Lab 4 Specification – Exploring Virtualization
Due (via your git repo) no later than 2 p.m., Monday, 12th Oct 2020.
50 points

Lab Goals

- Reflect on virtualization and Cloud Computing.
- Develop a new virtual machine on our laptop.
- Implement web application (services) on the virtual machine.

Summary

We will do a few hands-on exercises to create a virtual machine and implement services on the new instance. So far, we have talked about what is Cloud? and how Cloud is formulated using virtualization. It is the right time to combine these two items and understand how the setup works practically. Additionally, we will watch a video clip, which is a segment of a ted talk on Cloud Computing, to further solidify our understanding.

Learning Assignment

If not done so already, please read all of the relevant ”GitHub Guides”, available at https://guides.github.com/, which explains how to use many of the features that GitHub provides. In particular, please make sure that you have read guides such as ”Mastering Markdown” and ”Documenting Your Projects on GitHub”; each of them will help you to understand how to use both GitHub and GitHub Classroom. To do well on this assignment, you should also read

- **Conference Proceedings:** Read through the conference paper titled ”Cloud Computing 360 degree view.”
- **If not done already, Virtualization reading material in the class repository.**
- **If not done already, Basic Networking reading material in the class repository.**

Assignment Details

Now that we have discussed some fundamental principles behind virtualization and Cloud services, it is now time to implement some challenging requirements of virtualization on our laptop.

It is required for all students to follow the honor code. Some important points from the class honor code are outlined below for your reference:

1. Students are not allowed to share code files and/or other implementation details. It is acceptable to have a healthy discussion with your peers. However, this discussion should be limited to sharing ideas only.

2. Submitting a copy of the other's program(s) is strictly not allowed. Please note that all work done during laboratory sessions will be an opportunity for students to learn, practice, and master the materials taught in this course. By doing the work individually, students maximize the learning and increase the chances to do well in other assessments such as lab assignments, skill tests, projects, etc.

At any duration during and/or after the lab session, students are recommended to team up with the Professor and/or the Technical Leader(s) to clarify if there is any confusion related to the items in the lab sheet and/or class materials.

Section 1: Cloud Computing

This section is worth 15 points. The points breakdown is provided below:

- Task 1 = 15 points, a maximum of 3 points awarded for each question.

Carl Schmidt is a Senior Manager at CompuCom. CompuCom Systems Inc. is a technology managed services provider and product reseller headquartered in Fort Mill, South Carolina, a southern suburb of Charlotte, North Carolina. It is a wholly owned subsidiary of Office Depot, Inc. In business since 1987, CompuCom provides Managed Workplace Services including IT solutions and hardware and software resale, integration and support services and has numerous partnerships within the technology space such as HP, IBM, Cisco, Dell, Apple, Inc, Jamf Pro, AirWatch, and Microsoft (wiki).

By getting to know a professional, we know what it takes to become a professional. A short biography of Carl, taken from his Linkedin profile is provided below, for folks interested to read:

I love learning and understanding new technologies and how they can be applied in different business settings. Moreover, I love working with people who get excited about how these new technologies can help solve problems. Using new and proven technologies, understanding what the business needs to succeed and putting these two elements together is where I excel.

Would you believe that I started as a music teacher? It's true! I have a BS in Music Education, and ironically, that is how I got my start in learning technology– fixing the computers for the teachers and students and designing my school's first web page–after teaching all day.

To this day, I still have that passion for learning, sharing and working with teams to produce results. I have lead teams that successfully upgraded a 24/7/365 operating security system environment, deployed 1100 laptops to students in a week, and upgraded 9 multi-tenant clouds vSphere environment in a single weekend.

If you set high expectations, you get excellent work. I have found over the years that management tends to not say "Thank you" and "Great job!" to their teams. I always ensure that my team knows they are appreciated.

Specialties: Clouc, Public Cloud, Multi-Cloud, Managing technical teams, building/repairing inter-departmental relationships, Agile/kanban

This video is a segment from the series of talks given at a TEDx event in a TED conference. In this video, Carl presents his view on Cloud Computing. In this section, we will watch a video and reflect on the points discussed in the clip. This reflection is instrumental to further advance our understanding of Cloud Computing and in general to foster the learning from our recent discussions on virtualization and understand the importance of Cloud. To complete this part, it is required to do the following:

- **Task 1:** Watch this short video clip, by using the link below:

  `https://www.youtube.com/watch?v=jeOb0rKrt7A`

  After watching the video, create a markdown file and name it as `video-reflection`. In this file, provide detailed answers to the questions provided below:

  1. What is the simple idea behind Cloud Computing, discussed in the video?
  2. What are the different layers of Cloud Computing, discussed in the video?
  3. What did the speaker mention about the Entrepreneur or a Dreamer who is probably trying to build the next Foursquare or Groupon?
  4. What is Software as a Service? How can one use virtualization to develop software as a service?
  5. What is the transformative promise of Cloud Computing, discussed in the video?

Section 2: Virtualization and Web Computing

This section is worth 35 points. The points breakdown is provided below:

- Task 3 = 15 points
- Task 4 = 20 points

In this section, we will setup virtualization platform on our laptop and do computing on the virtual machine. The underlying principle that tried out here are the development of software as a service. The web application is the service (rendered from server to the client). To complete this part, it is required to complete the tasks listed in practical 5, which is outlined as the prerequisites below:

1. **Task 2:**
   - Install Oracle VirtualBox using the link : `https://www.virtualbox.org/wiki/Downloads`
   - Install ubuntu iso image online: `https://ubuntu.com/download/server`
   - If you are experiencing issues with ubuntu installation on windows, try out, ubuntu 18 version: `https://releases.ubuntu.com/18.04/`

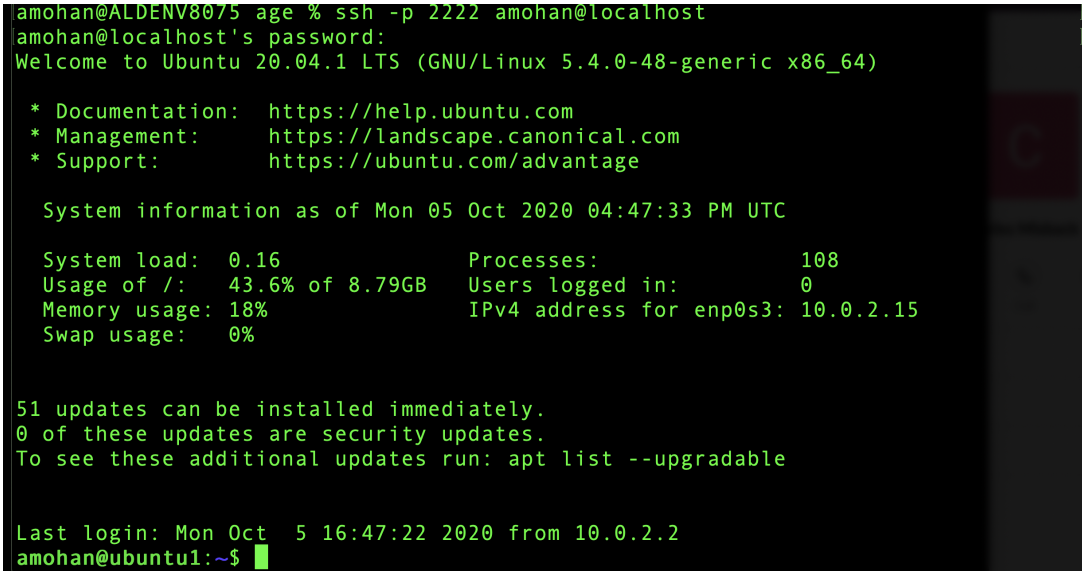
- Create a new virtual machine.
- Configure the virtual machine, by selecting the settings option. Here, do the following:
  (a) uncheck audio settings.
  (b) chose iso image in the disk controller (storage section) of the settings.
- Start virtual machine.
- Run the following commands on your ubuntu server:

  sudo apt update

  sudo apt install net-tools

  ifconfig
- After executing the third command, collect your ip address and keep it aside. We need this at a later step.
- Next power off the virtual machine.
- Right click and go to settings. Here click on the network section. Create a new rule by selecting advanced and port forwarding options. Next, add a new rule. The host ip is 127.0.0.1, host port is 2222, guest ip is the ip from the virtual machine, and guest port is 22.
- Start the virtual machine on a headless mode.
- At this point, we are ready to ssh to the host machine. We can use the ssh command for connecting to the new virtual machine from terminal (mac/linux), and git bash (windows).

  ssh -p 2222 amohan@localhost
- If all the steps above are completed successfully, we should get a similar output as below:



2. **Task 3:**

- Install a software called tomcat on the new virtual machine. Tomcat is a web application server that provides a platform to host Java based applications on the server side. Execute the following commands, to install Java JDK and Tomcat. Please type 'Y' when prompted:

  sudo apt install default-jdk

  sudo apt install tomcat9
- Once installation is completed, then simply go back and add another rule in the port forwarding layer. Right click and go to settings. Here click on the network section. Create a new rule by selecting advanced and port forwarding options. Next, add a new rule. The host ip is 127.0.0.1, host port is 8888, guest ip is the ip address from the virtual machine, and guest port is 8080. It is important to note that 8080 is the default port used by Tomcat.

- Type the following URl in a browser, like Chrome or Firefox:

  `http://localhost:8888/`

- This should render the webpage from the server (residing on the virtual machine) to the client. The webpage should indicate **It Works!**. Take a screenshot of this page, and upload to the submission repo using the file named `tomcat`
- Next we will try to develop a more meaningful computing task on our virtualized environment.

3. **Task 4:**

- The starter code has a file named `animation.html` This file is developed from an online free template, to display an animation on the browser. The free template was downloaded from the website below: `https://www.mockplus.com/blog/post/css-animation-examples`
- The technical content of the file (HTML, CSS, etc.) may be discussed in a different course such as Web Development course. Here we are focused on using these web technology (computing) as an example, to launch in our virtualized environment.
- Initiate the transfer of the html file to the server. Navigate to the starter-code repository in terminal (mac/linux), and git bash (windows) users. Type in the scp command to initiate the transfer:

  scp -P 2222 animations.html amohan@localhost:/home/amohan

- Note: The username "amohan" is a sample, and this needs to be changed with your specific username. An uppercase P is used as a switch to specify port number in SCP, whereas lowercase P is used as a switch to specify port number in SSH.
- If the set up works correctly, the `animation.html` file is copied over to the server in the location /home/amohan. To repeat, username is different in the path for each of us. Verify if file exists by ssh into the server. A sample verification screenshot is displayed below:

```
amohan@ALDENV8075 starter-code % scp -P 2222 animations.html amohan@localhost:/h
ome/amohan
amohan@localhost's password:
animations.html                               100% 7418     5.8MB/s   00:00
amohan@ALDENV8075 starter-code % clear
```

```
amohan@ubuntu1:~$ ls -l
total 8
-rw-r--r-- 1 amohan amohan 7418 Oct  5 17:13 animations.html
amohan@ubuntu1:~$
```

- Move this to the corresponding tomcat folder, so that the animation is hosted as a web application on the server, and is accessible from the client side.

  SSH to the server

  cd /var/lib/tomcat9/webapps

  sudo mkdir 402

  cd 402

  sudo mv /home/amohan/animations.html .

- Commands explained: By using the second command above, we navigated to the correct folder for creating a new web application. The third command creates a new directory called 402. Then the fourth and fifth command is used to navigate to the new directory and move the animations.html file to the directory.
- If this setup is completed correctly, then we should be able to access the web application (rendered from the server) on the client side. Type in the following in a browser, like Chrome or Firefox:

`http://localhost:8888/402/animations.html`

- This should render the webpage from the server (residing on the virtual machine) to the client. The webpage should render animation with numbers. By clicking on the toggle shape button, the animation opens a different view of the numbers. At this point, capture two screenshot, of the entire browser, for both views of the animation. Upload the file to the repo, using the name `animation1` and `animation2`.

4. **Optional Try out:** Try out other templates, from the website listed out in this section. First create a different web application folder, then move the animation file to the server and test it out. By testing out different animation files, we can further solidify our understanding on virtualization.

Submission Details

For this assignment, please submit the following to your GitHub lab repository.

1. **video-reflection** markdown file.
2. upload of **tomcat** file.
3. upload of **animation1** and **animation2** files.
4. It is recommended to upload a readme file, with the details that you would like the Professor to know while grading the work. For example, it may be reflection of your experience in the lab by highlighting some of the challenges faced and a brief mention of how you had addressed those challenges while implementing this lab. The readme file may also include a brief mention of any details that one should know about executing your program and what to expect during the execution.
5. It is highly important, for you to meet the honor code standards provided by the college and to ensure that the submission is made before the deadline. The honor code policy can be accessed through the course syllabus. Make sure to add the statement ”This work is mine unless otherwise cited.” in all your deliverables such as source code and PDF files.

Grading Rubric

1. Details including the points breakdown are provided in the individual sections above.
2. If a student needs any clarification on their lab credits, it is strongly recommended to talk to the Professor. The lab credits may be changed if deemed appropriate.