Intro

January 9, 2023 8:26 AM

ESXi + vCenter from vSphere (Vmware)

Hyper-V + SCVMM (Microsoft)

https://www.linkedin.com/learning/ - good resource for everything on COMP 1300

Intro to Virtualization

January 9, 2023 8:55 AM

Hardware Abstraction:

- between hardware and software
- hides differences in hardware so kernal doesnt need to be changed

Hypervisor = HAL++:
Host - physical machine
Guest - virtual machine

Virtualization vs Simulator/Emulator:

Virtualization - logical computer running on physical computer (act like a normal computer)

Simulation/Emulator - imitation of actual process, hardware/software that enables one device (host) to behave like another (client)

Type 1 (bare metal):
hypervisor runs without underlying OS

{
multiple OS's
hypervisor
hardware
}

Type 2:
application that requires a host OS

{
multiple OS's
hypervisor
OS kernal
hardware abstraction layer (HAL)
hardware
}

Why use Virtualization?

- only have 1 physical server to worry about
- way faster to do stuff (gold images and whatnot)
- training is realistic and way cheaper (cant break anything)
- testing/sandbox
- safety/security

Nested Virtualization:

"Virtualize Intel VT-x/EPT or AMD-V/RVI" enable for hyper-v or ESXi (makes nesting work)

Intro to virtualization and vSphere

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Physical Data Center:
- lame as hell, hard to maintain/administer

Virtual Infrastructure:
- dope as hell, easier to maintain/administer (all your servers are on one guy)
- gives a pool of resources that you can manage virtually rather than just having what you have

Benefits of using VMs
- easy to move - just copy the file bro
- easy to manage - how is hardware gonna fail if it aint even there in the first place?

intro to VMware vSphere:
- suite of software for virtualization
    - ESXi, vCenter Server

Hypervisor Function:
abstracts the host PC's resources and allows them to be allocated to multiple VMs

ESXi:
- high security
- small disk footprint
- installable on basically anything (usb drive even)

You can manage ESXi hosts directly or from a vCenter Server (or CLI)
You can also move VMs from VMware to ESXi

intro to vCenter Server - and demo instructions

January 24, 2023 10:06 AM

use vCSA to install vCenter - through a VM, doesnt need to run on top of windows server
- runs on photon os (linux fork)
- supports external oracle database
- supports AD integrated authentication

max of 2000 hosts per vCenter server

make sure DNS is setup and working, and there is an A record and pointer record for your ESXi server

login - https://(ip-address) or FQDN/

ESXi host license and vCenter server licenses are different, in PROJ 1000 ask for a vCenter server license (ESXi already licensed)

NTP - important to have everything synced up for PROJ, not super important in this class

folders can be made with different permissions like in windows on vCenter server

- add ESXi hosts under a data center, folder, or a cluster

demo start:

ESXi - setup a DC (in a vm)
- ctrl alt del > actions, ctrl alt del
- setup ad ds and DNS
    - make a new reverse lookup zone
    - make a new DNS A record - "vcsa"
    - install chrome/firefox on DC (cant use browser on host pc)

make sure hostname and IPs are right for ESXi

on sharepoint: course materials ISOs vcenter_7 (download the OVA)

ESXi2 :
- new VM "vcsa"
- upload OVA from sharepoint
- deployment options - use VM Network to install vCenter
    - TINY vCENTER
    - thin provisioning
    - power on automatically : uncheck

important dont skip
- additional settings:
- host network IP address family - "ipv4"
- host network mode - "static"
- host network ip address - "192.168.91.50"
- host network prefix - "24"
- host network default gateway - "192.168.91.2"
- host network dns server - "192.168.91.10"
- host network identity - " vcsa.comp1300.local"

- sso (single sign on) config:
- "P@ssw0rd"

- system config:
- "P@ssw0rd"

- misc:
- CEIP enabled - make sure its unchecked

- networking properties:
- domain name - comp1300.local
- domain search path - comp1300.local

warning, then finish > patience
MINIMUM RAM IS GOING TO BE 12GB, DO NOT REDUCE

power on: patience (bless up) let it sit for like 20 mins please god

go to website on DC > "https://vcsa.comp1300.local:5480" (IP NOT WORK, MAKE DNS GOOD!!!!!!!!!!!!!)
- setup
- root , P@ssw0rd
- make sure the settings are the same as we set before > save
- SSO config - this makes a single sign on domain for vCenter
- single sign-on domain name - "vsphere.local"
- password - "P@ssw0rd"
- only 1 vcenter server
- UNCHECK join vmware thing
- finish

it will then load, if it is taking a long time on a percentage, refresh the browser
now suffer :)
it will load !

vcenter server is gonna look different now !!!
"https://vcsa.comp1300.local:5480" is now vCenter management (ip address works now)
administrator@vsphere.local
P@ssw0rd


for PROJ 1000 - we need vSphere 6.5 (cant use 7 :(!)

Adding Host:
right click the vcsa.comp1300.local > add vm
- IP address of ESXi server
- username - root
- password - P@ssw0rd
- yes i want to connect
- license 😵 (dont do it)
- lockdown mode: disabled
- finish :)

you should be able to manage the VMs that are on the ESXi servers through vCenter as well as the ESXi servers themselves

user sign in

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to let a user sign in with AD DS credentials:

- menu > administration > single sign on > configuration > active directory domain
- join AD - domain: comp1300.local | organization unit (for admin account being in OU) | username: firstnameAdmin(bestpractice) | password: P@ssw0rd
- gotta restart vCenter :/ (do it from ESXi menu, then hit restart :)
- still gotta sign in with administrator@vsphere.local account
- add identity source > use machine account
- ~~right click on 'vcsa.comp1300.local' > add permission >~~ menu > administration > global permissions > plus > make sure is domain comp1300.local > firstnameAdmin as administrator > CHECK PROPOGATE TO CHILDREN (inheritance)
- firstnameAdmin@comp1300.local P@ssw0rd for new login!
- logging in with DC01 > caches user (must have signed in before hand)

Intro to Storage for Virtualization

January 31, 2023 10:09 AM

Direct Attached Storage (DAS)
- block level internal storage installed within ESXi
- Block level external storage connected to ESXi host by dedicated cable
    - SAS (serial attached SCSI)
- local storage does not support sharing between multiple hosts

Storage Area Networks (NAS)
- block level external storage connected to the ESXi host by network (fibre channel [FC], or fibre channel over ethernet [FCoE])
- block level external storage connected to the ESXi host by IP network (iSCSI)
- Shared storage is necessary for disaster recovery, high availability, and moving VMs between hosts (for us)

Network Attached Storage (NAS)
- file level external storage connected to the ESXi host by IP (NFS- Network File System)

Datastore - logical storage unit that can use disk space on one or more physical devices
- Vmware vSphere VMFS
- NFS
- used to hold VM files, templates, and ISOs

VMFS:
- allows concurrent access to shared storage
- dynamically expandable
- on-disk, block-level locking

use VMFS datastores whenever possible:
- optimized for storing and accessing large files
- max volume size of 64TB
- can be created on DAS, FC, FCoE, and iSCSI

demo again bro please why

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- add 120 gb drives to your ESXi01
- turn dc on again, might have to restart vCenter server

go to storage > datastores:
- wanna expand the size of the disk?
- click increase capacity of datastore, > expand datastore (2nd guy)

if drives dont show up....
- storage > devices > should show the drives ? > expand storage drive, add the whole drive and shit
- if that doesnt work gg restart esxi and add drives again loser

could also create a new datastore > this will see the disks maybe ?????????????? god i dont know

^^^^ all from inside of ESXi ^^^^

now we on vcenter >:)
- make sure the names of your datastores are good, otherwise youre gonna be sorry mister
- select a datastore > actions > increase datastore capacity --- vcenter wont let you do this because it would be reaaaal bad if you could
- however, you can create new datastores from scratch !
- storage > new datastore > wizard and shit

just use the lab - stopped paying attention

shared storage for virtualization

February 6, 2023 8:08 AM

shared storage:
- disaster recovery (required)
- high availability (required)
- moving VMs between hosts

iSCSI target must be configured with storage that it will provide to iSCSI initiators (ESXi hosts)

iSCSI target:
- install disks and configure RAID (optional)
- create block disk based on above
- create iSCSI target (IQN)
- create iSCSI Logical Unit Number (LUN)
- create iSCSI Access Control List (ACL)

using the ESXi web interface or vCenter:
- add iSCSI software adapter in storage adapters page
- add iSCSI target dynamically by specifying the IP address
- create a new datastore on the iSCSI target

★ iSCSI server is first to start and last to stop

in vSphere Client (192.168.91.50)
- click on ESXi server
- ~~datastores~~
- storage adapters (in configure - yes)
- add iSCSI storage adapter
- select > properties > edit > iqn.1998-01.com.vmware:esxi01
- do it for both guys

- dynamic discovery
- enter the IP address of your iSCSI server (192.168.91.200) (port 3260)

- setup the datastore AFTER you setup iSCSI

virtual networks and vmotion (standard)

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virtual switch connections:
- VM port groups for VM traffic (data)
- Vmkernal ports for: management, ip storage, vsphere vmotion migration, vsphere fault tolerance, vsan, and vsphere replication

multiple networks can exist on the same virtual switch at the same time
same network can also exist on separate virtual switches

- provides connections for VMs to communicate with other devices (same host, different host, or physical)

configuration:
vsphere web client > esxi server > configure > networking > virtual switches

VLAN support:
- ESXi supports 802.1Q VLAN tagging
- ESXi provides VLAN support by giving a VLAN ID to a **port group**
- (could also use virtual guest tagging or external tagging)

Network Policies:
- security
- traffic-shaping (setting priority)
- NIC teaming and failover

policies defined at levels:
- standard switch level:
  default policies for all ports on the standard switch
- port group level:
  effective policies: policies defined at this level override default policies that are set at standard switch level

security policies:
promiscuous mode - allows virtual switch or port group to forward all traffic (regardless of destination)
MAC Address changes - accept or reject **inbound** traffic when the MAC address is altered by guest
Forged Transmits - accept or reject **outbound** traffic when the MAC is altered by the guest

traffic shaping policies:
- uses average bandwidth, peak bandwidth and burst size to determine.
- disabled by default
- parameters apply to each virtual NIC in standard switch
- on a standard switch, traffic shaping controls only **outbound** traffic

NIC teaming and failover:
- originating virtual port ID
- source MAC hash
- source and destination IP hash

detecting network failure:
- VMkernel can use link status or beaconing, or both, to detect network Failure
- detected by VMkernel via monitoring of link state and performs beacon probing
- VMkernel notifies physical switches of changes in the physical location of MAC address

failover:
- VMkernel, can use either
  - failback - physical adapter is returned to active duty after recovering from failure
  - load-balancing option: use explicit failover order, always use the vmnic uplink at the top of active adapter list

Migrating VMs
- cold: migrate a powered-off VM to a new host or datastore
- suspended: migrate a suspended VM to new host or datastore
- **vSphere vMotion: Migrate a powered-on VM to a new host.**
- vSphere Storage vMotion: migrate a powered-on VMs files to a new datastore
- shared-nothing vSphere vMotion: migrate a powered-on VM to a new host and a new datastore simultaneously

vSphere vMotion benefits:
- improves overall hardware use
- continuous VM operation while accommodating scheduled hardware downtime
- vSphere DRS balancing VM across hosts

vMotion Migration workflow:
- source and destination hosts have access to a shared datastore with all the VMs files, only the memory is migrated

host requirements - source and destination hosts
- accessibility to all storage that is used by VM
- at least a 1 gigabit ethernet network
- compatible CPUs

EVC for vSphere vMotion:
- cluster feature that prevents vSphere vMotion migration from failing because of incompatible CPUs

EVC cluster requirements- all hosts in cluster need
- CPU from single vendor, either intel or AMD
- be enabled for hardware virtualization - AMD-V or intel VT
- enabled execution-disable technology: AMD No eXecute (NX) or intel eXecute Disable (XD)
- be configured for vSphere vMotion migration

shared-nothing vMotion
- enables virtual machine to change its host, datastore, networks, and vCenter Server instances simultaneously, even if the two hosts do not have a shared storage.
- combines vSphere vMotion and vSphere storage vMotion into a single operation

Distributed Switching (part 2 of virtual networks)

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types of virtual switches:

- standard switches - virtual switches for a single host

- distributed switches - centralized management and monitoring of the networking config for all hosts
    - they work with live migration too

(not available vsphere standard edition)

distributed switching has private vlans and standard switching doesn't

- can set configurations at the port level

traffic-shaping policy - setting traffic priority (want gaming > school for example)

- disabled by default
- apply to each NIC in the group or individually
- set for inbound and outbound traffic

NIC teaming - adds failover for redundancy in an ESXi server

- includes load balancing

VLANs - distributed switches allow for private VLANs

- private VLANs allow further segmentation of logical broadcast domain into smaller broadcast subdomains

Users and groups | Import and Export

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User Management

authentication and authorization govern access

vCenter SSO (single sign on) supports authentication which means it allows user access to vSphere components

each user must be authorized to view or manipulate vSphere objects

initial sign on is through vCenter SSO domain (administrator@vsphere.local)

- add identity source > which users and groups are defined to vCenter SSO
- give privs to a user or group by selecting an object and assign a role for the user or group

Import and Export

- import through Open Virtual Format (OVF)
- export into .OVF files
- Open Virtual Appliance (OVA) - works in vSphere versions older than 6.5

Exporting an OVF template:

- vm > actions > template> export OVF template (MAKE SURE VM IS TURNED OFF)
- enter in name and or description

Deploying an OVF template:

- right click server > right click > deploy OVF template
- select OVF template
- name and folder, unique name, easy

Master Guide Page VMWare

March 6, 2023 8:03 PM

ESXi DCUI

- hostname

configure network (f2)
DNS configuration > "use the following DNS server addresses and hostname" (space bar)
set IP of DNS server, and FULL hostname (ESXi.ist.com)

- setting management NIC

configure network (f2)
Network Adapters > any NIC with and x next to it is enabled for management (space bar)

- setting IP address

configure network (f2)
IPv4 Configuration > "set static IPv4 address and network configuration (space bar)
set IP, subnet mask, default gateway

- ping test

(f2) > test management network
put IPs you want to try and hostname to check for DNS

ESXi Web Interface

- getting to it

go into browser of VM that has connectivity to ESXi server
type IP into browser > 10.1.1.10 (ex)
root | P@ssw0rd

- changing NTP server

under host, manage tab > system > time & date
edit NTP settings > use network time protocol radio button
start and stop with host | add NTP server (time1.srv.ualberta.ca) > save

- monitoring & logs

monitoring | click on the monitoring tab > performance
logs | monitor tab > logs > generate support bundle

- showing licensing

manage tab > licensing

- setting DNS servers

networking tab (left side) > TCP/IP stacks > Default TCP/IP stack
edit settings, configure to liking

- making a datastore

storage tab (left side) > new datastore > create new VMFS datastore
select storage device and name of datastore (ESXi01local200GB)

- transferring ISOs to datastore

storage tab (left side) > select datastore
datastore browser > (either create directory or just upload)

*this will pull files from your adminWS that you are using to connect to the web client
put ISO in and let it upload

- creating a VM

Virtual Machines tab (left side) > Create/Register a VM

- either do this from a new VM (using ISO we uploaded) or deploying a VM (OVF or OVA file)

name of VM | Compatibility | OS > select datastore to put VM on
configure VM settings here (make sure to put the right ISO in at this point)

- creating and configuring accounts

creating a user
manage tab > security & users > users
add user > username | description | password

assigning permissions
right click host (top left) > permissions
add user > select created user | select pre-set role (or select the boxes below)
(propagate to children is important to be able to access things inside of ESXi, without it you will be able to only see ESXi monitor / manage)
you should be able to sign in with this account now with proper permissions

Hyper-V intro

March 13, 2023 8:08 AM

You can install Hyper-V on:

- windows server, add it as a role

- standard edition: two VMs with each windows server OS
- datacenter edition: unlimited VMs with each windows server OS

- Hyper-V Server ("BareMetal" install)

- only Hyper-V role
- command-line management only (if locally managed)
- free, VMs must be licensed separately

- 64-bit client OS since windows 8

- doesn't include server-level features like high availability or live migration

Should haves:

- Hyper-V host should have multiple NICs

- dedicated NIC for Hyper-V management
- At least one NIC for virtual machine networks
- Two NICs for shared storage
- dedicated NIC for failover clustering (private network)
- at least one NIC for live migration
- the links speed must support the expected traffic

How to install Hyper-V

- installed as a server role (restart required)
- hypervisor is added and starts automatically
- windows server is moved into "parent partition"
- adds a bunch of new stuff

ctrl+alt+left arrow to release mouse by default

NUMA:

- enables hosts to scale up CPUs and memory
- Partitions CPUs and memory into NUMA nodes
- allocation and latency depends on relative CPU location

Hyper-V lets NUMA happen at VM level

- physical and virtual NUMA will align by default

remote desktop over VMBus

- meaning that you can connect to a VM without network connectivity
- devices can be redirected,
- copy and paste works
- RDS works :) (just RDP into the name of the VM)

vSwitches

- external - connects to a physical adapter
- internal - parent and vm connections only

- private - vm connections only

configuration of vSwitches:
- Virtual Switch manager to create vSwitches
- vm settings to connect a virtual network adapter to switch

Gen 1 VMs
- VM has virtual hardware devices
- only things that support Hyper-V can be used
- virtual hardware can be:

- emulated - available during boot
- synthetic - available in supported OS
- SR-IOV - available in supported OS

Gen 2 VMs
- emulated devices are removed
- EUFI firmware instead of BIOS
- can run side by side with Gen 1 (must be used for legacy systems)
- supports windows 2012 or newer

on setup there aren't many settings
after install there are many !

integration services: literally VMWare tools but for Hyper-V

checkpoints (snapshots):
- checkpoints cannot be modified, only viewed, applied, exported, renamed, or deleted.
- have:

- configuration file (.xml)
- saved state file (.vsv)
- memory content (.bin)
- differencing disks (.avhd)

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Dynamic Memory

Startup RAM - ram assigned to vm during startup

Minimum RAM - minimum amount of RAM that the host will try to assign to a VM. Hyper-V can reallocate RAM away from VMs until minimum RAM value is met

Maximum RAM - max amount of RAM that the host provides a VM

Memory Buffer - the % of memory that Hyper-V should allocate to the VM as a buffer in case the VM demands for more memory

Memory Weight - priority set for this VM compared to other VMs

CPU Settings

Virtual machine reserve % - amount of CPU's power reserved for this VM, and therefore always available.

Virtual machine limit % - maximum amount of processor power that the VM can use. In times of CPU contention, the VM may not get a full 100%.

Relative Weight - when there contention for your CPU resources, the weight value determines the importance of a VM getting shares of CPU time. VM with a weight of 200 would get twice as many CPU cycles as a VM with a weight of 100.

Virtual Hard Drives

Fixed Size - creates a file that is a solid size of drive, wont change
Dynamically Expanding - created small, expands as it data is changed
Differencing - linked clone

Clustering and Live Migration

March 20, 2023 8:11 AM

IT Needs:
- always on and always available
- no single point of failure for business critical infrastructure
- redundancy - if a host (or node) fails, another host can pickup its job

Windows Failover Clustering
- a group of nodes (hosts) that work together as a single logical unit
- connected together via physical means as well as via software or at application layer
- if one or more node fails, another node in the cluster picks up the application, service, or role of the failed node

How does it work?
- constant queries the failover nodes to ensure they are healthy, alive, and working properly
- also called a "heartbeat"

Prerequisites and Requirements
- same version of windows server for all failover cluster nodes (not absolutely necessary but try to keep it the same)
- servers with the same or similar hardware configurations
- shared storage, via SAN with iSCSI and NFS targets

Quorum
- the number of failures that a cluster can support in order to keep working
- once the threshold is reached, the cluster stops working

- if you have two nodes, and one goes down, then comes back up later (assuming you don't have quorum setup) it can be reallllly bad
- causes "split-brain" - this can cause data corruption
- a quorum doesn't let this happen

Best practice is to use 3 nodes in a failover cluster (that way if one fails it's still working)

Hyper-V Live Migration
- windows failover clustering to live migrate VMs in Hyper-V
requirements for Hyper-V live migration without failover clustering:
- hosts have to be the same operating system
- both the source and destination servers must be in same domain
- source and destination Hyper-V hosts must be connected by a reliable network

Exploring Other Options (in Hyper-V)

March 28, 2023 10:10 AM

Creating VMs with an existing VHD File:
- create new VM wizard
- select "use an existing virtual disk"

why import/export vms?
- if you want to transfer a vm that is not a part of your cluster

Hyper-V Export
- you can take a vm out, comes with all data and settings
- you can use it to archive a VM too or make it an AD-HOC backup

Hyper-V Import
- allows you to recover VMs which were exported

Backing Up and Restoring VMs
- back em all up
- use a third party software in the real world (veeam, altaro)

- windows server backup will **not** backup VMs in a **cluster environment**

SCVMM Networking

April 11, 2023 10:11 AM

- it is more complex than the Hyper-V V-Switch manager

Logical Network - like VLANS
- things like: Corporate network, network management, testing, etc.

Network Sites - like SITES - different physical locations (or subnets)
- these sites allow SCVMM to assign the correct IP addresses (if using DHCP)
- can use IP address pools for DHCP

VM Networks - like VMNETS
- can have them setup to a network adapter for outside access or just internally.
- need to set which logical network and site in SCVMM

Uplink Port Profile - connectivity of virtual switch to the logical networks
- used for setting up QOS (quality of service - prioritizing some packets rather than others)

exam

April 11, 2023 10:41 AM

windows 22 server - call it **YOURFIRSTNAMEHV01**
8gb of ram
NIC on NAT

C:\ISO directory > put tiny 10 ISO in there

C:\Examfiles\VHDs
C:\Examfiles\VMs
C:\Examfiles\Export

checkpoints:
- snapshots
- right click vm and click checkpoint
- to go back, right click the checkpoint and click apply

creating a vm from an existing VHD:
- when going through creation wizard store on local drive (should only be this one)
- make sure **use an existing hard disk** option is selected and that you point it to the VHD

exporting / importing vms:
exporting:
- right click created vm and click export
- send it to C:\Examfiles\Export

you can now delete your vm

importing:
- click the "import virtual machine..." option on right side
- find the VM
- start it up ! its working!

backup and restoring vms:
backup:
- add another drive then bring it up (call it backup)
- install windows server backup feature on the Hyper-V Server
- open up windows backup
- click "backup once" on right side (WHILE VM IS RUNNING)

- different options
- custom
- add items
- expand hyper-v and select the VM
- select local drives then click on backup

can now delete the VM

restoring:
- windows server backup - **recover** on right side

- this server
- pick the date of the backup
- hyper-v
- select the VM
- recover to original location
- recover

vm should be working again

performance monitoring VMs

- open up performance monitor on Hyper-V server
- under monitoring tools > performance monitor - **hit the plus sign**
- these are all the different counters to track stuff
- Hyper-V has its own set of network monitoring things