acontis technologies GmbH

SOFTWARE

Hypervisor-UbuntuGuest-Guide

acontis Real-time Hypervisor and Ubuntu guest

Version 8.x

Edition: November 21, 2023

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1 Introduction

This guide describes how to set up a `Ubuntu` guest in the *acontis Hypervisor*. It is assumed, the steps listed in the *Hypervisor Quick Start Guide* have been successfully executed.

The last chapter describes how to set up an *additional* `Ubuntu` guest, if `2` (or *more*) `Ubuntu` guests are to be used.

2 Copy Ubuntu ISO installation media to Hypervisor Host

In a first step, we need to copy the `Ubuntu` installation media (`ISO` file) from a `Windows` (or `Linux`) system into the Hypervisor Host filesystem.

2.1 Using Filezilla (recommended)

- Open a shell (right click on desktop and select *'Open Terminal here'* **or** press `CRTL` + `ALT` + `T`) on the Hypervisor `Host`.
- Determine the IP address of the system (with `ifconfig` command and through `inet` entry):

```
rte@RTV-TP104:~$ ifconfig
enp2s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 172.17.10.5  netmask 255.255.0.0  broadcast 172.17.255.255
    inet6 fe80::ccbb:85f1:38d3:fa2a  prefixlen 64  scopeid 0x20<link>
    ether 90:1b:0e:18:c9:83  txqueuelen 1000  (Ethernet)
    RX packets 4618420  bytes 4033770375 (4.0 GB)
    RX errors 0  dropped 8865  overruns 0  frame 0
    TX packets 1460482  bytes 96608727 (96.6 MB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
    inet 127.0.0.1  netmask 255.0.0.0
    inet6 ::1  prefixlen 128  scopeid 0x10<host>
    loop  txqueuelen 1000  (Local Loopback)
    RX packets 6864  bytes 427092 (427.0 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 6864  bytes 427092 (427.0 KB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

vnet0: flags=99<UP,BROADCAST,NOTRAILERS,RUNNING>  mtu 1500
    inet 192.168.157.1  netmask 255.255.255.0  broadcast 192.168.157.
↪255
    ether 00:60:c8:00:00:00  txqueuelen 1000  (Ethernet)
    RX packets 765775  bytes 74216258 (74.2 MB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 767935  bytes 74780268 (74.7 MB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

In this *example* the IP address is `172.17.10.5`.

Hint: The device name `enp2s0` **differs** on different PC/IPC's!

- Open Filezilla (get current version from https://filezilla-project.org/) and create new connection entry:

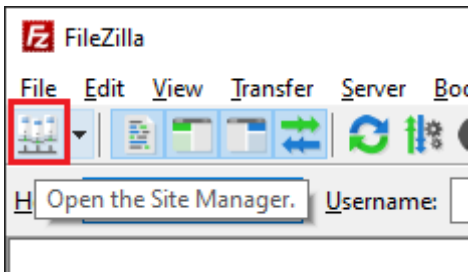


Fig. 2.1: Create new entry through site manager.

1. Push `New site` button
2. Give a qualified name
3. Select *SFTP - SSH File Transfer Protocol*
4. Give Hypervisor Host IP/name. In screenshot above the last byte is `X`-ed out. Replace it with the 'detected' IP address.
5. Enter User name (same as at Hypervisor install)
6. Enter password (same as at Hypervisor install)
7. Push `Connect` button

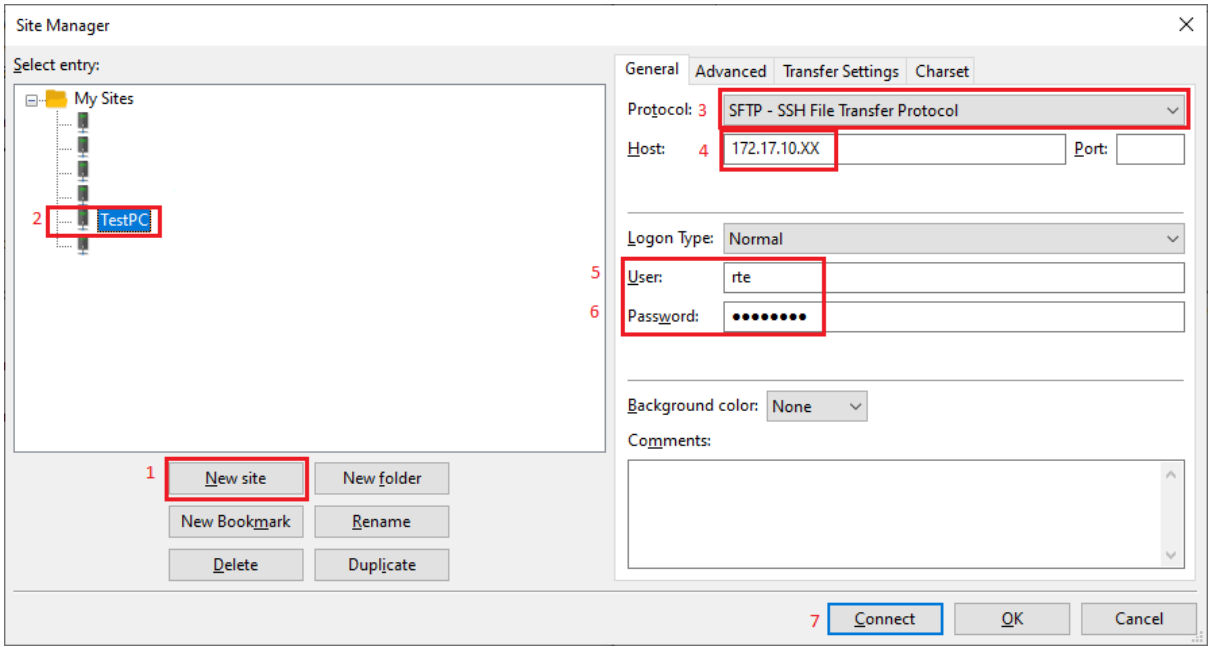


Fig. 2.2: Site manager dialog.

Select the installation media file (the `.iso` image) in the *Local* tab on the left and *upload* it to `/hv/guests/examples/ubuntu` into the *Server* tab on the right.

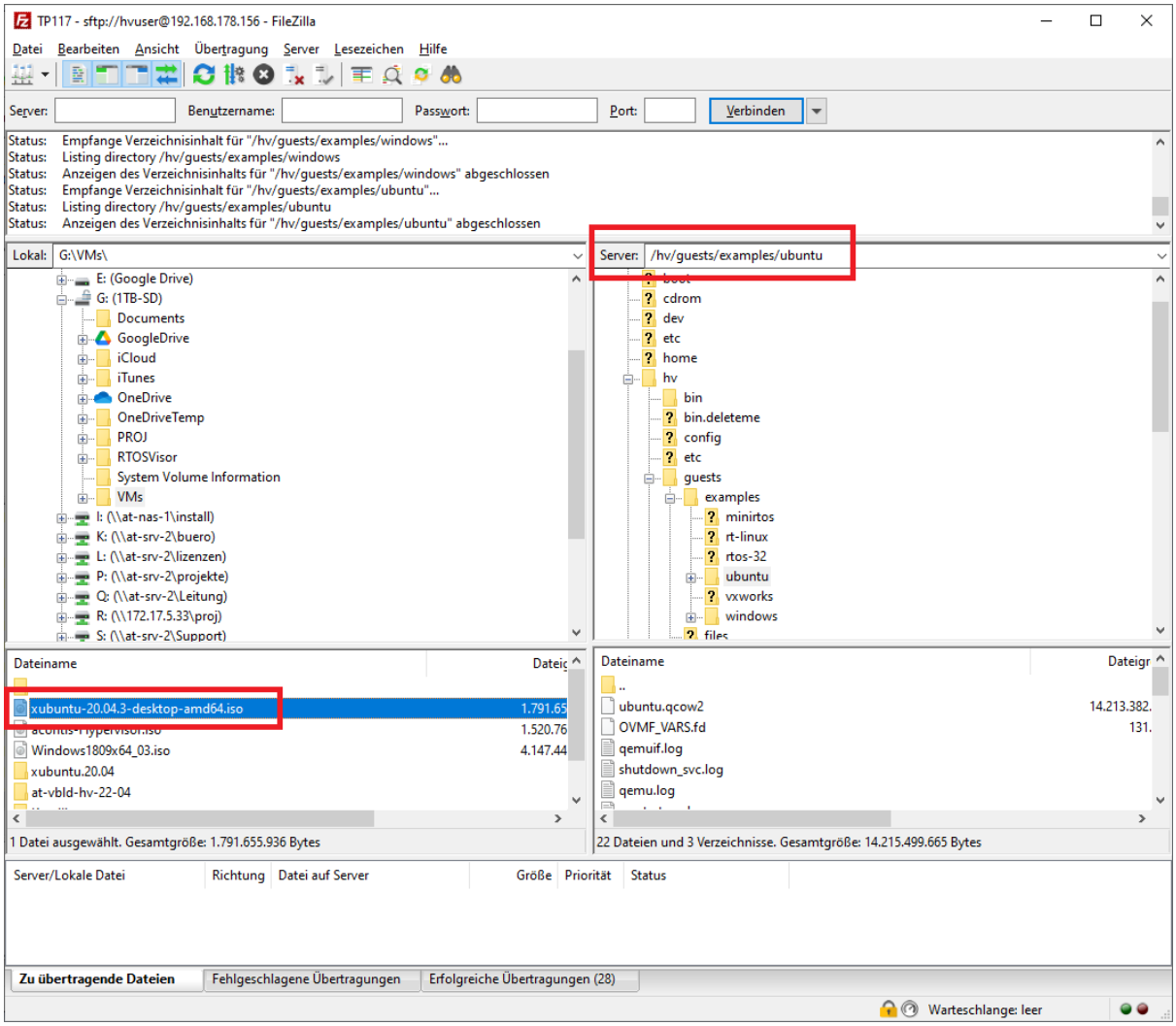


Fig. 2.3: Download installation media

2.2 Using a Windows Share

Here we will show how this can be accomplished using a network share (`//NameOrIpAddressOfPcWithShare/NameOfShare`) in the Windows system. We assume the network share has a directory `/hv` containing the file `ubuntu-22.04-desktop-amd64.iso`. We need to install the network client software (cifs) in the Hypervisor Host and then mount the Windows network share.

```
$ sudo apt-get install cifs-utils
```

```
$ sudo mount -t cifs //NameOrIpAddressOfPcWithShare/NameOfShare /mnt -o
↪  user=NameOfUserWithAccessToShare
```

Copy the Ubuntu ISO image to `/hv/guests/examples/ubuntu`.

```
$ cp /mnt/hv/ubuntu-22.04-desktop-amd64.iso
↪  /hv/guests/examples/ubuntu/ubuntu-22.04-desktop-amd64.iso
```

The mount point `/mnt` isn´t needed anymore and thus will be unmounted.

```
$ sudo umount /mnt
```

3 Guest Configuration

Prior to installing the guest, we need to configure the respective virtual machine (e.g. number of CPU cores, network settings etc.). The configuration files `guest_config.sh` and `usr_guest_config.sh` are located in the guest folder. The meaning of each configuration setting is explained in detail in those files. You need to edit these files and adjust them according to your needs and environment.

> **Caution:** If the guest is controlled by the System Manager tool, you must not change the `guest_config.sh` file (the content may be overwritten by the System Manager), instead uncomment the respective settings in `usr_guest_config.sh`.
>
> Example guests located in `/hv/guests/examples` are **not** controlled by the System Manager.

The number of CPU cores must **not** exceed the number of physical cores available in the system and not assigned to Real-time guests. For example, if on a *quad core* CPU, you need `2` cores for Real-time guests, the number of cores for the Windows guest must not exceed `2`. The default parameters should fit for most cases.

```
$ gedit /hv/guests/examples/ubuntu/guest_config.sh (and/or
↪  usr_guest_config.sh)
```

```
# Adapt following lines to your system and needs:
vmname=...
vmid=...
windows_guest=...
cdrom_iso=...
num_cpus=...
ramsize=...
```

You have to set the cdrom_iso parameter to the appropriate folder where the installation media ISO file had been copied before.

By default, the network connection is set up automatically (using DHCP). Please check the Hypervisor Manual for other settings.

> **Caution:** Automatic network setting will only work, if the Ethernet cable is connected!

> **Caution:** Please do not configure more CPUs than physically available (CPUs used for the Real-time OS are not available for the Windows guest). Example: The maximum number of of CPUs on a quad-core CPU where 1 CPU is used for the Real-time OS is `3`.

> **Caution:** Please do not configure more RAM than available. The VM may unexpectedly crash if too much RAM is configured. You can determine the available RAM as follows:
>
> ```
> $ cat /proc/meminfo | grep MemAvailable
> ```

4 Guest installation

After VM configuration you need to start the guest for the first time. The guest console will be shown then (the guest output or desktop).

```
$ cd /hv/guests/examples/ubuntu
$ hv_guest_start -view
```

The installation media iso file will be detected by the virtual bios, you need to press a key to boot from it:

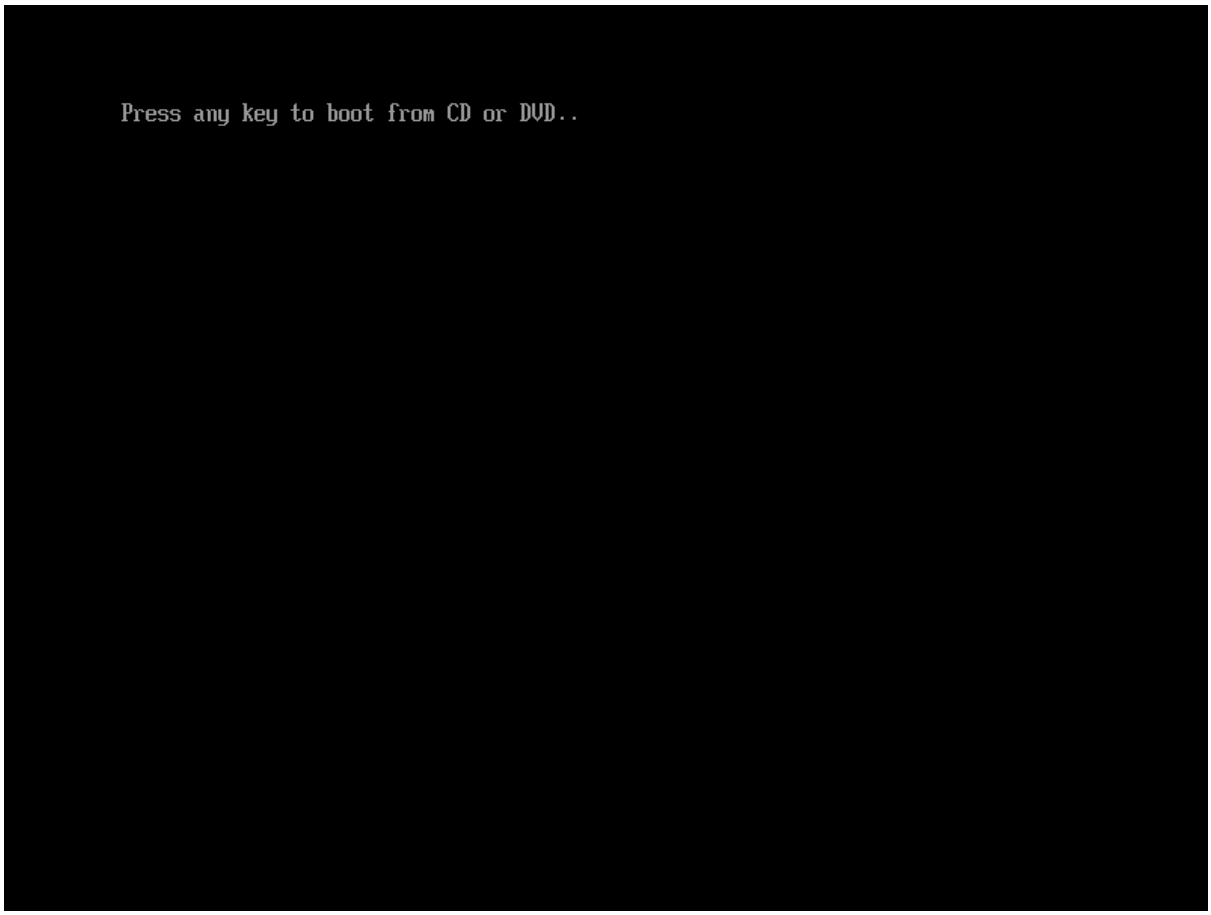


Fig. 4.1: Boot from ISO file.

Hint: In case no key was pressed in time or the installation media was not found, the EFI shell will be started.

- Option a) You can leave into BIOS by entering `exit`. If you also leave BIOS the boot begins again and you can press a key to boot from CD.
- **Option b) You can manually start the CD's bootloader by entering**
  - `$ FS0:`
  - `$ \EFI\BOOT\BOOTX64.EFI`

---

5 Ubuntu Installation

Follow the steps as usual for `Ubuntu`. In this guide the **default** cases are used where applicable.

- GRUB selection menu

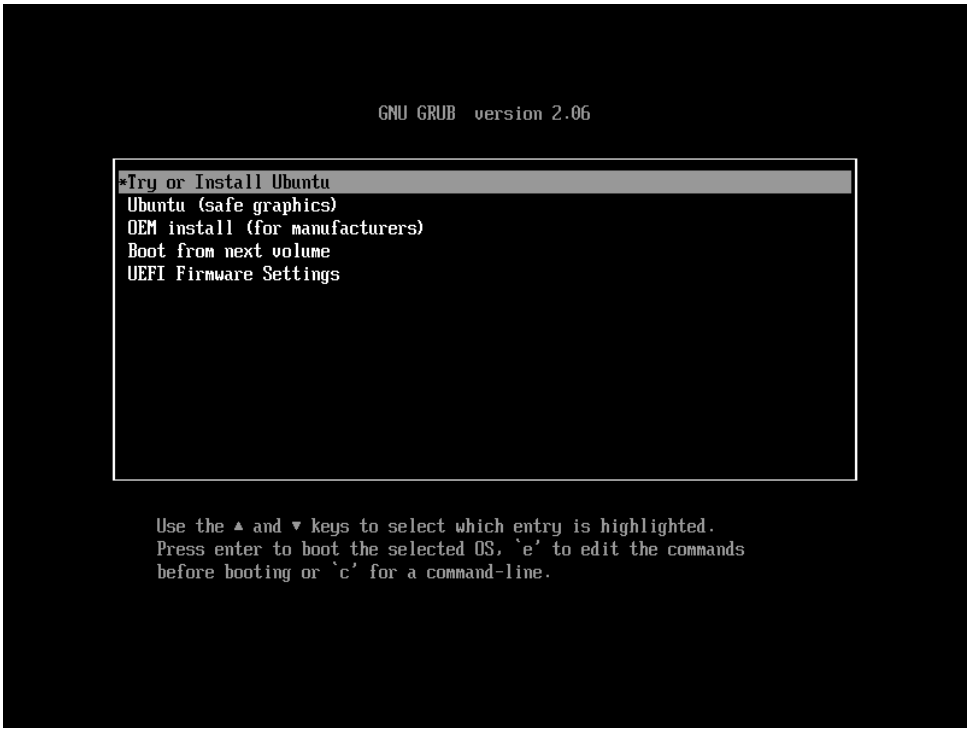


Fig. 5.1: Select `Try or Install Ubuntu` at GRUB selection menu.

- Select **Install Ubuntu**

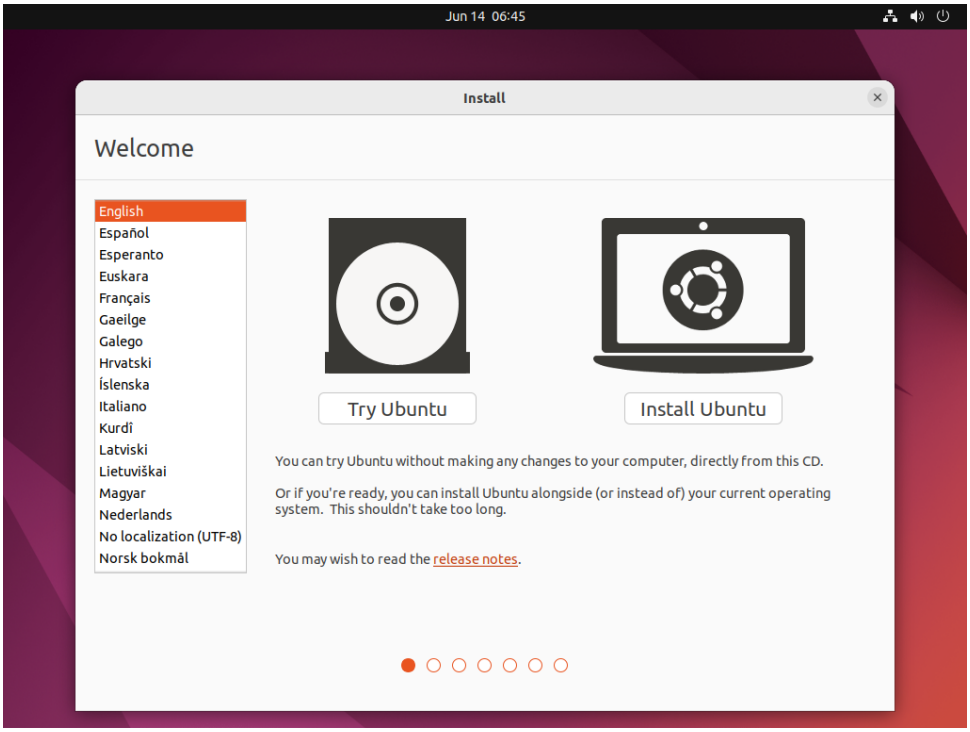


Fig. 5.2: `Install Ubuntu` select.

- Select your Keyboard layout –> `Continue`

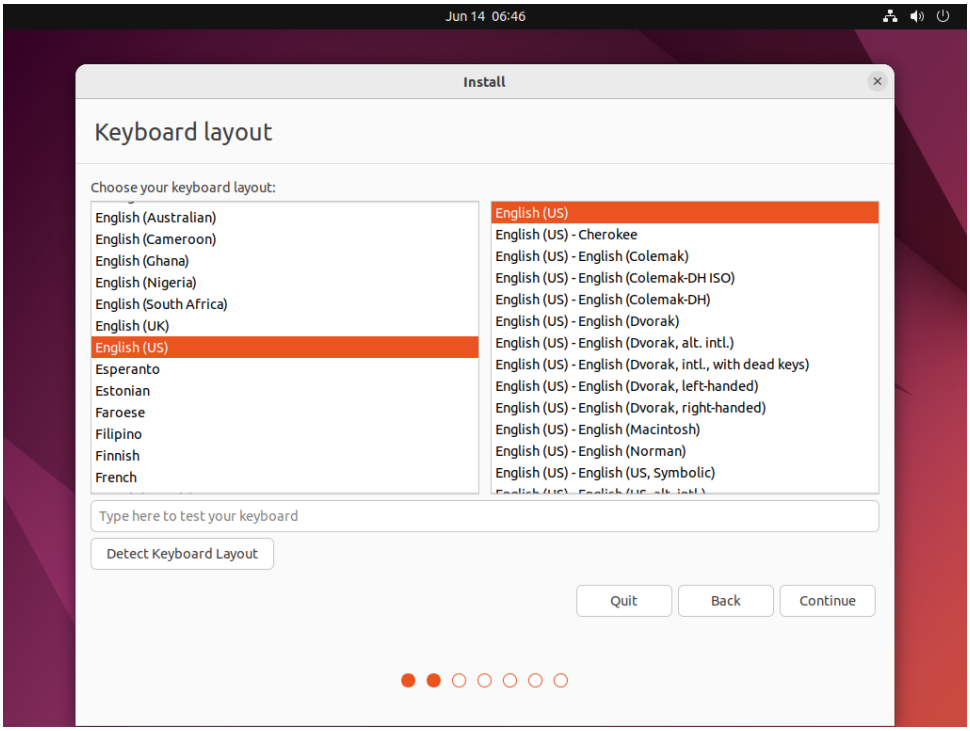


Fig. 5.3: Select keyboard layout.

- Updates and other software (default state) –> `Continue`

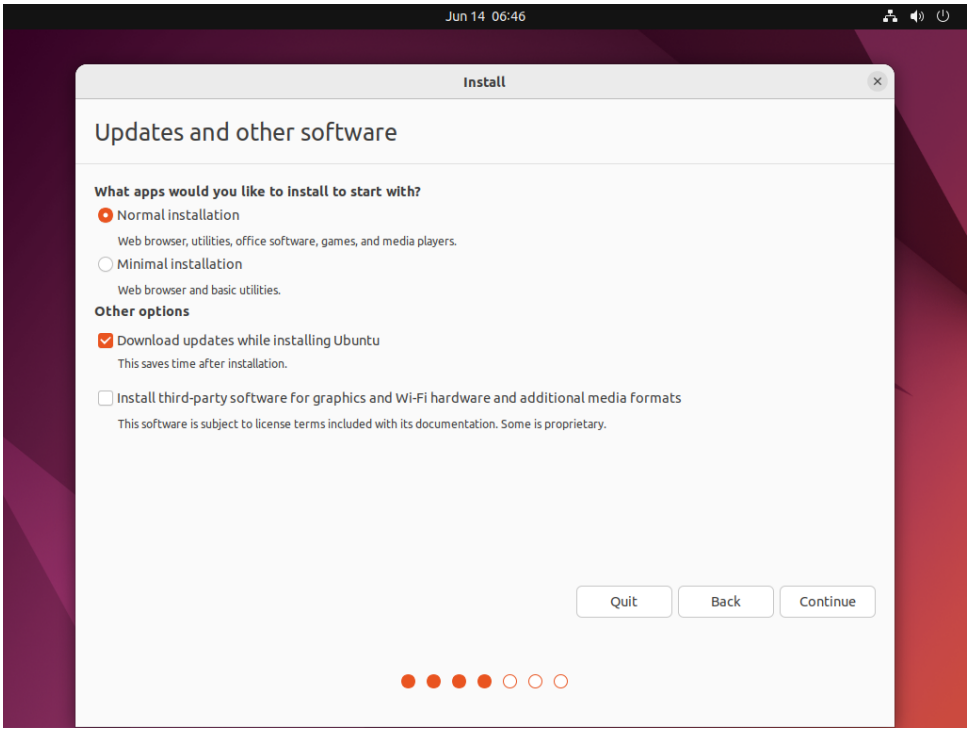


Fig. 5.4: Leave `Updates and other software` as default.

- Installation type –> `Erase disk and install Ubuntu` –> `InstallNow`

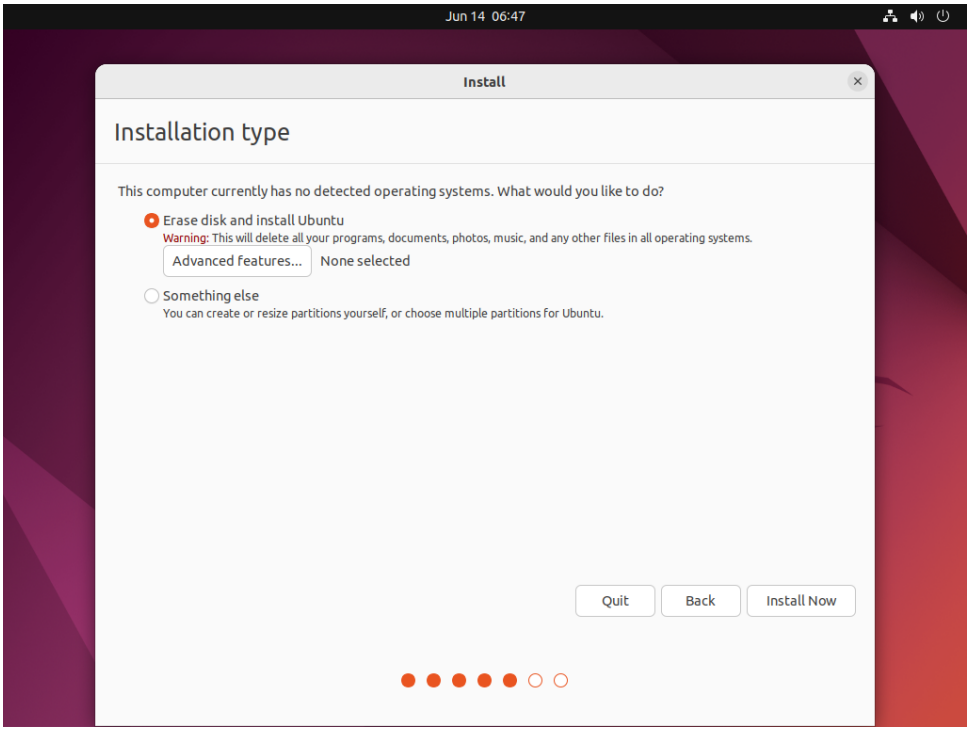


Fig. 5.5: Select `Erase disk and install Ubuntu` at installation type page.

- Confirm `Write the changes to disks?` dialog –> `Continue`

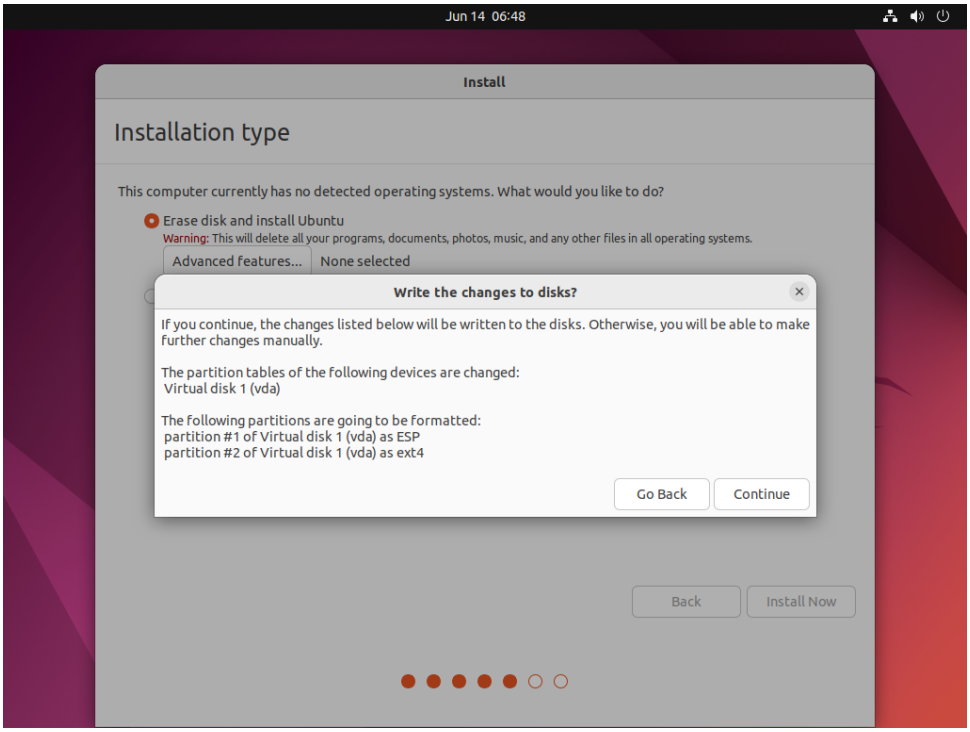


Fig. 5.6: Confirm `Write the changes to disks?` dialog.

- Where are you –> `Continue`

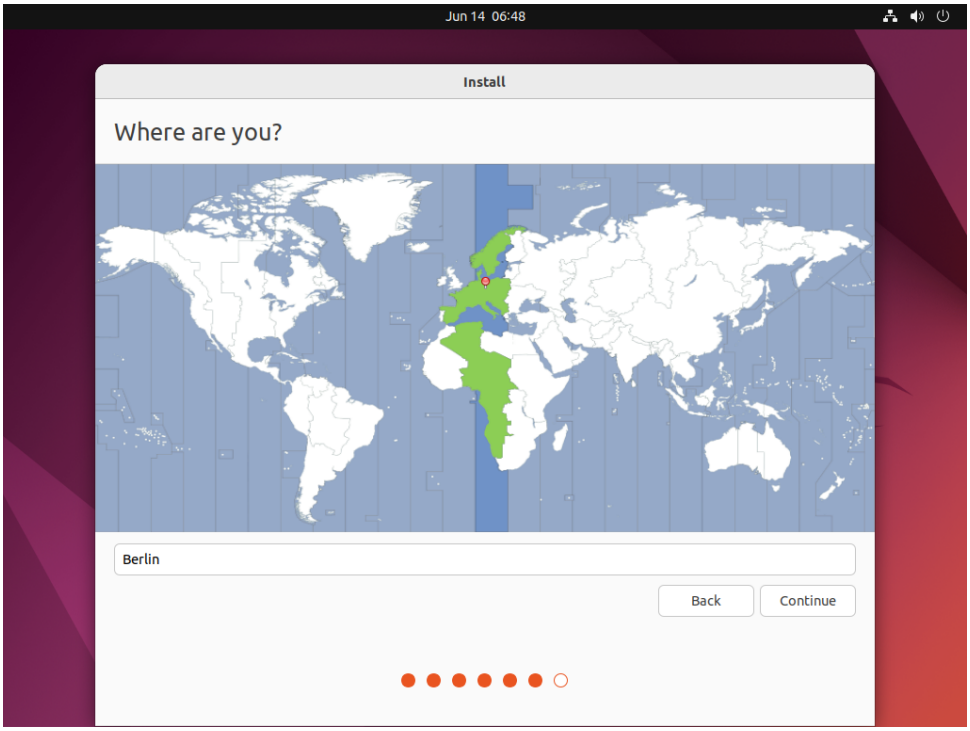


Fig. 5.7: Select where you are.

- Create credentials –> `Continue`

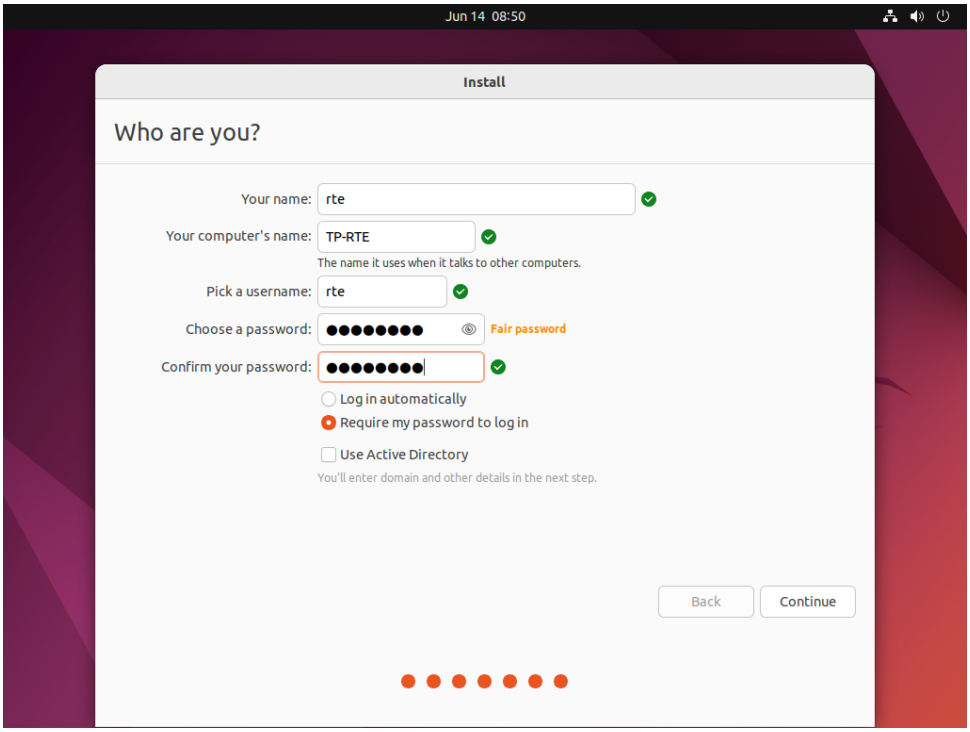


Fig. 5.8: Fill in the credentials.

Hint: In this guide the default user used is `rte`. It's recommended to supply a password.

- Restart –> `RestartNow`

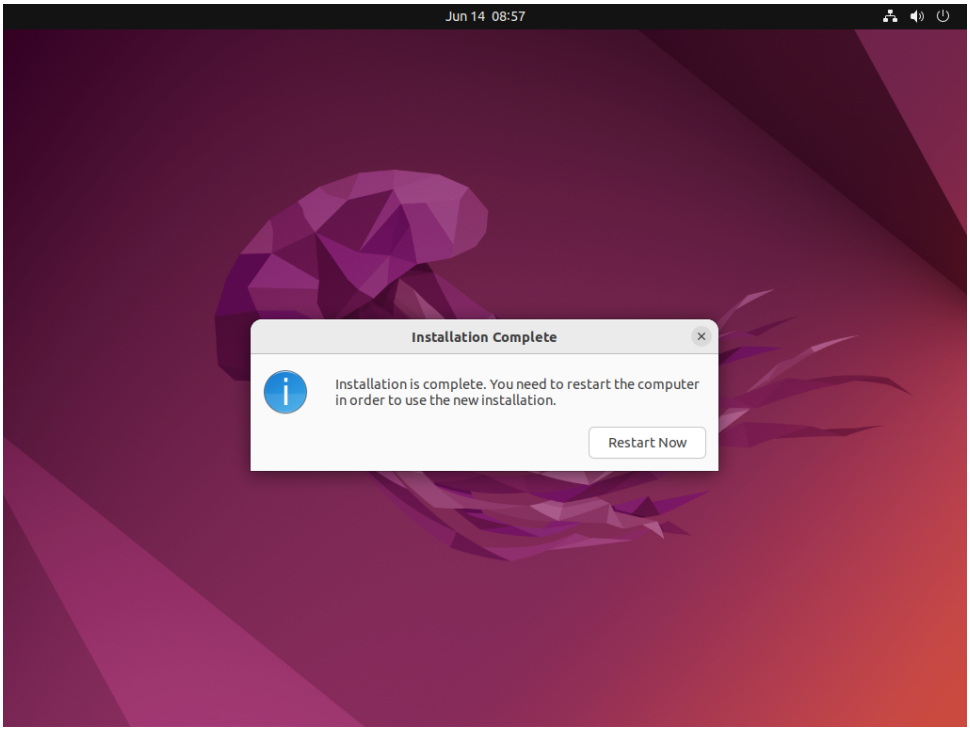


Fig. 5.9: Restart guest.

- Press enter –> `ENTER`

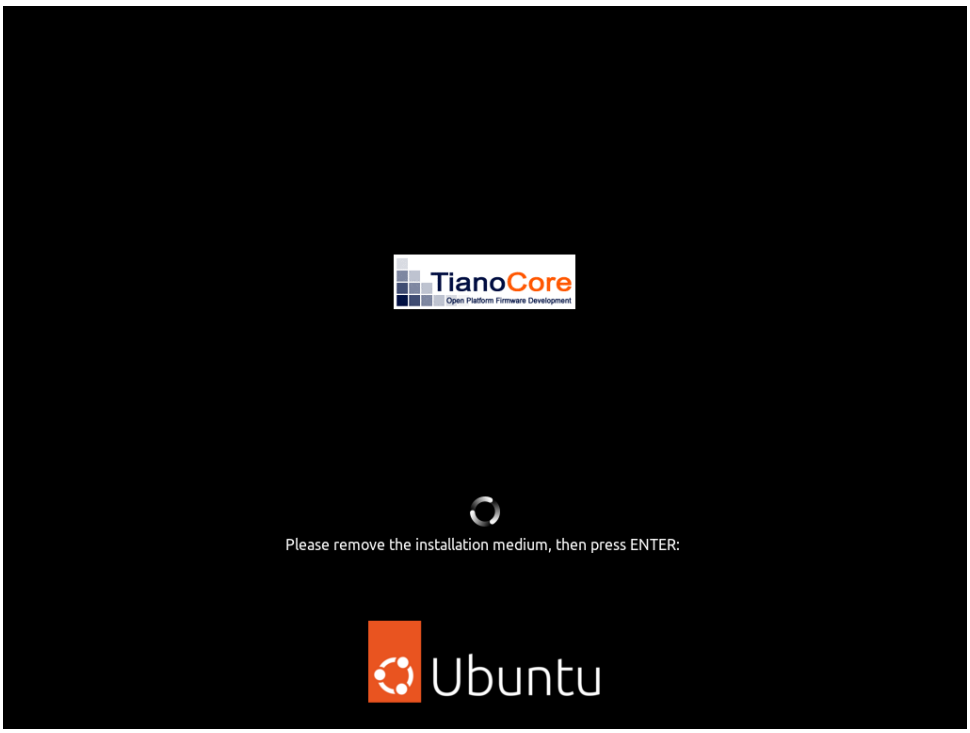


Fig. 5.10: Press `ENTER`.

- Login (in this example with user `rte` and the supplied password)

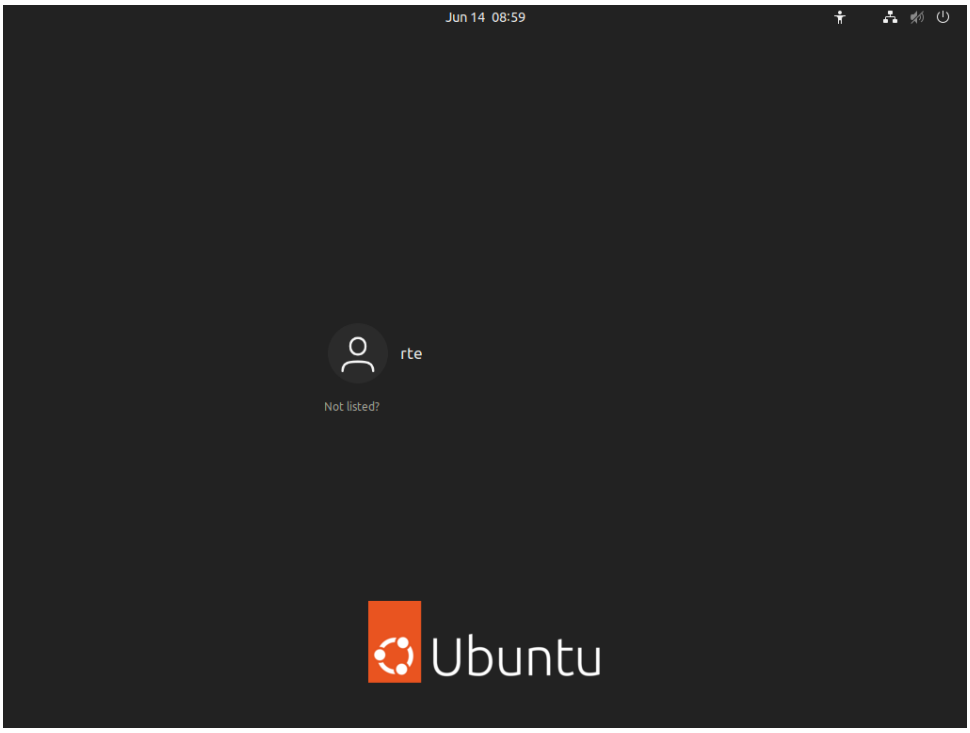


Fig. 5.11: Login into guest.

- `OPTIONAL` Update guest –> `InstallNow`

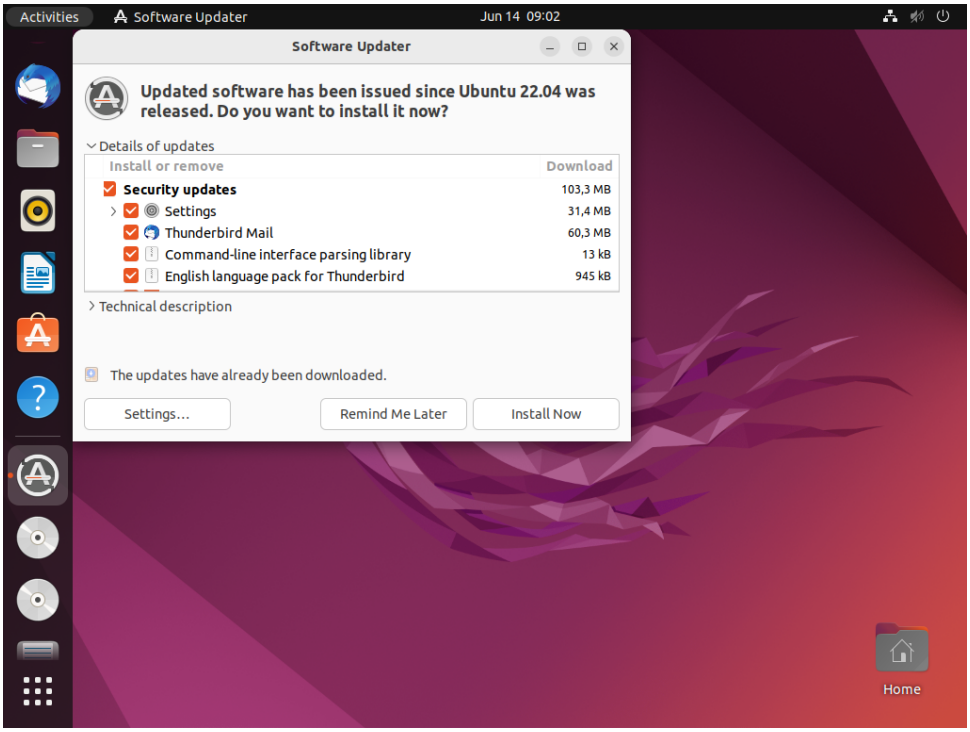


Fig. 5.12: Update guest.

6 Running Ubuntu guest

After successfully installing Ubuntu, you need to shutdown Ubuntu.

- Shutdown Ubuntu

Important: You need to shutdown the guest (do **NOT** reboot Ubuntu!). If this not possible inside the guest, please run hv_guest_stop in the guest folder (/hv/guests/examples/ubuntu).

- Adjust the file usr_guest_config.sh (to avoid booting the installation media again)

  ```
  $ gedit /hv/guests/examples/ubuntu/usr_guest_config.sh
  ```

  ```
  comment "cdrom_iso" with #
  ```

- Start the Ubuntu guest

  ```
  $ hv_guest_start -view
  ```

Hint: Due to hardware changes, Ubuntu may automatically reboot once. Mouse and desktop may still not work properly. In this case, please install all of the latest Ubuntu updates.

---

7 RTOS Communication Support

7.1 Installation

To communicate with an RTOS via the Hypervisor we need to run `install_attach.sh` which will install the required drivers and packages.

The installation is provided in a mountable directory. To access this directory we need to install the network client software (cifs-utils) and mount the SMB drive from QEMU where the installation is located.

Open a `console` prompt in the Ubuntu guest and enter the following:

```
$ sudo apt-get update
$ sudo apt-get install cifs-utils
$ sudo mkdir /mnt/qemu
$ sudo mount -t cifs //10.0.2.4/qemu /mnt/qemu -o guest
$ sudo /mnt/qemu/files/LinuxTools/install_attach.sh
```

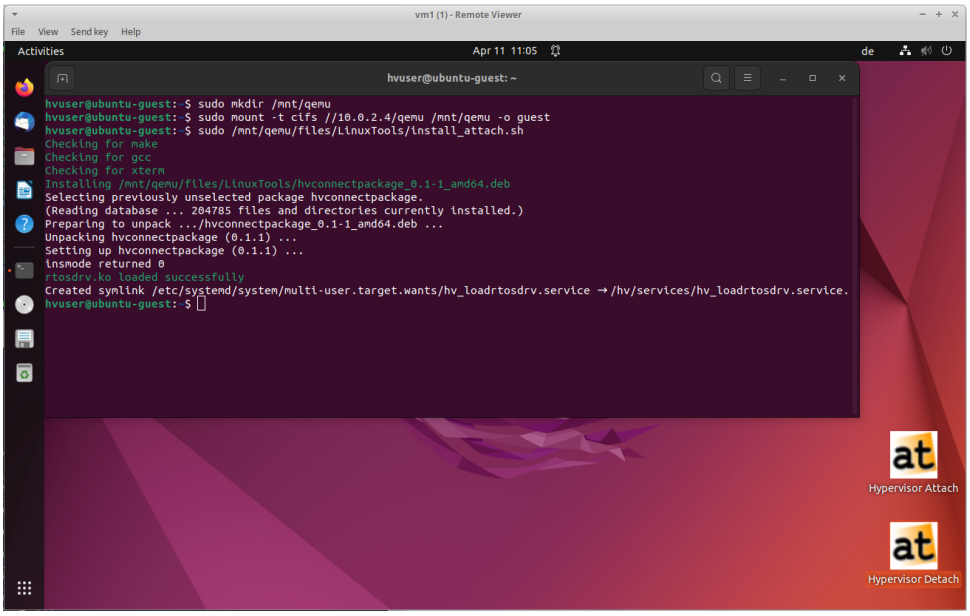


Fig. 7.1: Setup command.

With the installation process, the directory `/hv` is created. This is where all the essential binaries and files, required for the hypervisor in the Ubuntu guest environment, are stored.

Hint: If you encounter problems like `hvconnectpackage depends on <package-name>` when running the command `install_attach.sh`, you may have to install missing packages. Read the messages to see which package is missing. Then install the missing package. Before you can call `install_attach.sh` skript again you must first remove the aborted installation.

- Step 1: Run Ubuntu console
- Step 2: Input the command in the window: `sudo dpkg -r hvconnectpackage` and press `Enter`.

- Step 3: Input the command in the window: `sudo apt install <fill in missing packages here>` and press `Enter`.
- Step 4: Input the command in the window: `sudo /mnt/qemu/files/LinuxTools/install_attach.sh` and press `Enter`.

7.2 Load the driver at startup

For enabling communication between the Hypervisor Host and other RTOS systems on the hypervisor the driver `/hv/bin/rtosdrv.ko` needs to be loaded. To accomplish this you can start the service manually with `/hv/bin/load_rtosdrv.sh` or link the service `/hv/services/hv_loadrtosdrv.service` to the autostart function and enable it.

Open `console` prompt in Ubuntu guest and enter the following:

```
$ sudo ln -s /hv/services/hv_loadrtosdrv.service
↪  /etc/systemd/system/hv_loadrtosdrv.service
$ sudo systemctl start hv_loadrtosdrv.service
$ sudo systemctl enable hv_loadrtosdrv.service
```

Upon system startup, this service triggers the execution of the script `/hv/bin/load_rtosdrv.sh`. The purpose of this script is to verify the compatibility of the driver, recompile it if necessary, and then initiate it. This process guarantees the ability to load the driver even in the event of an operating system update.

7.3 Prepare for shared memory

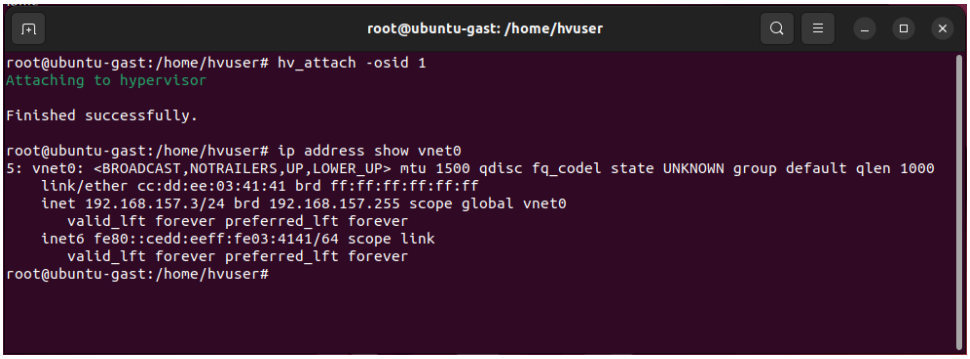
In order to use shared memory between Ubuntu guest and RTOS, modifications must be made to `/etc/default/grub`. These adjustments are executed automatically during the installation process, after which grub is updated. Before these changes take place, a backup copy of the grub file is created and stored the `/etc/default` directory.

The installation process adds `noexec=off` and `clearcpuid=nx` to the `GRUB_CMDLINE_LINUX` line within the grub file.

7.4 Verify installation

To verify whether the installation was successful, you can invoke the driver with the command `hv_attach -osid <OSID>`. The needed OSID was set with `export rtosOsId=<OSID>` in `guest_config.sh` when installing the Ubuntu guest. If hv_attach responds with 'Finished successfully', it indicates that the driver was correctly loaded and a connection was successfully established.

In this case, you can also check if a virtual network has been set up using `ip address`. Here you should see a vnet address.


root@ubuntu-gast: /home/hvuser
root@ubuntu-gast:/home/hvuser# hv_attach -osid 1
Attaching to hypervisor
Finished successfully.
root@ubuntu-gast:/home/hvuser# ip address show vnet0
5: vnet0: <BROADCAST,NOTRAILERS,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UNKNOWN group default qlen 1000
link/ether cc:dd:ee:03:41:41 brd ff:ff:ff:ff:ff:ff
inet 192.168.157.3/24 brd 192.168.157.255 scope global vnet0
valid_lft forever preferred_lft forever
inet6 fe80::cedd:eeff:fe03:4141/64 scope link
valid_lft forever preferred_lft forever
root@ubuntu-gast:/home/hvuser#

8 Ubuntu and Real-time guest in parallel

Caution: The `hv.config` configuration file is a link to the RT-Linux example guest configuration file. See also chapter **Example guest folders** in the Hypervisor Manual for more information.

In this step, we will run `Ubuntu` and `Real-Time Linux` in parallel.

- Shutdown `Ubuntu`, do **NOT** reboot!
- Run the `Real-Time Linux` guest

```
$ cd /hv/guests/examples/rt-linux
$ hv_guest_start -view
```

- Open a second shell (right click on desktop and select *'Open Terminal here'* **or** press `CRTL` + `ALT` + `T`)
- Start the `Ubuntu` guest

```
$ cd /hv/guests/examples/ubuntu
$ hv_guest_start -view
```

- **After logging in into Ubuntu, execute "Hypervisor Attach" (Desktop icon)**
  or open a shell and call `hv_attach -osid OSID`

  The needed OSID was set with `export rtosOsId=<OSID>` in `guest_config.sh` when installing the Ubuntu guest.

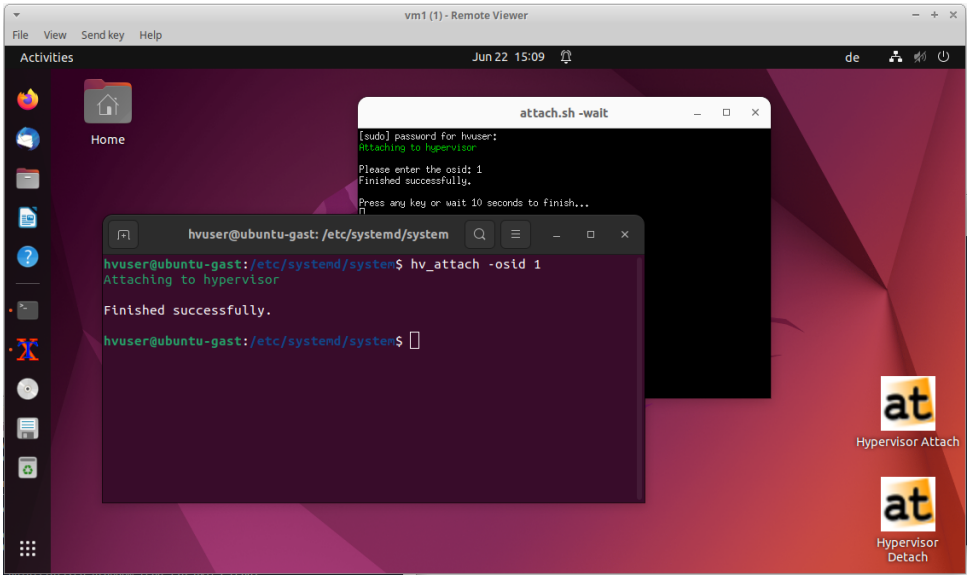


Fig. 8.1: Hypervisor Attach.

- To open the RT-Linux shell in Ubuntu guest: execute `ssh root@192.168.157.2` in Ubuntu shell

Fig. 8.2: Linux Shell.

Hint: With hv_attach, the driver establishes a virtual TCP/IP connection to the Hypervisor Host and the initiated RTOS systems on the hypervisor using the built-in rtosvnet driver. The IP Address is configured in `guest.config`:

```
[Rtos2\\Vnet\\0]
"IpAddress"="192.168.157.3"
"MacAddress"="AA:BB:CC:DD:EE:03"
```

- Log into `Real-Time Linux` and run the *Real-time* demo:

```
$ vmf64 login: root
$ password:  root
$ RealtimeDemo
```

9 Add an additional Ubuntu guest [OPTIONAL]

To clone an existing VM, follow the same steps as described in the `Hypervisor` manual.

As an *alternative* to cloning the installed `Ubuntu` image, it's also possible to use the `ubuntu.iso` installation media again – like in the previous chapters – and install it into another guest folder `/hv/guests/examples/ubuntu2`. See the `Hypervisor` manual for more details.

Hint: The *same* changes of *this* chapter applies **accordingly** for more `Ubuntu` guests (like `ubuntu3`, `ubuntu4`, etc).
