IT 341 Introduction to System Administration

Project I – Installing Ubuntu Server on a Virtual Machine

Here we create a new virtual machine and install **Ubuntu 20.04 LTS Server** on it.

- In this instance, we follow most of the defaults, meaning that the virtual network spoofs the identity of your server to be that of the host (the real) computer. This is how most home networks work.
- A router attached to the internet service provider (ISP) uses Network Address
 Translation to fool the ISP into thinking all of the computers on your local network are actually just one, by
 - o rewriting packets going out via the router with a single (spoofed) MAC address
 - keeping track of this in a table
 - o using this table when packets come back from the ISP
 - to rewrite the destination MAC addresses
 - for the local computers the packets are really meant for.
- In the next project, we will change this configuration -- considerably!

Please read instructions in full before proceeding!

- Decide which team will be first to create a VM. <u>One</u> member from <u>that</u> team should log into your physical host (<u>it2x</u>, where x = 1-8), using your Windows login.
 - This step assumes you have your Linux account <u>AND</u> your Windows login.
 - If you do not have a Windows login, then please notify your professor.
- 2. Check the *<u>Ethernet outlets</u>* next to your host:
 - If the CAT5 cable is plugged into the <u>top-side</u> CAT5 outlet associated with your host then the computer is connected to it20 on the IT Lab LAN, an Ubuntu server that acts as a router for the network <u>it.cs.umb.edu</u>
 - If the CAT5 cable is plugged into the <u>bottom-side</u>) CAT5 outlet the computer is another network, which is not as relevant to our purposes.
 If in doubt about this, <u>ask me</u>, and I can check your Ethernet connection for you!.
- 3. We want to install a virtual machine running **Ubuntu 20.04 LTS** Server. Fortunately, we have **ISO** images on our computers, so it will not be necessary to download them.

We begin by starting up <u>VMWare Workstation</u>. Use the <u>Start Menu</u>, or there may be a shortcut for this on the desktop. (*If you are unable to get VMWare Workstation working, then please see me.*)

At this point, you will almost certainly be sharing the physical machine with at least one other team, if not more. Each team must create a VM, but while one team is creating a VM, the other team(s) should sit and watch, as preparation for creating their own.

- 4. Create a new Virtual Machine.
 - Click Create a New Virtual Machine or File > New Virtual Machine



• Make sure the radio button for **Typical** is highlighted, and then click the **Next >** button.



- 5. Now we have a choice. We can either let the installation proceed on its own after giving a few parameters – which is suitable if you've installed Ubuntu before – or we can install Ubuntu step-by-step. We will do the latter, which is suitable if you...
 - are installing Ubuntu for the first time
 - or just want to refresh your memory.

Here, we will first create a VM and then (later) install Ubuntu, proceeding step by step...

i. Choose I will install the operating system later. Then, click Next.

 Browse
isk.
> Cancel
1

ii. For a Guest Operating System, choose *Linux*. For a Version, choose *Ubuntu 64-*

	New Virtual Machine Wizard	×	Other				
	Select a Guest Operating System		Version		Guest operating system		
	Which operating system will be installed on this virtual machine?		Ubuntu 64-bit	~	O Microsoft Windows		Connect to
			Red Hat Enterprise Linux 5	^	(e) Linux	/Mn	Aware vClou
	Guest operating system		Red Hat Enterprise Linux 5 64-bit Red Hat Enterprise Linux 4				
ew	Microsoft Windows	C	Red Hat Enterprise Linux 4 64-bit		VMware ESX		
nine	@ Linux	MW	Red Hat Enterprise Linux 3		Other		
	Novell NetWare		Red Hat Enterprise Linux 2		*		
	Osolaris		Red Hat Linux		Version		
	O VMware ESX		SUSE Linux Enterprise 12 64-bit		Ubuntu 64-bit	~	
	Other		SUSE Linux Enterprise 11	1000			
	Version	-	SUSE Linux Enterprise 11 64-bit SUSE Linux Enterprise 10				
	Ubantu 64-bit	8	SUSE Linux Enterprise 7/8/9				
		2	SUSE Linux Enterprise 7/8/9 64-bit				
			SUSE Linux 64-bit				
			Turbolinux		Units of Back Hards	Cineral	
			Turbolinux 64-bit		nep back mea	Canoer	
			Ubuntu Ubuntu 64-100			_	
			VMware Photon 64-bit				

- iii. Now, for a virtual machine name, we want (instead of the default "Ubuntu") a name that is meaningful to our network. Use your *team name*, based upon:
 - The name of your host: it2x, where x = 1-8
 - Your *section number* (or that number plus two)
 - Your <u>group ID</u>: <u>a</u> or <u>b</u>
 - For example, if you are sitting at host <u>it28</u>, in <u>section 4</u> and <u>group b</u>, then use the name *itvm28-4b*

	WORKSTATION 12	, Dac	C		
	Name the Virtual Machine What name would you like to use for this virtual machine?	/	0		Virtual machine name:
ew nine	Virtual machine name:		Connect to /Mware vCloud Air	3	itvm28-4b
	E:\FrodoHackins\Documents\Virtual Machines\Ubuntu 64-bit The default location can be changed at Edit > Preferences.	Browse		e	

- iv. There exists a subdirectory of <u>c:/IT341</u> with the name "<u>sectionyz</u>" where <u>y</u> is your section number (or plus two) and **z** is your group ID.
 - For example, if your team name is "<u>itvm28-4b</u>, then your VM will be in the directory C:/IT341/section4b of machine it28

- If this directory does not already exist, then I will need to create it for you...
- The location where the virtual machine image will be stored is in the directory
 C:/IT341/sectionyz
 so browse to that location, and hit the OK button,
 followed by the <u>Next</u> button.
- You may get a prompt about the location containing another virtual machine.
 As long as you are following directions for naming your machine, this will not be a problem so click the continue button.



 v. Go along with the default disk size and "<u>Split virtual</u> <u>disk into multiple files</u>". <u>20 GB</u> should be more than sufficient. Choose <u>Next</u>.

Specify Disk Capacity How large do you want this disk to be?	How large do you want this disk to be?
The vertual machine's hard disk is stored as one or more files on the hor compares physical disk. These fin(c) start small and become larger as you ad applications, files, and data by your vertual machine. Machinem disk size (GB):	The visital machine's hard data is strend as one or more files on the computer's sylveral disk. Therefold start small and become large you all digiplications, files, and data to your visual machine. Maximum disk star (GB): 21 😨
Store virtual disk as a single file Split virtual disk into multiple files Splitting the disk makes it easier to move the virtual machine to anot computer but may reduce performance with very large disks.	Store virtual diok as a single file State virtual diok into multiple files State based of a dia social case to more the virtual machine to computer but may reader and formance with very large diaks.
Help < Back Next C	Help < Back Next >

vi. We needn't customize any hardware. If we want to later, it is very easy, as long as our virtual machine has been *shut down*. Click **Finish**.

/

- vii. Now, under <u>Devices</u>, you will see that the <u>CD/DVD</u> drive has the value "<u>Auto detect</u>". We want to change this temporarily, so:
 - **A.** Double-click on <u>CD/DVD</u>. This will bring us to a panel where we can (temporarily) change the association so that we can install Ubuntu Server from an <u>Iso</u> image.



B. Choose **Use ISO image** ; and then browse to (from File System)

(NOTE: The exact file path may differ from what you see here!)

<u>C:\OS ISOs\Linux\Ubuntu\LTS\Server\ubuntu-20.04.1-live-server-amd64.iso</u>

Make sure you have "20.04"! If in doubt, ask me!

		Security				
		e Settings or ISO Image				
		pr ISO Image 👘 🚺 > This PC > OS (C) > OS_ISOS	> V Search			
tings		× • ↑ ♥ → This PC → OS (C) → New folder	New folder			
		New folder Name	Date modified Type			
Summary 1 G 1 C 2 C G 3 Attr 2 C G 4 Attr 4 Attr 6 detect Present Auto 6 detect Present Auto 6 detect	Device status Connected Connected Gonection Use physical drive: Auto detect Cr.(05_3504(Jinux)/Jbantu/Server/u ~ Browge Advanced	C) Name Date mode sydie.Bin kcycle.Bin 3/24/2015 til/Msi unfig.Msi 1/2/27/201 cuments and scuments and 9 Documents and Settings 2/10/2016 41 17341 1/5/2018 MinGW 4/6/2017 IGN PC 3/JOS 0 Ridin PC 2/9/2018 3/JOS 0 Sci toos 1/5/2018 inxx Pred Date created: 1/5/2018.354.AM 1/2/2020 Ubuntu Pred for M8 1/2/26/201 Dututu Pred for M8 1/2/26/201 Dututu Pred for M8 1/2/26/201	1/5/2018 3:54 AM File f			
age		ual Machine Settings				
> This PC > OS (C:) > OS	JSOS > Linux > V O Search Lin	Browse for ISO Image SO Image				
v folder Name	Date modified Type	← → ✓ ↑ 🖡 > This PC > OS (C) > OS ISOS > Linux > Libuntu > → 🖒 🕴 ← OS (C) > OS ISOS > Linux > U Organize ★ New folder New folder	Ibuntu > Server V D Search Se			
an		ConfigNet SRecycle.Bin Srecycle.Bin Srecycle.Bin Srecycle.Bin Srecycle.Bin Srecycle.Bin Sorer Dote created: 1/5/2018.355 AM Scece.667 MB Scece.67 MB S	Date modified Type ver-amd64.iso 8/15/2016 7:20 PM Disc Ima			

C. Once <u>ubuntu-20.04.1-live-server-amd64.iso</u> is highlighted, choose <u>Open</u>, and then <u>OK</u>.

						Connected Connect at power on	and the second se
rtual Machine Settings			×			Connection	and the second se
Browse for ISO Image						O Use physical drive:	
← → ~ ↑ ■ « 0	OS (C:) > OS_ISOs > Linux > Ubuntu > Server	~ U	Search Server	۶		Auto detect	
Organize • New fold	der]≘ •			Use ISO image hile: C:\05_ISOs\Linux\Ubuntu\Server\u \ Browse	
📞 OS (C:)	Name	Date modified	Туре	Size			If the ISO image is in
SRecycle.Bin Config.Msi	ubuntu-18.04.1.0-live-server-amd64.iso	8/15/2016 7:20 PM	Disc Image File	683,008 1		Advances	different location than
Documents and							specified here then
MinGW							you will need to look
ORIGIN PC							you will need to look
Linux							there, instead.
Ubuntu							
Desktop		L.					
Server	<						
File na	ame:		D-ROM images (*.i:	io) ~	move		
			Open	Cancel		Cancel Help	
1			1				

D. Now, our (virtual) CD/DVD reader is associated with the <u>ISO</u> image for Ubuntu Server, so we can now install the OS on our VMs. Next, make a note of your VM's current memory, likely at <u>4 GB</u>.

🖬 Steps Recorder - Recording Now 🛛 👘 📉 🔀			
🕕 Payse Record 🝳 Stop Record 📑 Add Comment 🔞 👻 😰 😩 📗 🔚 🧮	64 GB -		
Home × Ditvm28-4b ×	32 GB -		
itym28-4b	16 GB - 🔫		
Power on Min side of machine	8 GB -	Maximum recommended r	
Edit virtual machine settings	4 GB -	(Memory swapping may	
- Devices	2 GB - 🔫	occur beyond this size.)	
Memory 1 GB	1 GB -	13.5 GB	
Processors 1 Ard Disk (SCSI) 20 GB	512 MB -	Recommended memory	

i. Your VM should have only 2 processors right now. Click on <u>Processors</u>, and increase processors to <u>4</u>, and do not worry about cores. Click <u>OK</u>.

Home × El itvm28-4b ×	Number of processors: 4	\sim
ItVm28-4D Rower on this virtual machine Edit virtual machine seti-das Devices Memory 1 GB Processors 1 Hard Disk (SCS) 20 GB	Number of cores per processor: 1 Jx\ Total processor cores: 4 Virtualization engine Virtualize Intel VT-v/EPT or AMD-V/RD	~ VЛ
Choose <i>Power on</i>	■ Steps Recorder - Recording Now - C ×	
this virtual machine	Braue Record Step Record Add Comment D D	
	itvm28-4b	
You will be led,	Power on this virtual machine GI Edit virtual machine set-	
You will be led, step-by-step,	Power on this virtual machine Control of the set of th	
You will be led, step-by-step, through the	Prover on this virtual machine Devices Memory 1 GB Processors 1 Hard Disk (CSS) 20 GB O(DMN) (SAD), Memorial EG (SAD), 1	

 \checkmark

- iii. To give control of your keyboard and mouse over to the virtual machine, click on its screen. (Whenever you want to give control back to your host, press <u>Ctrl-</u>
 <u>Alt</u>. A reminder of this simple sequence is on the lower-left corner of your VMware Workstation window.)
- iv. For a Language, choose English vii. If you see ens33 and eth for NAME and and hit Enter. TYPE, arrow to "Done" and hit Enter. Willkommen!Bienvenue!Welcom/! Доб Configure at least one interface this server can use and which preferably provides sufficient access for u Please choose your preferryd langua ens33 eth 192.168.40.141/24 (from dhcp) ► OUTOCT25Tad:cb:dd / Intel Corporation / 82545EM Gigabit (PRO/1000 MT Single Port Adapter) English Asturianu [Create bond ►] Català Hrvatski [Done Back Nederlands Suomi ace to configure it or select Done to c When you receive the Installer update ٧. viii. We <u>don't</u> want a proxy, so leave **Proxy** available screen, choose Continue address *blank* and hit Enter. without updating, and hit Enter. Configure proxy Installer update available If this system requires a proxy to connect Version 21.08.2 of the installer is here. currently running). Proxy address: If you need to use a HTTP enter the proxy informatio [Update to the new installer] Continue without updating Back
- vi. For "Layout" and "Variant", choose



ix. If <u>Mirror address</u> matches the below, then arrow to "Done" and hit **Enter**.



x. Use the arrow to choose "<u>Use an</u> <u>entire disk</u>" and hit <u>Enter</u>. <u>Uncheck</u> the LVM option! (*See end-of-report questions.*) Tab/choose <u>Done</u>



xi. Assuming things are in order as indicated below, arrow to "Done" and hit <u>Enter</u>. When asked to confirm, arrow to "Continue" and hit <u>Enter</u>.

Filesystem	n setup			
FILE SYSTEM SUMMAR MOUNT POINT [/	Y SIZE T 19.997G e	TYPE ext4	DEVICE TYPE partition of	: local disk ►]
AVAILABLE DEVICES	vices			Confirm destructive actio
[Create softwar [Create volume	re RAID (md) group (LVM)			Selecting Continue below will begin the instal result in the loss of data on the disks select You will not be able to return to this or a pr installation has started
USED DEVICES				Are you sure you want to continue?
DEVICE [/dev/sda [partition 1 bios_grub [partition 2	SIZE 20.000G 1.000M 19.997G	TYP loc (0%) (99%	E al disk ▶] ▶]	[No] [<u>Continue</u>]
Tornatteo	as ext4, mo	Junte	u at 7	
		/	(Rese [Back	et] s]

xii. At this point, the install will start to commence, and you will be given a "Profile setup" screen. Here, it is extremely important that you provide the correct information to define your *hostname*, admin *username*, and admin *password*. Carrying out these steps

correctly NOW saves you the trouble of having to fix mistakes later! To make it easier, remember you are using the following two pieces of (*case-sensitive*) information:

The name **sysadmin** Your team name (ex. **itvm28-4b**)

Enter the relevant information below. (**Replace itvm28-4b** with your own team name, naturally.) Then arrow to "Done" and hit **Enter**.

Profile setup
Enter the username and password (or ssh identity) you will use to log in to the system.
Your name: <mark>sysadmin</mark>
Your server's name: <mark>itvm28–4b</mark> The name it uses when it talks to other computers.
Pick a username: sysadmin
Choose a password: itvm28-4b
Confirm your password: itvm28-4b
Import SSH identity: [No ▼] You can import your SSH keys from Github or Launchpad.
Import Username:
[Done]

(Notice that your team name is serving as your hostname and as your admin password!)

In response to the following prompt, leave <u>UN-selected</u>, tab to <u>Done</u>, and press <u>Enter</u>:



xiii. We do not want to add any snaps, hit **Tab** – which should move focus directly to





xiv. Choose "Reboot Now" (*only* "Reboot Now", specifically) and hit Enter.



xv. You should click "I Finished Installing". Then, click inside your VM, so that you can

press **Enter** in response to the prompt:

L] Stopped target Local File Systems (Pre).
		Stopping Monitoring of LVM2 mirrors, snapshots etc. using dmeventd or progress polling
[] Stopped Remount Root and Kernel File Systems.
[] Stopped Create Static Device Nodes in /dev.
[] Reached target Shutdown.
		Starting Shuts down the "live" preinstalled system cleanly
[] Stopped Monitoring of LVM2 mirrors, snapshots etc. using dmeventd or progress polling.
		Stopping LVM2 metadata daemon
[] Stopped LVM2 metadata daemon.
Ple	ease	remove the installation medium, then press ENTER:

xvi. (After a wait...) The system will reboot, and your screen may look something like this:

Ubuntu 18.04.1 LTS itvm28-4b tty1 itvm28-4b login: Mounting Mount unit for core, revision 4917... [OK] Mounted Mount unit for core, revision 4917. [OK] Stopped Snappy daemon. Starting Snappy daemon... [OK] Started Snappy daemon. [OK] Started Snappy daemon. [OK] Started Wait until snapd is fully seeded. [OK] Reached target Multi-User System. [OK] Reached target Comphised Interface

Though it may not be exact. If in doubt, just ask me!

1. **Ctrl-Alt** to return focus to the host.

2. Click the icon indicated below, and choose Shut Down Guest; confirm to shutdown.



3. Double-click on <u>CD/DVD</u>. This will let us

change the association back.

 Choose <u>Use physical drive</u> and "<u>Auto</u> <u>detect</u>" for the device. Click <u>OK</u>.



5. Now we are ready to turn the virtual machine *back on*...

Choose Power on this Virtual Machine.



After your VM finishes booting, you will see:



 Log in as <u>sysadmin</u>. Remember, the password is the same as your team name, same as your VM's name.

108 updates are security updates.

The programs included with the Ubuntu system are the exact distribution terms for each program are individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the applicable law.

To run a command as administrator (user "root"), See "man sudo_root" for details.

sysadmin@itvm28-4b:~\$ _

Before you continue, enter the script command as indicated below.

This will allow you to save the output of your CLI session to a text file, with a unique file

name. You can export this file from your VM to another source, later, and have access to the material to use in your lab report.

7. Let's see if we can reach the outside. Enter the following command:

ping -c 5 www.yahoo.com

sysadmin@itum28-4b:~\$ ping -c 5 www.yahoo.com
PING atsv2-fp.wg1.b.yahoo.com (98.139.180.180) 56(84) bytes of data.
64 bytes from media-router-fp1.prod.media.vip.bf1.yahoo.com (98.139.180.180): icmp_seq=1 ttl=128 tim e=34.0 ms
64 bytes from media-router-fp1.prod.media.vip.bf1.yahoo.com (98.139.180.180): icmp_seq=2 ttl=128 tim e=33.8 ms
64 bytes from media-router-fp1.prod.media.vip.bf1.yahoo.com (98.139.180.180): icmp_seq=3 ttl=128 tim e=29.0 ms
64 bytes from media-router-fp1.prod.media.vip.bf1.yahoo.com (98.139.180.180): icmp_seq=4 ttl=128 tim e=48.5 ms
64 bytes from media-router-fp1.prod.media.vip.bf1.yahoo.com (98.139.180.180): icmp_seq=5 ttl=128 tim e=35.4 ms
atsu2-fp.ug1.b.yahoo.com ping statistics 5 packets transmitted, 5 received, 0% packet loss, time 4003ms Example Output rtt min/aug/max/mdev = 29.027/36.170/48.530/6.550 ms supadainBitum28-db:***

Be sure to record success or failure as part of your lab report's daily entries.

8. We want to install some software; but we need to do some preparatory steps. For each of the four commands below, type the command and then press **Enter**. After the first

command, you will be prompted for **sysadmin**'s password because you invoked the sudo command. Hereafter, you need not re-enter the password because it has been "cached".

Also, it's always a good idea to do an update of your catalog before these installations.

This, too, will require invoking *administrative* privileges with the **sudo** command.

sudo apt-get update

sysadmin@itvm28-4b:~\$ sudo apt-get update Hit:1 http://archive.ubuntu.com/ubuntu bionic InRelease Hit:2 http://archive.ubuntu.com/ubuntu bionic-updates InRelease Hit:3 http://archive.ubuntu.com/ubuntu bionic-backports InRelease Hit:4 http://archive.ubuntu.com/ubuntu bionic-security InRelease Get:5 http://archive.ubuntu.com/ubuntu bionic/main Translation-en [516 kB]	
Get:7 http://archive.ubuntu.com/ubuntu bionic/nestricted mansfation-en [3,584 B] Get:7 http://archive.ubuntu.com/ubuntu bionic/universe Translation-en [4,941 kB]	
Then we will do an upgrade \rightarrow sudo apt-get upgrade	
Fetched 306 kB in 2s (122 kB/s) Reading package lists Done sysadmin@itvm28-4b:~\$ sudo apt-get upgrade	
After lots of output, you are asked if you want to continue. Choose Y, or just press En	nter
uuid-runtime vim vim-common vim-runtime vim-tiny vlan wget xfsprogs zlib1g 189 upgraded, 0 newly installed, 0 to remove and 4 not upgraded. Need to get 139 MB of archives. After this operation, 129 MB of additional disk space will be used. Do you want to continue? [Y/n]_	

Much more output will follow...

(Note that this is the <u>ONLY</u> time you will run an upgrade in this course. If you feel you have a

compelling reason to run an upgrade at a later date, ask me before proceeding!)

9. Then install the ssh server \rightarrow sudo apt-get install openssh-server

MUTHING HOURS IN / GUE/ LA-LEF LITTEA LES/ UNUA LETU
done
done.
Processing triggers for resoluconf (1.78ubuntu5)
Trocessing criggers for resolveon (1.10abalicas)
$\alpha_{1} = \alpha_{1} + \alpha_{2} + \alpha_{2} + \alpha_{2} + \alpha_{3} + \alpha_{3$
Sysauminerrom20-40, 2 suud apr-yer install openssi-server

(You will want to answer Y at the prompt)

0 upgraded, 8 newly installed, 0 to remove and 4 not upgraded. Need to get 817 kB of archives. After this operation, 5,898 kB of additional disk space will be used. Do you want to continue? [Y/n]

10. Be sure you are *documenting* all of this in your lab report's daily log entries. May be

part of exam questions.

11. Now you can end your

script session and log out. exit	sysadmin@itv exit Script done sysadmin@itv	vm28–4b:~\$ <mark>exit</mark> , file is 2 <u>0190204_</u> 2320.session.tx vm28–4b:~\$ logout	t
12 At this point, you should de	two things	Shut down VM first!	

12. At this point, you should do two things:

- First, recall how we made changes to the VM's specs for Memory and Processors.
 - Referring back to the step where you made these changes, you need to change the memory back to the original amount of 4 GB.
 - You will also want to change the number of processors back to 2.
 - When we "upgraded" your VM's specs back then, it was just to speed up the installation process. Now that installation is finished, we need to "downgrade" so that your VM does not consume too many of the physical workstation's hardware resources!
- Second, you need to create your first snapshot. Ctrl-Alt to return focus to the host, and then click the first of the 3 clock icons below – the one with a plus sign.

13. In the dialog box, give your snapshot a meaningful name and a useful description. Shut down VM before taking snapshots! Then, click Take Snapshot.

itvm28-4b -	Take Snapshot X
	king a snapshot lets you preserve the state of the virtual achine so that you can return to the same state later.
<u>N</u> ame: <u>D</u> escription:	Project 1 - Complete Project #1 was completed successfully. The last task was installing the SSH server and client
	Take Spanshot Cancel
	Take Shapshot Cancel

14. You can take a Snapshot of your VM at any time, and you can have several of them, representing the VM's <u>state</u> at various points in time. In order to <u>restore</u> your VM to the state as of the *latest* snapshot, click the second clock icon:

15. You can view and manage all of your snapshots for your VM by clicking the third clock icon, which opens the **Snapshot Manager**:

5 💭 🚇				
Manage snapshots for this virtual machine				

This will give you a dialog like the following:

itvm	28-4b - Snapshot Manager	×
	Project 1 - Complete	
Snapsh	ot details	
Name:		Take Snapshot
Descrip	tion:	

Where was the snapshot saved? Figure this out and <u>write about it</u> in the indicated question below. You can change this, or you can copy it to a memory stick if you have one. Then you won't lose your work if you mess up!

FINALLY! It is imperative that you get in the habit of copying your VM files to an external memory source like a USB thumb drive. Accidental deletions of VMs DO happen, and you want to be prepared for this possibility!

Discussion Questions:

- What does <u>LTS</u> <u>stand for</u>, and what does that <u>mean</u>? Please explain.
- What is an LVM? (It stands for "logical volume manager".)
 Please explain what a logical volume is and what a logical volume manager does.
- Please explain what the sudo command is, how it is used, and why we need it.
- 4. Please explain what **apt-get** is and why we use it.
- 5. Please explain <u>what "snapshots" are</u> *and* <u>why they are useful to</u> <u>us</u>.