TCP/IP NETWORKING

E2-232 2:1

NETWORKING AROUND RASPBERRY PI – Lab Manual

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LAB 2: CONFIGURE RASPBERRY PI (RPI) FOR HEADLESS SETUP

Aim: Install ubuntu server on RPI, connect to IISc WLAN and access RPI remotely

What you will need:

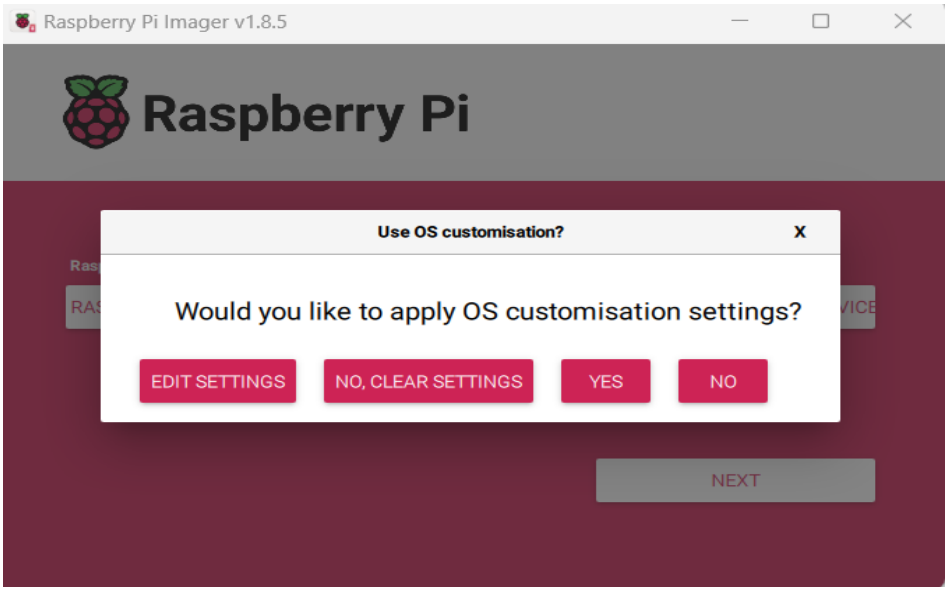
- A stable internet connection (Wi-Fi)
- A microSD card (16GB/32GB) and a card reader
- Raspberry Pi 4 board with power cable

PROCEDURE:

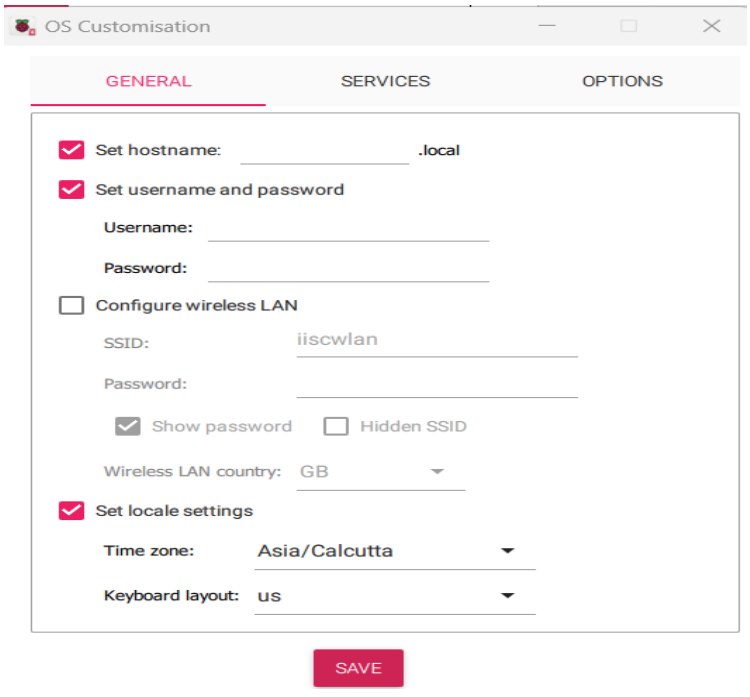
Instructions to install Ubuntu Server for a headless setup:

1) Go to www.raspberrypi.com/software and download the "**Raspberry Pi Imager**." You can install any OS that is compatible with your Pi using the imager.

2) Run the imager application, first **choose device** under Raspberry Pi Device – select the device as '**Raspberry Pi 4'**.
3) The ubuntu server image is shared at http://10.114.58.148/files/tcpip/, download the image file (http://10.114.58.148/files/tcpip/ubuntu-22.04.4-preinstalled-server-arm64%2Braspi.img). Next under operating system select **Use custom** then select and under that choose the downloaded '**ubuntu-22.04.4-preinstalled-server-arm64+raspi.img'** from your system.
4) Next under storage select the location where SD card is connected and click '**Next**' and opens the OS customization window with options. Select **'Edit settings**.'

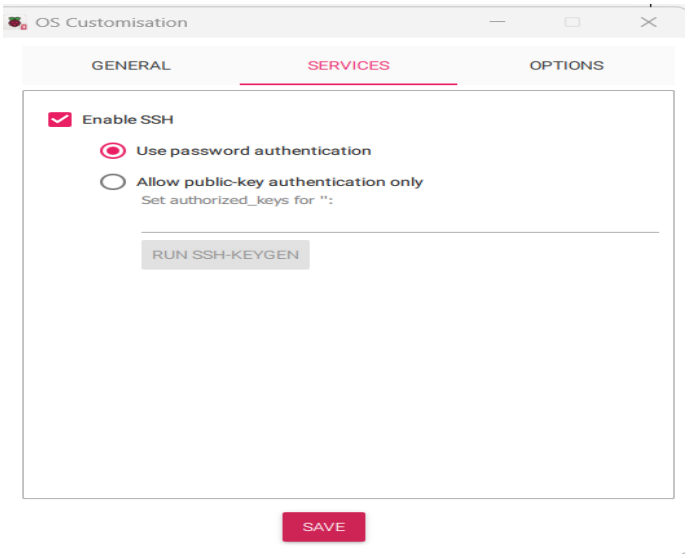


5) In OS customization under **'General'** set <hostname>, <username> and <password> of your choice. Note down the credentials as they are required to login to RPI.



6) **Do not configure** wireless LAN. Set local settings and set the '**Time zone'** to Asia/Calcutta and setup the '**Keyboard layout.'**

7) Next select **'Services'** and select Enable SSH and under that select use password authentication and click '**SAVE'**



8) Under **'options'** select all the choices and click '**SAVE**'

9) After this the OS customization setting window will pop up again, select '**Yes**'

10) Next **'A warning'** window with the message saying that "All the existing data on 'Mass storage Device USB Device' will be erased. Are you sure you want to continue?' message will appear. Select **'Yes.'** After installation, the SD card will be ejected.

NOTE: You can also download the .iso file from teams link or from https://ubuntu.com/download/raspberry-pi (Ubuntu Server 22.04.4 LTS, 64-bit version) and burn the image file using Balena Etcher application/Win disk Imager for windows or by using Raspberry Pi imager on Ubuntu.

11) Next step is to configure RPI for a headless setup. Insert the SD card into the card reader and connect it to your system. Open the boot folder and open **network-config** file and make the changes shown in Figure below Enter your own IISC email ID and password under identity and password, and save the file.

```
# Please note that, at this time, there is no way to specify the wifi
# regulatory region in the netplan or cloud-init configuration (LP: #1951586),
# and the /etc/default/crda configuration file has been removed. If you need to
# specify a regulatory region, append the following to the line in
# "cmdline.txt" (adjusting "GB" to your own region):
#
# cfg80211.ieee80211_regdom=GB

# Some additional examples are commented out below

network:
  version: 2

  ethernets:
    eth0:
      dhcp4: true
      optional: true

  wifis:
    wlan0:
      dhcp4: true
      optional: true
      access-points:
#         myhomewifi:
#           password: "S3kr1t"
#         myworkwifi:
#           password: "correct battery horse staple"
          iiscwlan:
            auth:
              key-management: eap
              method: peap
              identity: "<your_iisc_email_id>@iisc.ac.in"
              password: "<your_iisc_password>"
#             ca-certificate: /etc/my_ca.pem
```

12) Insert the SD card to your RPI and connect the power supply. Wait for few minutes until the board boots up (approximately 5 mins)

13) Install '**putty'** on your system which is used to establish remote access. Choose SSH terminal and type in your Raspberry pi's **'Hostname.'**

14) The terminal starts and type in your username and password that you used in step 5. If you have not given any username and password, the default username is '**ubuntu**' and default password is also '**ubuntu**.'

15) You will be asked to change your current password for security purpose, change the password and you will gain access to the ubuntu server on RPI.

16) After logging in to the PI, type "**sudo nano /etc/wpa_supplicant/wpa_supplicant.conf**" which will open a new file to add your network configurations. Check if the file has the following details. If not add the details and save the file.

```
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev
update_config=1
country=IN
ap_scan=1
eapol_version=1
network={
    ssid="iiscwlan"
    scan_ssid=1
    key_mgmt=WPA-EAP
    eap=PEAP
    identity="<your_iisc_email_id>@iisc.ac.in"
    password="<your_iisc_password>"
}
```

17) Run the command "**sudo apt install net-tools**" and "**sudo apt install wireless-tools**"

18) Run **ifconfig** on the terminal and you will be able to see that **wlan0** is configured, note down the mac address of your RPI.

19) Use the following link for installation reference:

https://ubuntu.com/tutorials/how-to-install-ubuntu-on-your-raspberry-pi#1-overview

20) To discover IP address

On windows command prompt use this command: nmap -sP 10.114.240.0-255 and nmap -sP 10.114.241.0-255

You can also download use 'Advanced IP scanner' application to discover IP (For Windows OS)

Angry IP Scanner for Ubuntu system

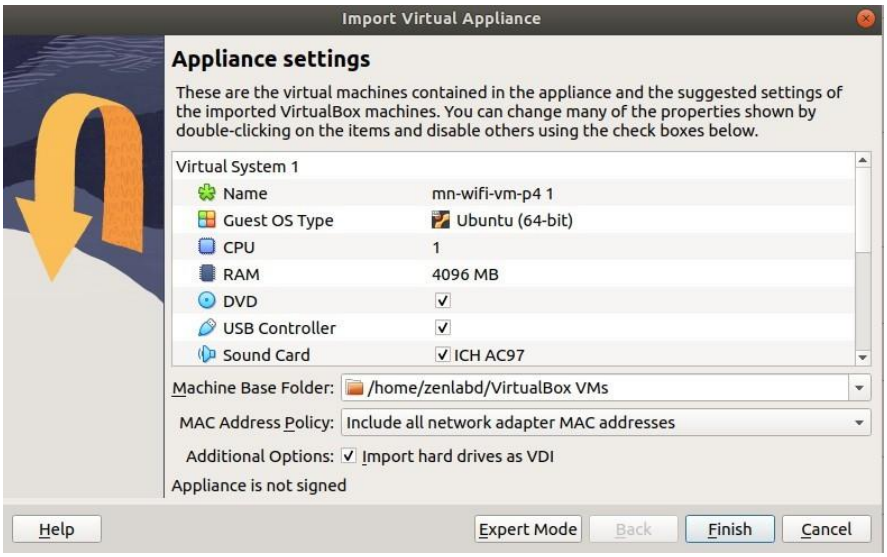
LAB 2: SETTING UP MININET ENVIRONMENT TO EMULATE NETWORKS ON ORACLE VIRTUALBOX

What you will need throughout the lab course:

- A stable internet connection (Wi-Fi)
- Oracle Virtual Box (installed on a Windows/Linux system)
- Mininet VM (http://10.114.58.148/files/tcpip/→mn-wifi-vm-p4.ova)

Instructions to add the Mininet VM image to Oracle Virtual Box:

- Download the Mininet VM image locally on your system.
- Right Click on the Mininet VM Image and open it using the Oracle Virtual Box.
- Select the following options and click on **'Finish.'**



Optional: Instructions to install Oracle Virtual Box: ()

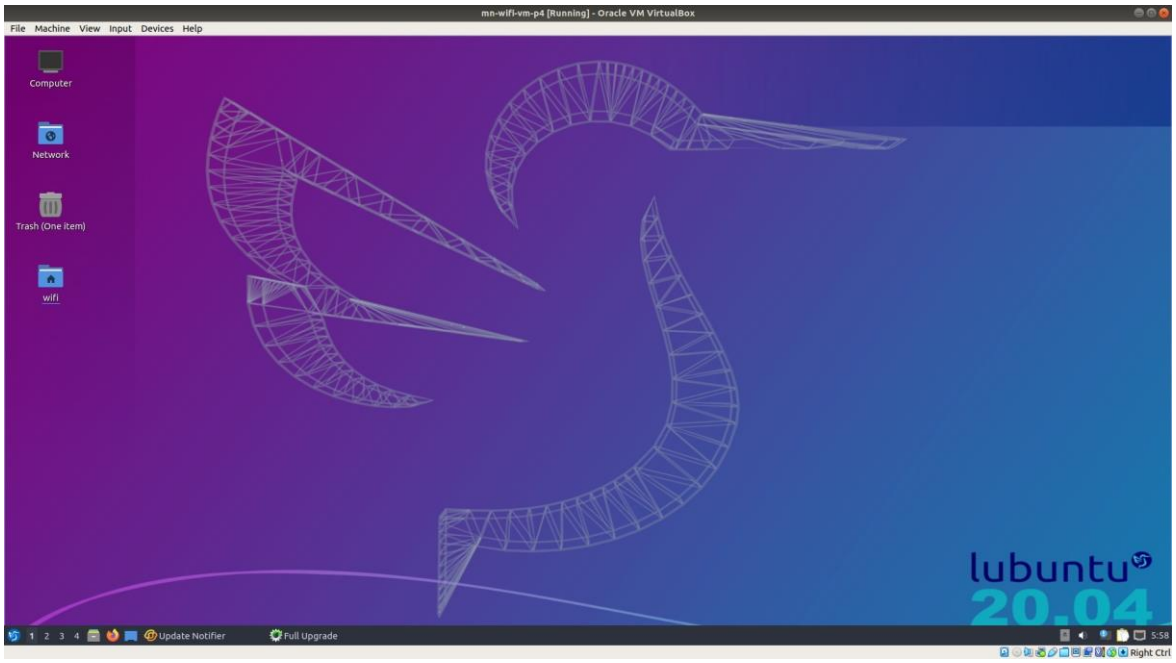
For Windows:

- Go to https://www.oracle.com/in/virtualization/technologies/vm/downloads/virtualbox-downloads.html and download the latest (version7.0.10) executable file.
- Double click on the downloaded executable file and install the Virtual Box as any other Windows application.

For Ubuntu Linux distribution:

- Go to Ubuntu Software application.
- Search for Oracle Virtual Box and install the application.

- Finish the installation of the Mininet VM in the Virtual Box environment
  - username - wifi
  - password - wifi
- Run the command **"sudo apt install wireshark".**



What is Mininet?

Mininet creates a **realistic virtual network**, running **real kernel, switch and applicationcode**, on a single machine (VM, cloud or native), in seconds. (source: https://mininet.org/)