***Lab 1: UNIX System Administration***

CNIT 34000

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**PROCEDURES**

The procedure section below covers how to install and deploy Windows Server 2022, Ubuntu Linux, and Alma Linux as virtual machines in VSphere. For the Windows Server deploy, the procedure section covers how to install VMware Tools, as well as configure the network. For each Linux Server deploy, it covers how to add users, manage users, their directories, and their passwords, configure networking, enable disk quotas, and print over the network. All procedures were completed on minimal install versions of each Linux operating system. All screenshots of completion of procedures were implemented into Appendix A.

The formatting key of the following section will obey rules below: buttons are **bold**; options are *italicized*; text entered into the computer is in Courier New style; menu and folder navigation are shown with the pipe symbol and are *italicized*: *Start | Programs | MS Office | Word*.

**Installation of Operating Systems**

Windows VM:

1. Logged onto https://studentvc.cit.lcl
2. Right clicked the Heavilon Student Cluster and created a new virtual machine.
3. Selected the Heavilon Storage Cluster as the storage compatible with ESXi 7.0 U2 and later.
4. Selected Microsoft Windows Server 2022 (64-bit) as the OS.
5. Set the Memory to 8GB and hard disk as 80GB (thin provisioned) and set the Network as CNIT340-Windows.
6. Added a CD/DVD and navigated to *\\rtfm\windows\server\en-us\_windows-server\_version\_2022\_updated\_october\_2021\_x64\_dvd\_b6e25591.iso* and checked ‘connected on power on’.
7. Booted the VM and selected *Install | I don’t have a product key | Standard Desktop Experience |* Selected the 80GB Virtual drive.
8. Clicked *Install VMware Tools…* on vSphere to mount the file.
9. Opened File Explorer on the VM and launched Setup64 on the mount and completed the install wizard.
10. Opened *Control Panel | Network adapters | Ethernet0 | IPv4* and set the network fields as follows:  
    IP: 10.19.1.36  
    Subnet Mask: 255.255.255.0  
    Default Gateway: 10.19.1.1  
    DNS: [REDACTED]
11. Navigated to *Updates and Security*, scanned for Windows updates, and installed all available updates.
12. Checked *sync time to host operating systems* under *VM options | VMware Tools*.

Ubuntu Installation:

1. Logged onto https://studentvc.cit.lcl
2. Right clicked the Heavilon Student Cluster and created a new virtual machine.
3. Selected the Heavilon Storage Cluster as the storage compatible with ESXi 7.0 U2 and later.
4. Selected Ubuntu Linux (64-bit) as the OS and named it ‘CNIT340.GO36.Hammond.Ubuntu’
5. Set the Memory to 4GB and hard disk as 60GB (thin provisioned) and set the Network as CNIT340-BSD.
6. Added a CD/DVD and navigated to the Ubuntu Server iso from RTFM and checked *connected on power on*.
7. Selected install and used *Minimal installation* with US Keyboard.
8. Selected eth0 network connection and configured the IPv4 settings as follows:
   1. Subnet: 10.19.3.0/24
   2. Address: 10.19.3.36
   3. Gateway: 10.19.3.1
   4. Name server: [REDACTED]
   5. Search domain: c340.cit.lcl
9. Clicked *Something else* for the partitioning and used the new partition table.
10. Partitioned 1Mb bios grub, 4GB /boot, 4Gb /home, 4Gb /var, and 47.997Gb /.

Alma Linux

1. Logged onto https://studentvc.cit.lcl
2. Right clicked the Heavilon Student Cluster and created a new virtual machine.
3. Selected the Heavilon Storage Cluster as the storage compatible with ESXi 7.0 U2 and later.
4. Selected Alma Linux (64-bit) as the OS and named it ‘CNIT340.GO36.Hammond.Alma’
5. Set the Memory to 4GB and hard disk as 60GB (thin provisioned) and set the Network as CNIT340-Linux.
6. Selected ‘Network Settings’ and set the network configuration as follows:
   1. Address: 10.19.2.36
   2. Subnet: 255.255.255.0
   3. Gateway: 10.19.2.1
   4. Name Server: [REDACTED]
   5. Search Domain: c340.cit.lcl
7. Selected *Drives* and selected the one 60GB disk and selected *Standard Partition* and partitioned the drive as 2000MB /boot ext4, 600MB /boot/efi efi, 45903 MB / ext4, 6144MB swap, 4096 /home ext4, 4096 /var ext4 and clicked *done*.
8. Clicked *Done* and navigated to *User Profile Creation* and created an administrator account with a password.
9. Selected *Software Selection* and picked *Minimal Install*.
10. Clicked *Done*, *Begin Installation*, and *Reboot System*.
11. Disabled SELinux by entering sudo setenforce 0.

**VMWare Tools Installation**

1. In studentvc.cit.lcl, right clicked each VM, and added a CD drive with the correct VMWare Tools package from the rtfm iso and connected it.
2. Entered sudo apt install open-vm-tools to install VMware Tools on the Ubuntu system.
3. Entered sudo yum install open-vm-tools to install VMware Tools on the Alma system.

**User Creation**

1. Entered sudo useradd Jill and sudo useradd Jack on both of the Linux machines.
2. Created passwords for the users by typing sudo passwd Jack and sudo passwd Jill and setting passwords for them.
3. Checked if they have working home directories by typing cd ~ to go to their home directories and see if they can access them.
4. Created home directories for each user on the Ubuntu machine using sudo mkdir /home/Jack and sudo mkdir /home/Jill (See Appendix A).
5. Changed ownership of the home directories on the Ubuntu machine by using sudo chown directoryName username.
6. Changed group ownership of the directories on the Ubuntu machine by using chgrp directoryName groupName.
7. Changed permissions of the home directories by using chmod 775 directoryName
8. Entered sudo groupadd *groupname* to add groups for both of the users.
9. Entered sudo usermod -a -G groupname usernameto add both users to the created group.

**Ubuntu Software Installations**

1. Entered sudo apt update, sudo apt upgrade to update the machine on the Ubuntu Machine.
2. Typed sudo apt install iputils-ping to install the ping command
3. Entered sudo apt install nano to install the nano command on the Ubuntu Machine.
4. Checked if BASH was installed by looking at the version with bash –version.

**Alma Software Installations**

1. Entered sudo yum makecache –refresh to install quota tools.
2. Entered sudo yum update and sudo yum upgrade to update the machine on the Alma VM.
3. Entered sudo yum install nano to install the nano command on the Alma Machine.
4. Checked if BASH was installed by looking at the version with bash –version.

**Network configuration**

1. Entered sudo apt install net-tools on the Ubuntu machine.
2. Entered sudo yum install net-tools on the Alma machine.
3. Used ifconfigto check the network configurations.
4. Used ping 8.8.4.4 to ping Google’s DNS servers to check for internet connection.

**Setting disk quotas**

1. Ran vi /etc/fstab and edited the file to add defaults,usrquota,grpquota to the /home entry.
2. Remounted the home file system by running mount -o remount /home.
3. Created quota database files by entering quotacheck -cugv /home.
4. Turned on quotas by entering quotaon /home.
5. Assigned quotas per user by using edquota -u username and modified the soft and hard values to be 800Mb soft and 1Gb hard (See Appendix A).

**Password configuration (ubuntu)**

1. Used apt install libpam-pwquality to install the necessary PAM files.
2. Used sudo nano /etc/pam.d/common-passwordto modify the password configuration file.
3. Appended the following to the line including ‘pam\_pwquality.so’: minlen=8 difok=3 lcredit=-1 ucredit=-1 dcredit=-1 ocredit=-1 reject\_username enforce\_for\_root
4. Saved and closed the file (See Appendix A).
5. Tested by using su Jill to switch users.
6. Used passwdto create a new password that did not meet the requirements.

**Password configuration (Alma)**

1. Used sudo vim /etc/pam.d/system-auth to edit the PAM config file.
2. Appended the following to the line including ‘pam\_pwquality.so’: minlen=8 lcredit=-1 ucredit=-1 dcredit=-1 ocredit=-1 enforce\_for\_root
3. Saved and closed the file (See Appendix A).
4. Tested by using su Jill to switch users.
5. Used passwdto create a new password that did not meet the requirements.

**Syncing time with host OS**

1. Navigated to ‘studentvc.cit.lcl’ and selected the *VM Options* tab and checked *sync time periodically* on all three VMs.

**CUPS Configuration on the Ubuntu VM**

1. Used sudo apt-get install cups -y to install CUPS on the machine.
2. Typed sudo systemctl start cups to start the service.
3. Entered sudo systemctl enable cupsto enable the service.
4. Modified the cups config file with sudo nano /etc/cups/cupsd.conf and changed the settings as follows (See Appendix A):
   1. Changed *Browsing Off* to *Browsing On*
   2. Changed ‘Listen Localhost:631’ to *Port 631*
   3. Appended *Allow @LOCAL*
   4. Appended *AuthType Default \ Require valid-user \ Allow @LOCAL*
5. Used sudo systemctl restart cups to restart the service and apply changes.
6. Found the IP of the HEAV printer by pinging the hostname ‘[REDACTED]’
7. Added the printer to CUPS with lpadmin -p [REDACTED] -E -v socket://10.4.2.8.

**Configuration of CUPS for Alma**

1. Used sudo yum install cups to install CUPS onto the OS.
2. Used sudo systemctl start cupsto start the service.
3. Entered sudo nano /etc/cups/cupsd.conf to modify the CUPS configuration file.
4. Changed the settings as follows (See Appendix A):
   1. Changed ‘Browsing Off’ to ‘Browsing On’
   2. Changed ‘Listen Localhost:631’ to *Port 631*
   3. Appended *Allow @LOCAL*
   4. Appended *AuthType Default \ Require valid-user \ Allow @LOCAL*
5. Used sudo systemctl restart cups to restart the service and apply changes.
6. Found the IP of the HEAV printer by pinging the hostname ‘heavb008.printers.cit.lcl’
7. Added the printer to CUPS with lpadmin -p [REDACTED] -E -v socket://10.4.2.8.

**Printer testing**

1. Used cat > printerTest to create a test file and added test text in the /home directory on both machines.
2. Typed lpr printerTest -P [REDACTED] to print the file.

OS COMPARISONS

**Similarities between the operating systems**

* They both look very similar via command line.
* The method for installing packages is the same, just different commands.
* Setting disk quotas is the same process between systems.
* The process for network configuration during install is the same between systems.
* The process for CUPS is the same, but some lines are in different places in the same file
* Partitioning the drives in pre-installation was the same process.
* User management is the same between the two systems.

**Differences between the operating systems**

* Alma Linux had a GUI in the pre-installation boot.
* Alma uses yum install while Ubuntu uses apt get install.
* Ubuntu required an installation of *libpam-pwquality* for PAM to work as intended.
* Ubuntu’s PAM files were in */etc/pam.d/common-password* while the Alma ones were in */etc/pam.d/passwd*.
* Alma allowed for nano to be installed directly, while Ubuntu had a different system and first required the use of vim.

The two operating systems are relatively close in comparison to each other for everyday usage. This includes things like user management, file manipulation, and general processes. However, there are many small things that are different such as different commands for each operating system that may add up and seem very different while the operating systems really aren’t that different. Most processes and logical patterns to complete tasks are the same but have slightly different ways of accomplishing them.

APPENDICES

**Appendix A: Screenshots**

Figure 1: Screenshot of IP Configuration for Alma

Text

Description automatically generated

Figure 2: Screenshot of IP Configuration for Ubuntu

Text

Description automatically generated

Figure 3: Screenshot of name servers (same for both Linux VMs)

Text

Description automatically generated

Figure 4: Screenshot of user’s home directories

Text

Description automatically generated

Figure 5: Screenshot of disk quota for user ‘Jill’

Graphical user interface, text

Description automatically generated

Figure 6: Screenshot of pam.d/password-auth config file for PAM on Alma

Text

Description automatically generated

Figure 7: Screenshot of pam.d/common-password config file for PAM on Ubuntu

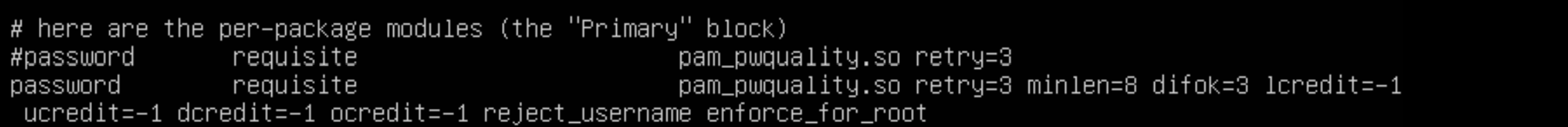


Figure 8: Screenshot of /etc/cups/cupsd.conf (same on both Linux systems)

Text

Description automatically generated

BIBLIOGRAPHY

Boucheron, B. (2019, February 21). *How to set filesystem quotas on ubuntu 18.04*. DigitalOcean. Retrieved September 26, 2022, from https://www.digitalocean.com/community/tutorials/how-to-set-filesystem-quotas-on-ubuntu-18-04

Buzdar, K. (1968, January 1). *Set up cups print server in ubuntu 20.04*. Linux Hint. Retrieved September 26, 2022, from https://linuxhint.com/cups\_print\_server\_ubuntu/

Bykoromicha-, By, -, koromichaI am the Co-founder of Kifarunix.com, Koromicha, & I am the Co-founder of Kifarunix.com. (2019, March 23). *Enforce password complexity policy on ubuntu 18.04*. kifarunix.com. Retrieved September 26, 2022, from https://kifarunix.com/enforce-password-complexity-policy-on-ubuntu-18-04/

Bykoromicha-, By, -, koromichaI am the Co-founder of Kifarunix.com, Koromicha, & I am the Co-founder of Kifarunix.com. (2019, March 22). *Enforce password complexity policy on centos 7/rhel derivatives*. kifarunix.com. Retrieved September 26, 2022, from https://kifarunix.com/enforce-password-complexity-policy-on-centos-7-rhel-derivatives/

Command-Line Printer Administration. (n.d.). Retrieved September 26, 2022, from https://www.cups.org/doc/admin.html

Kumar, P., Mk, Dany, Pradeep, Vikas, Whitney, P., Hajian, H., Crimson, K., Santosh, Bruce, & Karunanayaka, B. (2020, February 11). *How to enable user and Group Disk Quota on centos 7 / rhel 7*. |. Retrieved September 26, 2022, from https://www.linuxtechi.com/enable-user-group-disk-quota-on-centos-7-rhel-7/

*Linux LPR command help and examples - computer hope*. (n.d.). Retrieved September 26, 2022, from https://www.computerhope.com/unix/ulpr.htm