# Homework 0 - Introduction to Linux

**Due date**: not for submission.
**Teaching assistant in charge**: Daniel Bransky.
**Guidelines**:
If you have any questions regarding this assignment, you may:
1.  Attend the reception hours of the teaching assistants, or
2.  Post your question at the Piazza forum (as announced in the course website).
    a.  Read previous questions carefully before asking your question; repeated questions will probably go without answers.
    b.  Be polite, remember that course staff does this as a service for the students.
    c.  When posting questions regarding this assignment, put them in the "hw0" folder.

**Please note: asking your questions by email is not an option! Please do not send any emails regarding the assignment to the TAs.**

The goals of this assignment are to set up your working environment and to get you familiar with Linux on x64 platforms. The following homework assignment will be developed and tested under Linux, so it is very important for you to feel comfortable with the basic workflow of booting your Linux machine, working in the terminal, backing up your files, and so on.

# 1. Load a Linux Virtual Machine (VM)

The specific Linux distribution which we will use in this course is Ubuntu 18.04 LTS by Canonical, along with its default tool chain (e.g., GCC version 7.4.0). Since most of you probably use Windows or Mac personal computers, working with Linux is not immediate for you. You may install Ubuntu 18.04 LTS on your personal computer, but this is suboptimal for a few reasons:
1.  Homework assignments require you to modify the Linux kernel.
2.  Few of us can write perfect code the first time.
3.  Errors in the kernel can render the machine unusable.

It is thus not recommended for you to modify the actual kernel of your Linux machine.
The preferable method is working on a virtual machine (VM): you will run your own Linux VM on top of a Windows host machine. The host intermediates between the VM and the physical hardware, such that a VM crash is no more than an application crash.

You have two options for running your VM on, either using VMWare player or VirtualBox. We recommend using the VMWare player unless you have some issues installing it on your system then you may install the VirtualBox instead.
Here are the installation detail for each of these two alternatives:

## 1.1 VMWare Player:

To download VMware Player and run a local Linux VM in it please follow these instructions:

1. Download the latest version of "VMware Workstation 16 Player for Windows 64-bit Operating Systems" from broadcom:
   a. Sign up to the website and log in
   b. on to top right side of the website chose "VMware Cloud Formation" from the drop-down menu



   c. go to "My Downloads" on the left-hand side of the site and search for "VMware Workstation Player" on the search bar on the right.
   d. download the latest release 17.5.2 from the options, you might need to input additional information like your address.
   **If you are unable to download the vm player, this is a known issue you can try a different email address or use virtual box instead.**
   e. Install the "VMware Workstation Player" you just downloaded.

2. Download the **"ubuntu18 (full img).7z"** Linux VM image from here.
   This image is specifically tailored for the course requirements, so you are obliged to work on this copy only. No technical support will be given by the course staff for other versions of Linux distributions/kernels.

3. Unzip the image file. You may need 7-Zip or p7zip for this step.
   The unzipped folder should contain a virtual disk file called "ubuntu18.vmx" file, which VMware treats just like a standard hard disk device. Your virtual disk has been preloaded with a copy of Ubuntu 18.04 LTS. You will have the root password for this machine, so you will have full privileges on the machine (for example, for "sudo" commands).

4. Optional: (Let your vm work in full resolution) Go to your "ubuntu18.vmx" file and open it in your favorite text editor (e.g. notepad++). Change the field "svga.guestBackedPrimaryAware" to "FALSE".

5. Start the VMware Workstation Player.

6. Double-click the *"Open a Virtual Machine"* and choose the *ubuntu18.vmx* in the unzipped folder.

7. Click *Power on this virtual machine*, and choose "I copied it" if you are asked. Play the VM and wait until it loads; this may take a few minutes.

8. Your VMware player may suggest you to download and install "VMware Tools for Linux" on your VM. Ignore these messages with "Remind Me Later".

9. Login with username **student**, and password **1234**.
   Please note that the **student** user has sudo permissions (and we configured sudo to not ask for passwords).

10. Your Linux virtual machine is now on!

11. **Note: DO NOT UPGRADE your ubuntu from 18.04 to later version**

**FAQ:**
Q: I have an error message: "intel vt-x is disabled".
A: https://www.youtube.com/watch?v=co2b3RjMQeQ

## 1.2 VirtualBox

1) Download "VirtualBox" from this landing page:
   https://www.virtualbox.org/wiki/Downloads
   This software is a free virtual machine monitor which can host virtual machines.
2) Install the "VirtualBox" you just downloaded.
3) Download the *"ubuntu18-vbox (full image).7z"* Linux VM image from here.
   This image is specifically tailored for the course requirements, so you are obliged to work on this copy only. No technical support will be given by the course staff for other versions of Linux distributions/kernels.
4) Unzip the image file. You may need 7-Zip or p7zip for this step.
   The unzipped folder should contain a virtual disk file besides a virtual-box file called "ubuntu18.vbox", which VirtualBox can import and treats just like a standard hard disk device. Your virtual disk has been preloaded with a copy of Ubuntu 18.04 LTS. You will have the root password for this machine, so you will have full privileges on the machine (for example, for "sudo" commands).
5) Start VirtualBox.
6) Select the option "Add" under "Machine" menu.
7) Browse the unzipped files and select the "ubuntu18.vbox"
8) Now, you can see the added virtual machine in the VM VirtualBox Manager. Just select the VM, and click on the "Start" button to power on the VM.
9) You will be auto logged in, if not then login as student, the password is 1234.
10) Your Linux virtual machine is now on!

# 2. Get Familiar with the Shell

The VM image you just loaded provides you with a command-line interface to the Operating System (OS) services: the shell. More specifically, your Ubuntu 18 default login shell is bash. Please read the first tutorial of MATAM (234124), which can be downloaded from the course website, and make sure you understand the bash commands and tools that are described there. It is highly recommended that you practice your skills in the bash shell and not just go over the material. Specifically, make sure you can write bash commands that:

- Navigate through the file system,
- Create, edit and delete text files,
- Execute programs and redirect their input/output from/to a file,
- Concatenate two programs with pipes.

# 4. Transfer Files Between Host and VM

The graphical user interface you just installed provides you with everything you need to develop C/C++ code under linux. Go ahead build a simple "Hello World!" program in your shell:

```
>> cd ~
>> vi main.c   # put your code in this file
>> # you can also use Geany or other text editor for this
>> gcc main.c
>> ./a.out
Hello World!
>>
```

Having said that, we know that some of you may prefer to develop code in their familiar Windows/Mac environment and test it in the VM when the code is ready.
You have several methods for transferring files between the VM and your host machine:

1) Install Dropbox on your host machine and put your files there.
   Then install Dropbox on your VM with:

   ```
   >> cd ~/atamos_vm/
   >> make dropbox
   ```

   The Dropbox folder syncs automatically and has the added bonus that your files are always backed up in the cloud.

2) Download and install WinSCP https://winscp.net/eng/download.php
   In the login window insert the IP address of your VM, which you can find with:

   ```
   >> cd ~/atamos_vm/
   >> make my_ip
   ```

   Click Save and then Login.

If an alert window is raising click *Yes*.
Now you can transfer files between the host (the left window) and the VM (the right window).

3) Enable the VMware "Shared Folders" feature. Read more in the VMware docs:
https://docs.vmware.com/en/VMware-Workstation-Player-for-Windows/15.0/com.vmware.player.win.using.doc/GUID-0C23FCBF-F0CC-447B-A08E-35B90C52091E.html

# 5. Develop on the host VSC with remote shell into the VM

The best approach to develop is not use the actual GUI provided by the VM software (vmware/virtualBOX) as it is slow and annoying.
We recommend using ssh (secure shell) to connect from your VSC on the host directly into the VM.
Slides and recording can be found on the course's site:
https://grades.cs.technion.ac.il/grades.cgi?QxkQMqZ7gX5hYFi+3+02340123+202402+ho_7699001706639719.html
https://panoptotech.cloud.panopto.eu/Panopto/Pages/Viewer.aspx?id=b2d78286-ed0f-4cd6-a4cd-b10700e32930

Have a nice journey!
-- Course Staff