a **high-availability feature** as well and **dynamic workload management.**
- Citrix Essentials is available in two paid editions for Hyper-V and XenServer, Enterprise and Platinum with the Platinum version containing the lab and stage management features.
- A free edition for Hyper-V has support for StorageLink for storage management and site recovery.

4. vControl from Vizioncore (paid)

- VControl is a **multi-hypervisor Web-based self-provisioning** and VM virtualization management tool for Citrix XenServer, Microsoft Hyper-V and VMware ESX/ESXi.
- It’s a Windows application that uses open source software and consists of two components -- **a master server and a workflow server**.
- VControl has an easy-to-use Web interface and is great for environments that do not have a vCenter Server for mixed hypervisor environments.
- The workflow portion of vControl enables administrators to use workflows to manage daily tasks and provision VMs.

5. VMC Management Console from Reflex Systems (paid)

- VMC has evolved into a complete virtualization management product that provides monitoring, reporting, asset management and automation for the whole VMware environment.
- Featuring a nice graphical interface, VMC consists of the main management console application with reporting, alerting, event correlation and policy automation.
- VMC and its various components provide a single pane of glass for VMware.

6. Migrate from PlateSpin and vCenter Converterfrom VMware

- It allows administrators to do physical-to-virtual and virtual-to-virtual conversions.
- Although not as robust as some of the paid conversion applications, it does the job of conversions well and is simple to use.
- PlateSpin Migrate is a paid application that converts physical servers into any hypervisor VM format (P2V) including XenServer, ESX/ESXi, Virtual Iron and a variety of image formats.

7. iSCSI SAN Software from StarWind Software and OpenFiler from Open Source(paid/free)

- OpenFiler is a great open source application that can install on a physical server or as a VM to convert a host’s often unused local disk to shared storage that can be accessed via NFS or iSCSI.
- StarWind’s paid iSCSI SAN software can also turn local storage into shared storage so it can be accessed via iSCSI.
- The StarWind virtualization management tool has many advanced features as well, including thin provisioning, replication, high availability and mirroring.

8. vCenter Mobile Access from VMware (free)

- With vCenter Mobile Access (vCMA), VMware administrators can monitor and manage their hosts and VMs using a Web interface optimized for a mobile phone display.
- Administrators can view host and VM information, alarms and events and can perform inventory searches, initiate a VMotion, change VM power states and manage snapshots.
- vCMA can be deployed as a pre-built virtual appliance that administrators use to manage their virtual environments from their mobile phones.

9. Veeam Backup and Replication (paid)

- Veeam Backup and Replication was the first to embrace the many new features in vSphere that took advantage of the vStorage APIs for more efficient VM backups.
- Backups are critical for virtualization management in any environment, and having a good backup application that is designed and optimized for virtualization is important.
- Being able to restore data when necessary is equally important.
- Veeam’s recently announced SureBackup feature allows users to test VM restores in a simple manner that has no impact.

10. ESX Deployment Appliance from Herco van Brug

- For VMware ESX, the ESX Deployment Appliance (EDA) is a must-have virtualization management tool for large environments because it makes deploying new ESX hosts with a pre-defined configuration simple.
- Using network PXE boot, it has a Web interface to configure and deploy many ESX hosts within minutes.
- This virtualization management tool also has a script builder that makes post-configuration of ESX hosts an automated procedure.
- The EDA is a big time-saver when building ESX hosts and ensures all hosts are deployed to a standard configuration.

Virtualization management product selection considerations

1. A high level of scalability.

In enterprise shops, the number of virtualized servers has grown rapidly, and as organizations begin to virtualize large numbers of desktops, the need for robust and scalable virtual management capabilities becomes even greater.

So the technology you purchase should be **able to manage multiple hypervisors and scale hundreds of physical servers, thousands of desktops and dozens of virtualization management instances**.

Virtualization management product selection considerations

2. Open and extendable architecture.

Given the growing diversity of virtualization products on the market, a virtualization management tool **must provide support for multiple vendors and technologies.** This includes major hypervisors, connection brokers, OSes and application deployment offerings.

The **product must have interfaces that allow easy integration** into customers' existing management ecosystems, and should provide a common interface and set of processes for managing physical and virtual infrastructure.

The product should also include **open interfaces** for integrating with major enterprise software systems, such as configuration management databases (CMDBs) and other IT management packages.

Virtualization management product selection considerations

3. Powerful, flexible workflow.

The virtualization management offering must be **policy driven and provide workflows** that can be extended and customized to fit an end user's needs.

The workflow engine should be able to **automate the execution of manual, repetitive tasks** that are required to provision and manage a virtual infrastructure.

Virtualization management product selection considerations

4. Ease of use and administration.

The management technology should provide users with a **self-service portal** to provision and manage their own virtual servers and provide administrators with a visual dashboard and array of reporting capabilities.

The tool should also **offer a set of pre-defined, out-of-the-box templates and workflows**.

New full stack monitoring capabilities in Azure Monitor