Institute of Electrical and Microengineering
Biomedical and neuromorphic microelectronic systems

Systèmes logiques 2023, SMT-BA3, SEL-BA3. EE110-EE207-2023_SW01_v3.1.fm

v1.6	A. Schmid	2020, March 18	v2.0	A. Schmid	2021, February 24	v2.1	A. Schmid	2021, August 11
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SYSTEMES LOGIQUES
EE-110, EE-207 SOFTWARE INSTALLATION

Introduction

All software used in used in the EE110 and EE207 courses can be installed on personal computers free of charge from the software providers. Three methods are offered, namely i) hard local installation in a Windows environment, ii) virtual machine and iii) USB key.

- The local installation of all software is the preferred installation as the most robust and fast in usage. The full local installation is covered in the following Section 1 through Section 4.
- The virtual machine option is not recommended as slower in usage, and is covered in Section 5. This option can be considered using a powerful PC.
- The USB key option is conditionally recommended as fast in usage using a USB3.0 key and USB3.0 PC ports, and is covered in Section 6. This option can be considered using a recent PC.

All the software could also be installed in an Ubuntu operating system; the latter has been demonstrated fully operative within some alternate context, but has not been verified as such for EE110 or EE207.

Mac (Intel Mac) users are recommended the USB key option that has been tested fully functional (and fast) on MacBook Air with Intel i5 processor; steps in Section 6 must be taken. Mac (Apple silicon, M1, M2) users can use a partial solution explained in Section 7 and that has been tested on a MacBook Pro M2.

1. LOGISIM-EVOLUTION

The software logisim-evolution is used as the development and simulation environment for digital systems. The exact version of the executable may change along the course. At the moment of writing, a custom fork of version 3.7.2 is used. Only the java executables provided on the Moodle should be used, as they are customized to the board used in the class.

logisim-evolution.jar is a java executable that can be downloaded from the course Moodle site. java executables require that the java environment be installed. Please, check whether an up-to-date version of the java environment (>=16) is available by issuing following command from Windows Command Prompt, cmd:

```
>java -version
```

Alternatively, starting logisim-evolution that does not result into opening the GUI window reveals an incorrect version of the java environement that must be re-installed.

A suitable java environment (OpenJDK or OpenJRE) can be obtained free of charge from:

https://adoptopenjdk.net/releases.html

The full jdk/jre can be installed, for example Figure 1.1:

OpenJDK16U-jdk_x64_windows_hotspot_16.0.2_7

Double-click on the icon of the *.msi file, and follow the installation pop-up boxes (the pop-up boxes in Figure 1.2(a) through Figure 1.2(e) were captured during the installation of version 16U_jdk which justifies the display of this code; the installation of later versions follows and identical process).

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Figure 1.1: Selection of the appropriate jdk for download considering a Win10 64-bit installation.

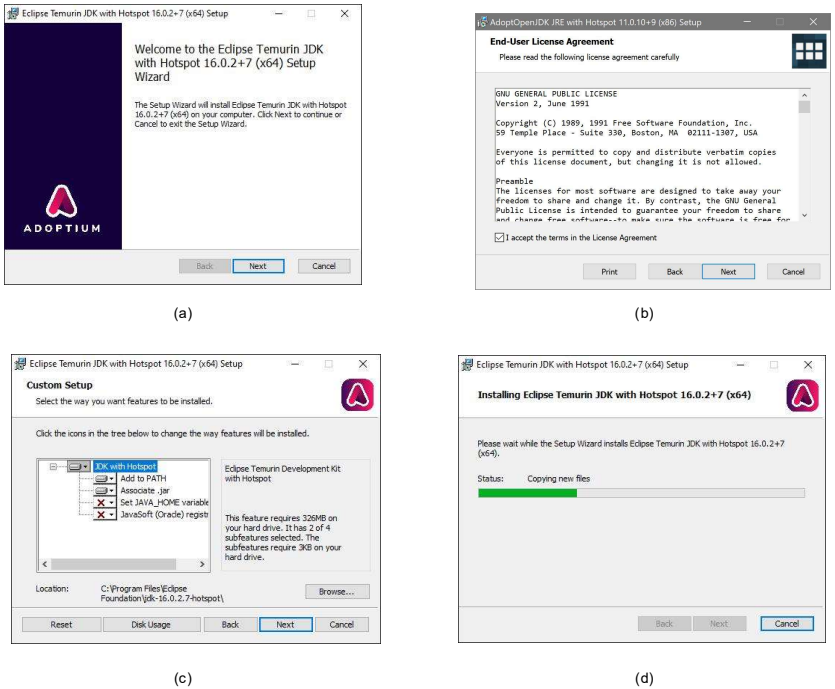
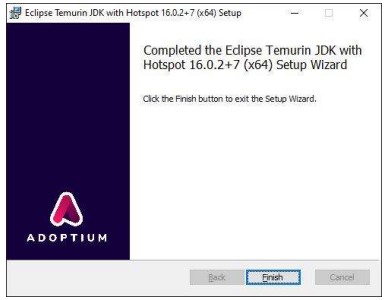


Figure 1.2: Successive steps of installation (a)-(e), showing some installation options.



(e)

Figure 1.2: Successive steps of installation (a)-(e), showing some installation options.

The java executable logisim-evolution.jar can be started by double-clicking the icon. In some cases of improper installation of the java engine, double-clicking the java executable yields a Windows error message. Nevertheless, the executable can be started using a Windows terminal command:

1. Windows Start menu → type "cmd" to start Windows application named "Command prompt"
2. navigate to the location of the logisim-evolution.jar file using command cd
3. start the application using following command: java -jar logisim-evolution-3.7.2-all.jar

By default, Windows will block network accesses from java. Some network access permission must be granted, at the first run (in some cases at the end of installation). A pop-up box will appear (Figure 1.3(a)), and suitable access must be granted by clicking and accepting. Installing the java updates that may be proposed from time to time is recommended. In addition, logisim-evolution may ask whether an online check of a newer version should be carried out, which should be declined to avoid nagging pop-up windows (Figure 1.3(b)).

Eventually, the main window of logisim-evolution appears as follows. A tutorial is available from the Help menu.

The files and projects that have been developed must be saved as myfile.circ in a safe backup.

Connection from logisim-evolution to hardware boards is done through the graphical user interface available from the FPGA→Synthesize and Download menu. This part is discussed later, and is trained in the laboratory sessions.

2. QUARTUS PRIME LITE

Quartus Prime Lite is the software that enables developing FPGA projects and downloading them to an FPGA board.

Quartus Lite Prime is used in a transparent way in EE207, EE110 in the sense that Quartus Prime Lite is called in batch mode using scripts from within logisim-evolution. Consequently, Quartus Prime Lite must be

(a)

(b)

Figure 1.3: Pop-up windows that appear on the first start of logisim-evolution.

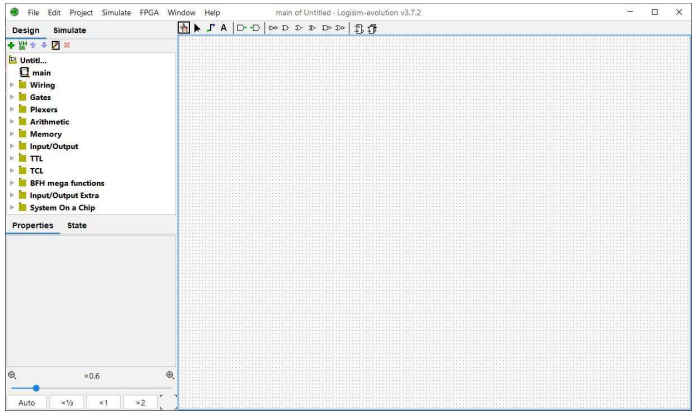


Figure 1.4: Main GUI window of logisim-evolution.

installed along with its appropriate hardware libraries, and logisim-evolution must be configured to point to and use it.

Quartus Prime Lite can be downloaded free of charge from the web site of Intel-FPGA, at following URL.

https://www.intel.com/content/www/us/en/collections/products/fpga/software/downloads.html?s=Newest

A full registration of the users including the creation of an account is not demanded.

The denomination “Altera” is the name of the company that has developed the FPGA circuit, and Quartus software, and that has been taken over by Intel under the roof of Intel-FPGA. The “Lite” version is a light educational edition of a professional software.

EE207, EE110 have been developed using Quartus Prime Lite version 16.1 and 21.1 for Windows. Other/later versions are expected to be (partly) compatible, but have not been verified.

The “Multiple Download” option can be taken, thought the total file size is higher than 5 GB.

For example (Figure 2.1), the following file has been downloaded, and the resulting file (.tar) unpacked (Figure 2.2), and is installed on a Window 10 laptop:

Quartus-lite-21.1.0.842-windows.tar

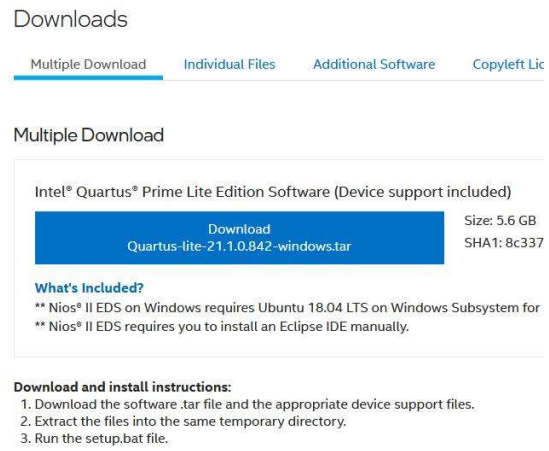


Figure 2.1: Unpacked contents of the Quartus intallation.

Double-click on the setup.bat file.

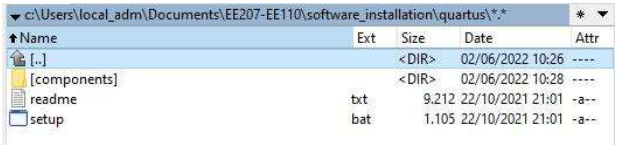


Figure 2.2: Unpacked contents of the Quartus intallation.

Windows may issue installation security warnings that must be agreed upon, *e.g.*, Figure 2.3.

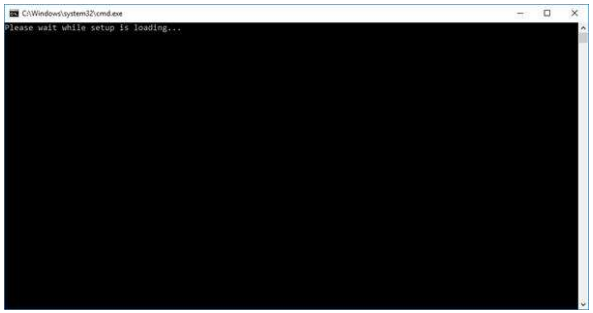
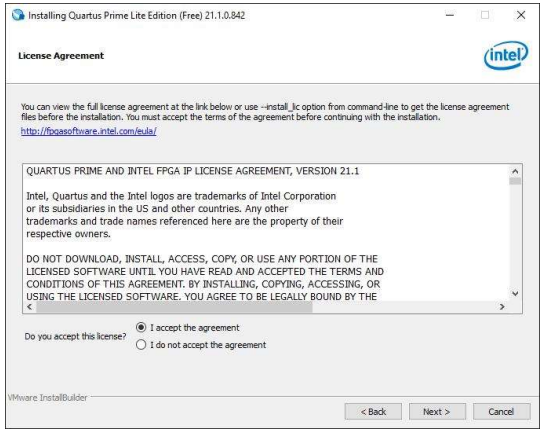


Figure 2.3: Pop-up terminal windows that may appear during the installation.

The windows presented in Figure 2.4 appear along the installation process.

(a)

Figure 2.4: Pop-up installation windows and their parameters.



(b)

Figure 2.4: Pop-up installation windows and their parameters.

Accept the installation of Quartus at the root of the C disk drive, Figure 2.5. No other disk is suitable.

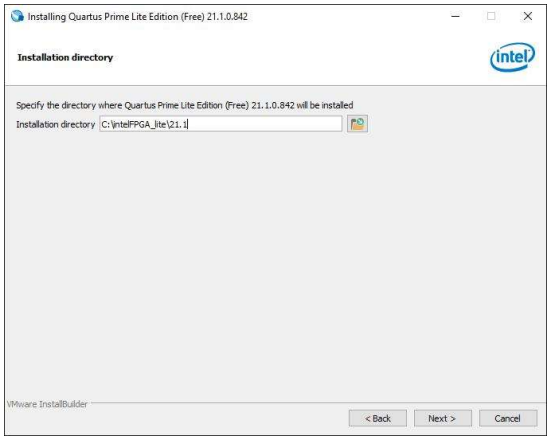
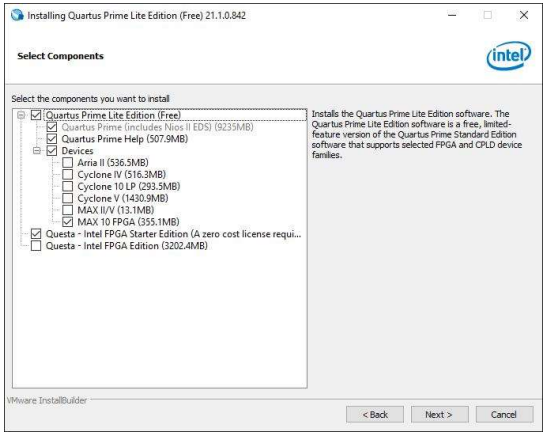
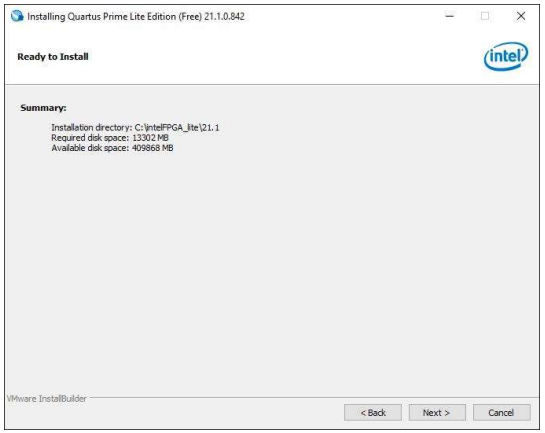


Figure 2.5: Installation of Quartus mandatory path.

As a default, the following installation is proposed. Please note that the FPGA that is used is a MAX 10 model, and thus, the other models may not be installed (Aria II, Cyclone IV, Cyclone V, MAX II/V). Also, the Questa simulator (Free edition) may be installed for carrying out advanced time-domain simulations, though it is not used early in the course.



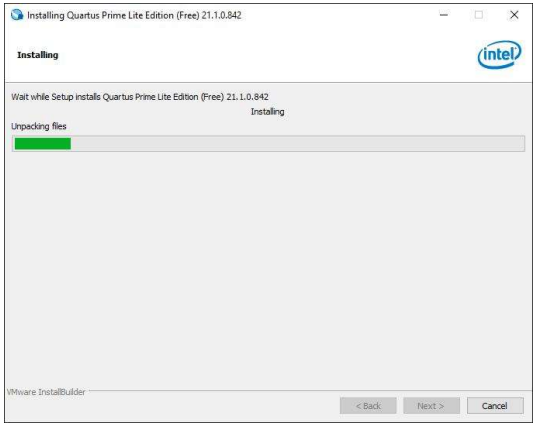
(a)



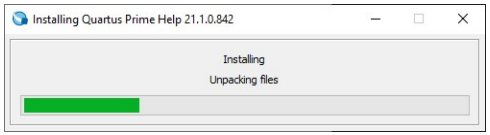
(b)

Figure 2.6: Pop-up installation windows, (a) installed libraries (boards) and (b) final confirmation step.

The installation of Quartus Prime Lite may take several minutes; this may vary according to the FPGA libraries that have been selected, Figure 2.7. Thirty minutes may be required for the full installation.



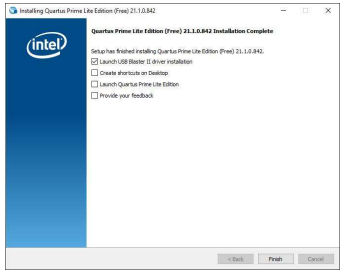
(a)



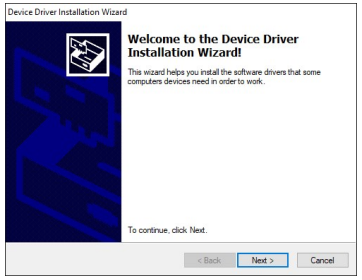
(b)

Figure 2.7: Installation process.

Quartus is used as a development and system synthesis platform. Quartus also carries out programming of the developed circuits into the target. To do so, drivers must be added to Windows.



(a)



(b)

(c)

(d)

Figure 2.8: Device driver installation and license acceptation.

The installation pop-up box in Figure 2.8(a)-(c) must be accepted (“Install”). The final step consists of the software license declaration, Figure 2.8(d).

Quartus Prime Lite can be started and used from this point. In EE110, EE207, Quartus Prime Lite is invoked from within logisim-evolution, and is never used as an independent platform.

3. SOFTWARE INSTALLATION TESTING AND HARDWARE PROGRAMMING

A test circuit that enables verifying the simulation, download and operation on the target boards can be prepared. For example, test_circuit01.circ presented in Figure 3.1 verifies combinational and sequential operations; inputs are given from the buttons (main and daughter board) and outputs are displayed on the main board LEDs.

logisim-evolution is started and the circuit loaded, or designed.

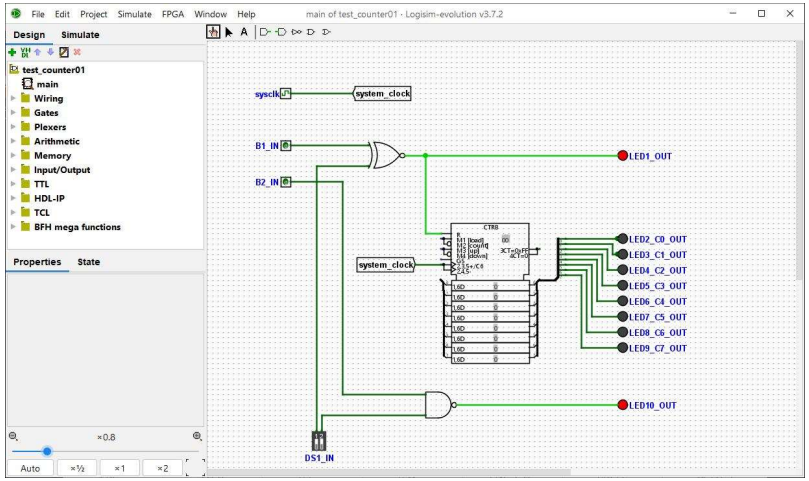
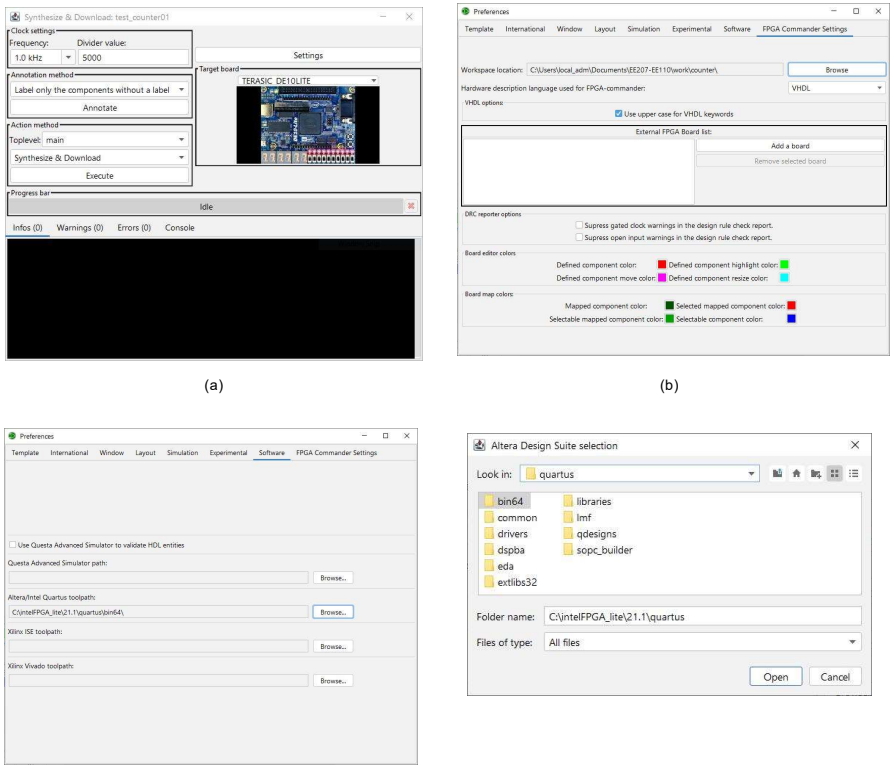


Figure 3.1: Example circuit allowing the test of some major functions on-board.

Start the FPGA Commander from the FPGA→Synthesize and Download menu. The following configuration must be thoroughly asserted

1. From the main window, Figure 3.2(a), select the board as the TERASIC_DE10LITE and assign it a processing tick frequency. Identify the top-level cell. Annotate if you have left some nodes of your circuit unnamed, which is the normal case using the logisim-evolution GUI. Decide on the action to take, *e.g.*, Synthesize and download.
2. From the Settings→FPGA_Commander_Settings, identify your workspace as a location on your disk to which the system has full access, Figure 3.2(b) .
3. From the Settings→Software identify the location of Quartus Prime Lite (Altera/Intel Quartus toolpath),, Figure 3.2(c)-(d).



(a) (b)

(c) (d)

Figure 3.2: Configuration of the Synthesis and Download "FPGA Commander."

The correct location of Quartus must be given to the logisim-evolution, that will invoke Quartus in batch mode.

An incorrect location of Quartus would result in a warning or error message, at this point, Figure 3.2.

Figure 3.3: Incorrect path to Quartus.

Using earlier versions of logisim-evolution (e.g., 2.13.22) would not cause any error message to pop up. Simply, the process would be stopped during the download step, and the programing would not occur. This symptom should be considered.

The location of all the files that are generated by Quartus in the synthesis, place and route and download processes can be changed from its default assignment using the Workspace configuration. Windows assigns a default value which should be known and can be modified:

C:\Users\your_name\logisim_workspace

An annotation is done, following a safety rule such that all nodes be given a name. Click over the “Annotate” button, Figure 3.4.

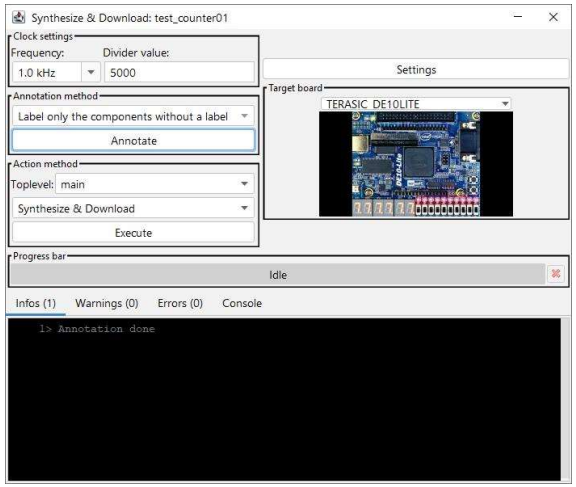


Figure 3.4: Synthesize and Download, annotation done.

Then, download is carried out by clicking the Execute button. The following window pops-up that allows assigning the IOs of the schematic to the physical board IOs. This latter window tends to stay over all other windows.

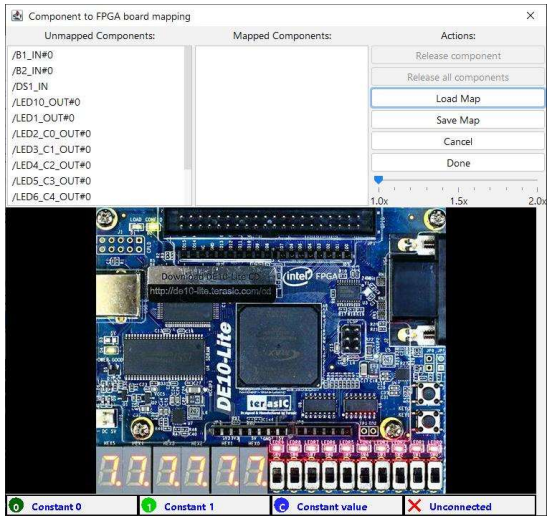


Figure 3.5: Board pins assignments.

The bottom part of Figure 3.5 shows a photograph of the TERASIC_DE10LITE board consisting of a Terasic DE10-Lite board including an FPGA and peripherals. The IOs components that should be assigned will appear in light red in this window, as possible assignment choices.

A component from the list “Unmapped component list” is first selected. For example, component PIN: B1_IN is selected that corresponds to the input of the schematics that bears the name B1_IN. This input must be clicked over one or two times, depending on the level. Possible assignment choices appear as light red boxes overlaid onto IOs of the board figure. Clicking over one light red box assigns the pin to the IO. A reasonable choice for B1_IN is the motherboard button located on the right side and marked with an overlaid arrow in Figure 3.6.

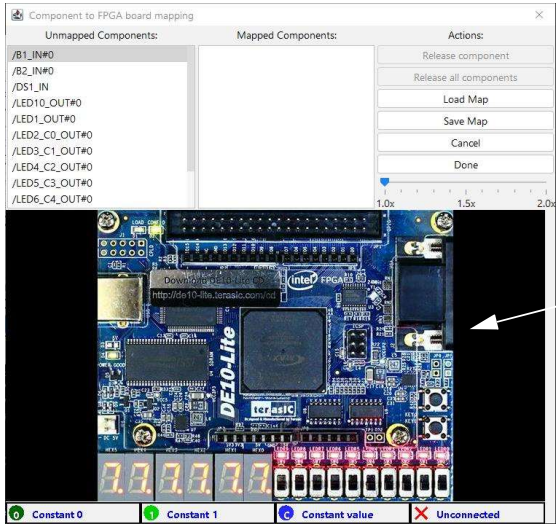


Figure 3.6: Assignment of a button.

The selected pin appears in the list of "Mapped component list." The selected components show under a green mask, Figure 3.7. All masks can be selected to verify which pin has been assigned to them. Obviously, two pins or signals can not be assigned to one IO.

All components must be mapped, for example following the description in Figure 3.8.

The mapping can be saved using the menu that saves the mapping inside the original circuit file. Thus, the mapping is automatically retrieved upon loading a new file. This feature should be extensively.

Incorrect assignments can be modified using the "Release ..." menus.

When all assignments are completed at satisfaction, proceeding to the board programming is carried out from the "Done" button. An incorrect definition of the path of Quartus in the earlier Toolpath step would result into a process that stops at the following window, for versions of logisim-evolution earlier than 2.13.22, *e.g.*, Figure 3.9.

In contrast, the correct process shows the progress bar in Figure 3.10 that indicate the status of Quartus operations. Please note that the full process may be long, specifically on its first run. Simulations must confirm the correct operation of the entire schematic. Download to the target board can be carried out after successful simulations, only. Expressed differently, the board can not be used for debugging purposes.

After completion of optimization and synthesis, Quartus displays a dialog box asking for downloading the design into the target FPGA, which can be acknowledged.

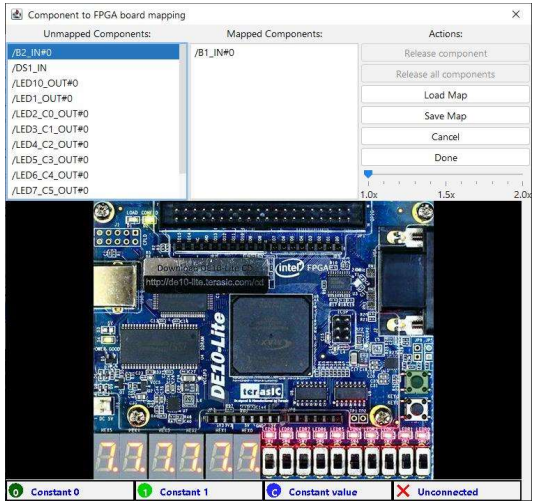


Figure 3.7: Assignment of a button completed.

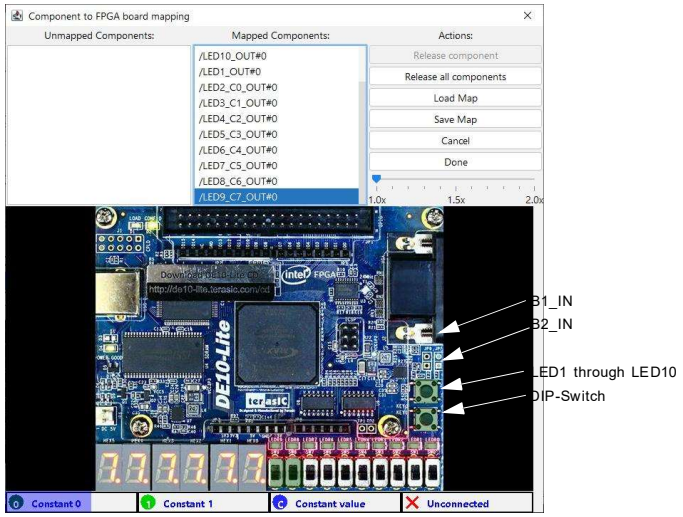


Figure 3.8: Full I/Os assignments completed.

Download failure is marked by the following error message that appear inside the console over a red background "***** FATAL***** Failed to download design; did you connect the board?" Also, the initial board setup that display numbers on the seven-segment display while blinking the LEDs would not stop.

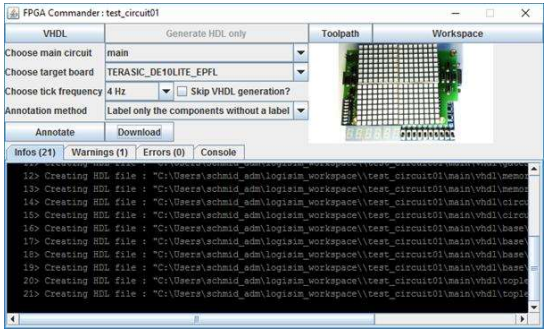


Figure 3.9: Incorrect assignment of Quartus resulting in a process that seemingly never terminates.

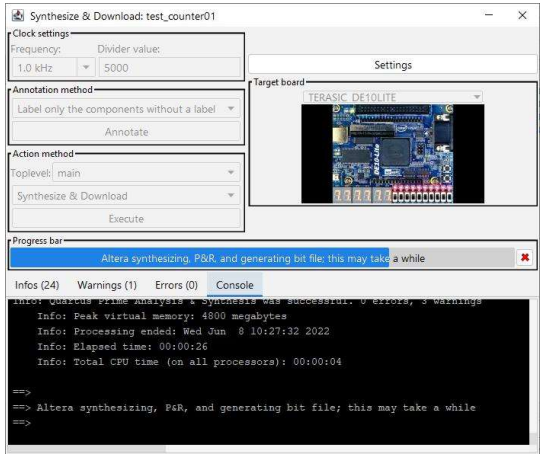


Figure 3.10: Correct progression window, showing the console progress status and and progress bar (grey zone over the console).

Figure 3.11: Download confirmation dialog window.

This error may be due to the faulty installation of the USB-Blaster driver. Also, this error tends to show up at the first download attempt.

In addition, please note that this window displays four tabs that carry over relevant information, namely the Info, Warnings, Errors, and the Console tab. It is worth it checking all of them.

A successful download is expressed from a Console information similar to the information that appears below.

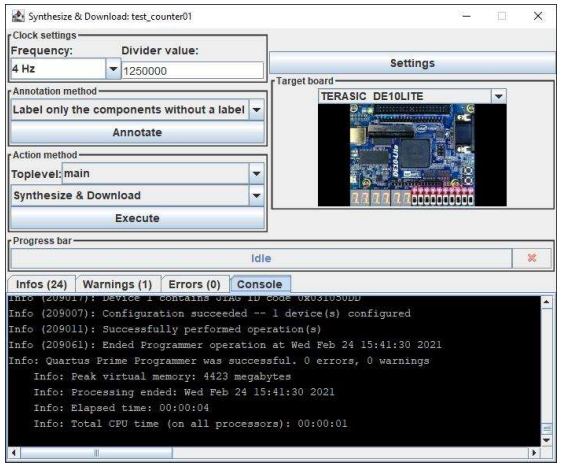


Figure 3.12: Successful completion of download.

At this point, the circuit that had been developed in logsim-evolution is implemented on the target board, using the assigned IOs. The correct operation can be checked on the target system. In the proposed example, some buttons can be pressed, that should infer a specific behavior observed at the LEDs:

- Sequential circuit: pressing button B1 releases the reset of the counter; binary counting is seen on LEDs 2 to 9.
- Combinational circuit: pressing buttons B1 and B2 and selecting the DIP-Switch reflect to the LED1 through an XNOR gate and LED10 through a NAND gate.

Note that this is only a basic test aimed at verifying the correct software installation, download process and basic board functionalities.

Disconnecting the FPGA from the PC will cause a power failure, since the DE10-LITE board has no battery supply. In addition, the configuration that has been programmed is lost. In order to download the circuit, the very long re-synthesizing is not necessary, i.e., the “Action Method” configuration window of the Synthesize and Download can be change from its default to Download Only.

4. USB-BLASTER DRIVER INSTALLATION

The proper installation of the USB driver is observed to be potentially unsuccessful. This leads to the error "FATAL; Failed to download design" read from the Error tab and an additional message in the Console tab that states that the USB cable can not be found. The USB driver also appears not installed from Windows Device Manager (right-click on Start, then select Device Manager). The Universal Serial Bus Controller driver named "Altera USB Blaster" shows an error, and upon opening its properties, shows that the driver is not installed.

Alternatively, upon plugging the USB cable to the PC for the first time, an incorrect installation of the driver may trigger a new installation process. In this case, the location of the driver must be entered as shown below.

A proper re-installation of the USB-Blaster driver can be carried out from the installer located as presented in Figure 4.1.

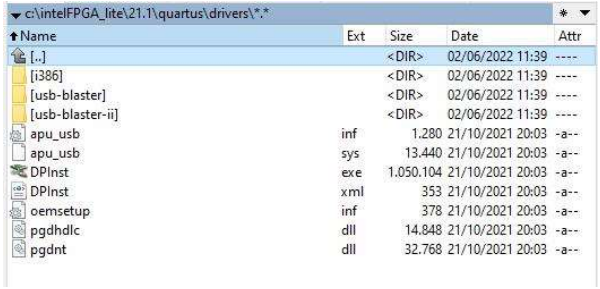


Figure 4.1: List of files.

The installer is named DPInst.exe. The start of the installation is confirmed from the window in Figure 4.2.

The process should show the correctly installed driver.

Though, the following incomplete driver installation can be tolerated, Figure 4.3.

Then, the PC may need to be restarted upon appearance of the popup message (Figure 4.4).

Figure 4.2: Installation dialog window.

Figure 4.3: Device driver status installation window.

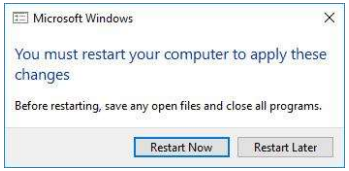


Figure 4.4: Restart request pop-up window.

5. VIRTUAL MACHINE

A VirtualBox virtual Win10 machine that has been installed with all drivers and correct software versions can be used. Its installation must be done properly. The VM can be found from the Moodle site of the course.

As a general observation, virtual machines operate slower than local installations which should be preferred.

5.1 INSTALLATION

VirtualBox is installed in version 6.1.22r144080, *e.g.* Some steps are displayed in Figure 5.1. The software can be downloaded from the course servers or from https://www.virtualbox.org/wiki/Downloads.

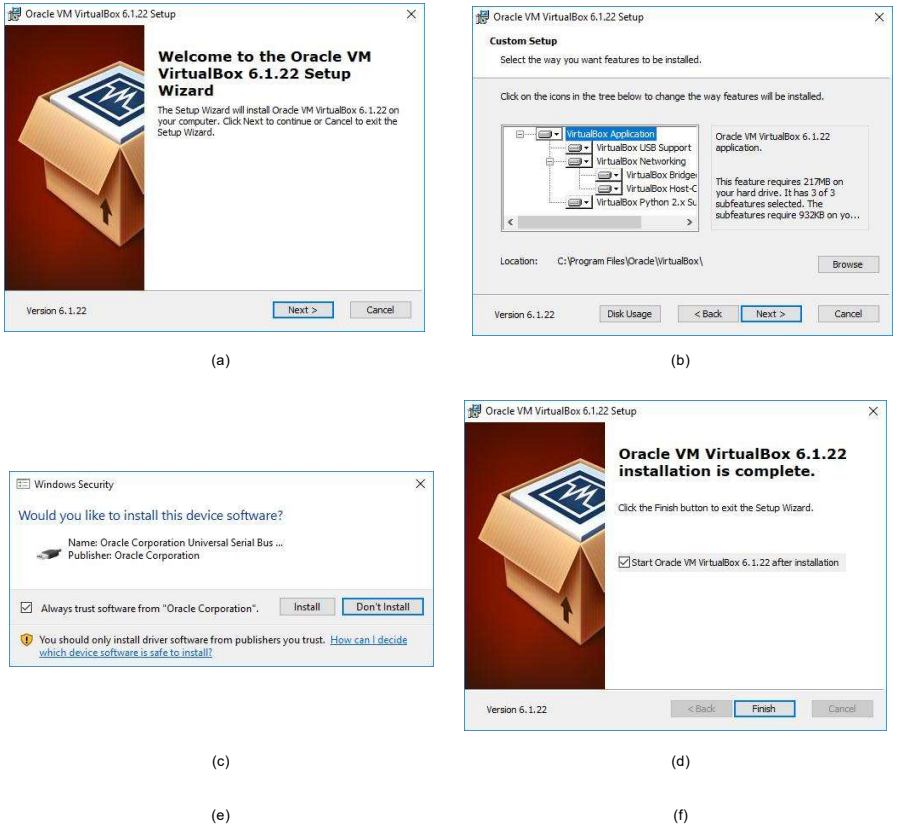


Figure 5.1: Some steps (a) through (c) of the installation process under Windows 10. Note that the security warning in (c) must be accepted (Install option).

The actual virtual machine must be copied locally, which consists of two files, namely EE110-EE207-EE208-MICRO210_Win10VM.vbox and EE110-EE207-EE208-MICRO210_Win10VM.vdi.

5.2 OPERATION

The course virtual machine must be referred to from VirtualBox. Use the menu Machine → Add... and refer to the virtual machine EE110-EE207-EE208-MICRO210_Win10VM.vbox. The new virtual machine appears in the left-hand side column, under the tools.

The virtual machine must then be adapted to the host (hard computer). Click on the left-click on the virtual machine and then left-click on the Settings button. A new window pops up that allows adjusting several setting. Importantly, under System → Motherboard and System → Processor, adjustments should be made to (reasonably) increase the amount of memory allocated to the VM as well as the number of CPUs. Keeping the default values may result in a virtual machine that is excessively slow. The host PC should not run any other application, and should only be allocated one CPU in VirtualBox → Settings → System; the amount of memory allocated to the VM should be as high as possible, *i.e.*, some memory must be kept for the host OS (2-3 GB). The USB 3.0 should be activated under Settings → System.

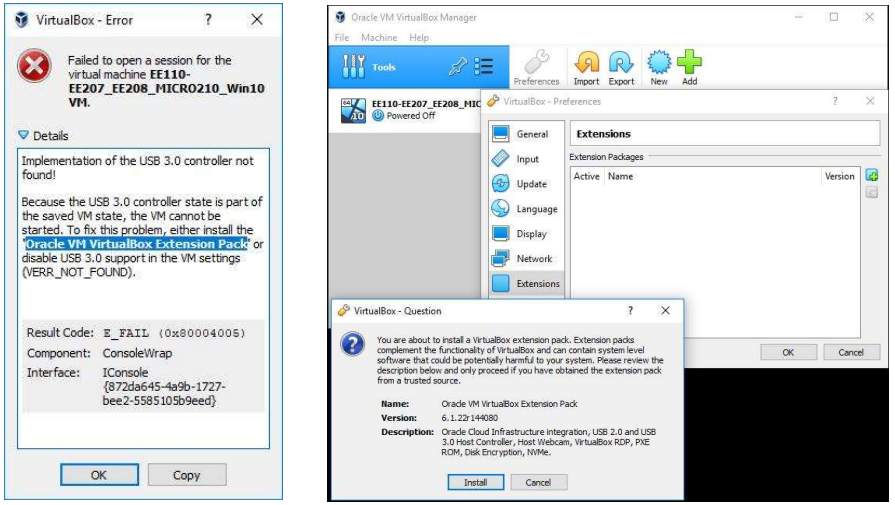


Figure 5.2: (a) Error message resulting in starting the course virtual machine without installation of the extension pack, and (b) three consecutive pop-up windows in the installation of the extension pack.

In addition, the Oracle extension pack must be installed, Oracle_VM_VirtualBox_Extension_Pack-6.1.22r144080. Please note that the extension pack version must exactly match the version of the VirtualBox software. Failing to install the extension pack will yield the error message in Figure 5.2(a). The extension pack is installed from the File → Preferences → Extensions → Add consecutive buttons, as presented in Figure 5.2(b).

After the virtual machine has started, the "Guest CD Addition image" (VBoxGuestAdditions.iso) may also be installed to control over additional features. The menu is named Devices and the image is located in the installation directory of VirtualBox (*e.g.*, C:\\Program Files\Oracle\VirtualBox).

5.3 OPERATION USING SYSTEMS CONNECTED TO A USB PORT

Everytime a new device is connected to the USB, the actual connection must be manually activated:

(menu at the bottom of the window) Devices → USB → *activate the required device*. The needed devices very often relate to an FTDI driver *(e.g.*, AVRISP-U, RS232 white cable): FTDI UTRS232R, FTDI Dual RS232 or the Altera (Intel-FPGA) driver named Altera USB Blaster.

First insert the USB cable and connect the device, then activate the driver that has appeared in the list.

It is possible to use a USB extension hub (even with the RS232 communication). Several USB ports activations must be done in this case (one for each device, not one single for the USB hub).

5.4 KEYBOARD

A virtual keyboard can be used in case some software tools do not capture the function Fn keys:

(menu at the bottom of the window) Input → Keyboard → Soft keyboard.

6. USB KEY

A operative system image that is suitable and installed with the course software can be downloaded and copied on a movable device, *e.g.*, a USB stick. The system image can be found from the Moodle site of the course.

The installation procedure is simpler than the virtual machine, and the run-time operation is also faster.

A 64GB USB3.0 (or higher) is recommended. An external HDD/SSD or a USB2.0 are also suitable. Note that the target drive (USB stick or HDD/SSD) will be fully erased, and thus using a USB stick is more effective than an external HDD/SSD. Using USB3.0 will only guarantee faster operation than USB2.0.

6.1 INSTALLATION

The system image, *e.g.*, named W10-IEM.vhd must be copied on a local disk drive.

The software tool rufus-3.15p.exe (https://rufus.ie/en/) can be downloaded in its portable version which does not require a local installation.

Insert the external drive that will be used for installation, and pay attention that all data on this external drive will be lost. Ideally, this should be a free 64GB USB 3.0 stick. Start the cloning software rufus and configure it as follows. Under Device, indicate the external target drive onto which the system must be installed. Under Boot selection, indicate the location of the system image that was previously downloaded, *e.g.*, W10-IEM.vhd. Select Start, (Figure 6.1).

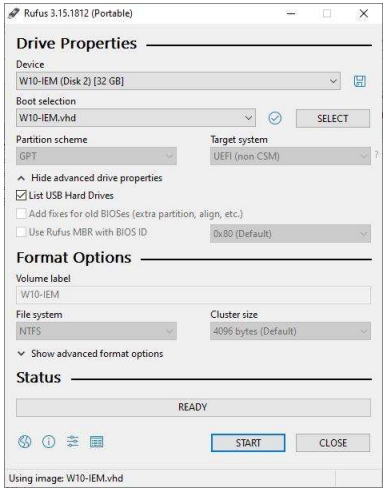


Figure 6.1: Rufus cloning software main window. The target (USB key) is to be entered into the "Device" menu, and the source (image file with .vhd extension) is to be entered into the "Boot selection" menu.

6.2 OPERATION

Restart you computer, and boot on the newly installed external drive. The selection of the boot device depends on the computer brand; this is usually done at boot time by pressing F12 or ESC or F8 or one other brand-specific key (Mac: option key), which interrupts the standard boot sequence, and branches to a selection of the possible devices to boot from. Use the arrow keys to navigate to the newly created drive (e.g., USB key) and press enter. The boot time depends on the USB version (3.0 fast, while 2.0 slower). Using a USB hub may also slow down the boot process, and may require booting with insistence on the first trials such that the device gets further recognized reliably.

Note that you may need to switch the Boot mode of the laptop/PC to UEFI. If necessary, this is done in the BIOS configuration. The boot of the PC must be interrupted by pressing F2, or F1, F10, ESC, DEL or one other brand-specific key. Then, a Boot mode parameter must be found and changed to UEFI. The PC can then boot on the USB key. This configuration must usually be manually switched back to enable correct booting on the non-UEFI local system and disk drive.

The first utilization of the key system on a specific laptop will cause updates of the key operating system involving software adaptations and automatic reboot sequences that take time.

7. APPLE SILICON MACOS OPERATION

Quartus does not support MacOS and neither supports Windows 11 at the date of this document. Specifically, it is the driver layer that does not operate correctly, while all applications that do not require FTDI drivers operate seamlessly.

7.1 PREINSTALLED VIRTUAL MACHINE

A virtual machine named "Windows_11-aarch64_v2.3" that includes logisim-evolution and Quartus operating on Windows 11 has been prepared and can be used. Downloading of files onto the DE10-Lite board is not possible. This operation is expected possible only when Quartus offers official support of Windows 11 for the Quartus Prime Lite version.

The virtual machine developed operates under the UTM Mac virtualizing software that can be freely downloaded form

https://mac.getutm.app/

UTM must be installed on the MacOS system and started.

The virtual machine (VM) can be downloaded using a link available on the Moodle course website. It can be loaded into UTM after unzipping it: File → Open and will appear as one new VM inside the right-hand side pannel. It is convenient to create a directory that is shared among MacOS and the Windows 11 VM. To do so, select your VM which becomes highlighted, then click on the "Edit Selected VM" icon located on the top right of the window. In the "Sharing" configuration, browse to indicate the path to the shared director, e.g. named "utm_shared." Additional parameters can be adapted to your hardware configuration, including the memory and number of allocated CPU cores; the performance of the VM will depend on this configuration (which is of course limited by the actual hardware). The VM can then be started and used by double clicking its icon or its represented window.

7.2 INSTALLING A VIRTUAL MACHINE

Alternatively, a VM can also be reinstalled from scratch. Hence, this part can be skipped if the preinstalled virtual machine presented in Section 7.1 is available. The procedure to install a new virtual machine reads as follows.

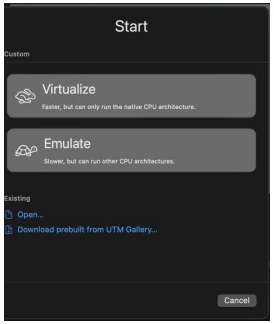
1. Download a Windows 11 aarch64 operating system available at Windows Insider Preview
   https://www.microsoft.com/en-us/windowsinsider/

   Register and sign-in a free account. Then move to the Windows Preview download

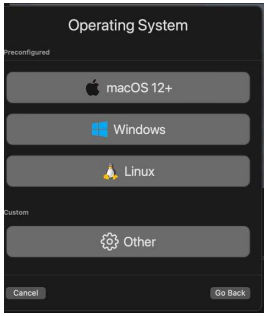
   https://www.microsoft.com/en-us/software-download/windowsinsiderpreviewARM64

   Confirm the exact requested version and download the following file.

   Windows11_InsiderPreview_Client_ARM64_en-us_22598.VHDX
2. Start UTM and start a new VM (File → New). Chose to Virtualize, i.e., not Emulate (Figure 7.1(a)). Select Windows as the operating system (Figure 7.1(b)). Select the aforementioned .vhdx file to create the VM by browing to the file, and make sure to tick both the "Import VHDX file" and the "Install drivers and SPICE tools" boxes (Figure 7.1(c)). Selected the allocated memory and CPU cores depending on the available hardware (Figure 7.1(d)). Indicate a directory that will be shared between MacOS and Windows 11 by browing to it, e.g., here named "utm_shared" (Figure 7.1(e)). The machine is created after a relatively long delay, and appears in the left-hand side pannel (Figure 7.1(f)). The new VM can be modified as long as the machine is not running from the "Edit Selected VM" icon located on the top right of the window.

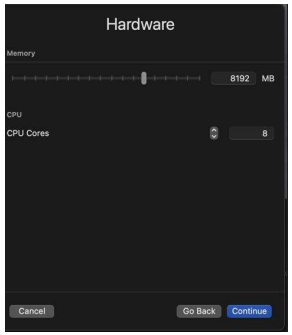


(a)

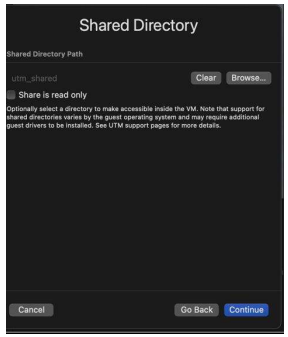


(b)

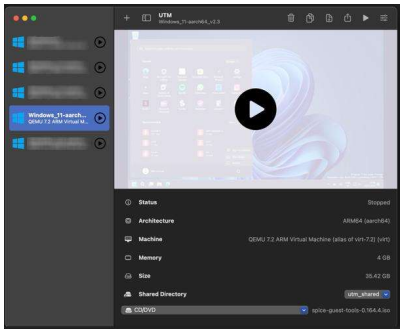
(c)



(d)



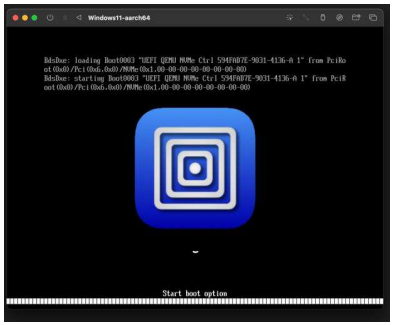
(e)



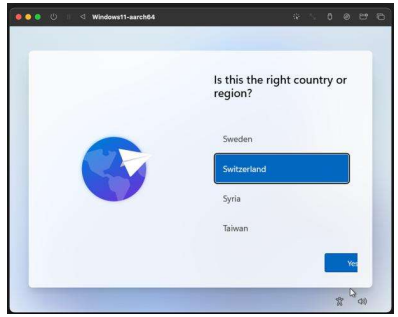
(f)

Figure 7.1: Creation of a new VM in UTM. (a) through (e) Consecutive configuration windows, and (f) resulting new VM selected among other VMs.

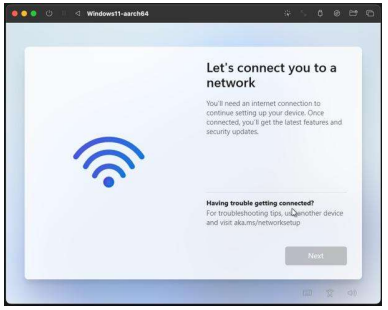
3. Double click on the new VM to start the installation process of Windows 11. The system may reboot several time prior to displaying the Windows 11 installation sequence (Figure 7.2(a)). Proceed through the installation sequence answering configuration-related questions (Figure 7.2(b)). At the moment of installing the network connection, no prompt to elude this step appears (Figure 7.2(c)); though, network cannot be installed at this step and thus a workaround must be applied as follows to let the option of not installing the network appear. Make sure the window is active (or click in it) and then press FN + Shift + F10; in case no command prompt appears, then it may be hidden and click on CMD + TAB to navigate to the command prompt (the application named "Terminal"). Type the following in the prompt "oobe\bypassnro" and enter (Figure 7.2(d)). The VM will restart and this time an option to bypass the network configuration will be available as "I don't have internet" and must be taken (Figure 7.2(e)). Note that the backslash character is accessed on a Swiss-French Mac keyboary as the combination of OPTION + < keys. Terminate the configuration of the installation by answering questions, and wait until the Windows 11 is ready (Figure 7.2(f)).



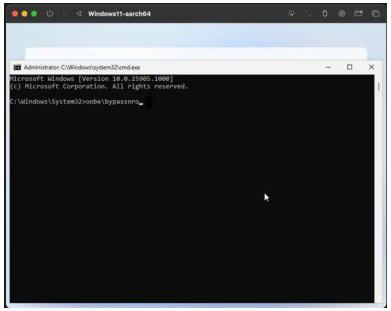
(a)



(b)

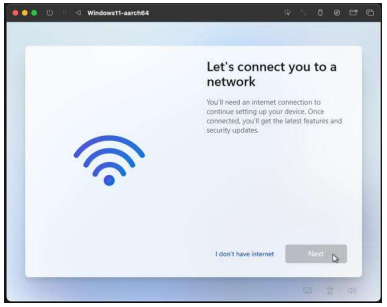


(c)

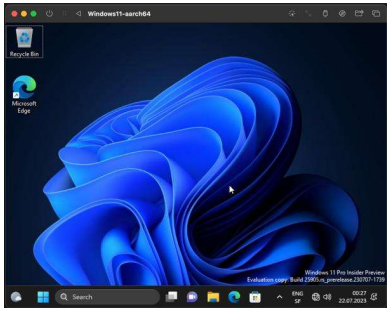


(d)

Figure 7.2: Installation of a Windows 11 VM on UTM. (a) Start of the UTM sequence. (b) Beginning of a classiscal Windows installation. (c) Network installation issue. (d) Prompt and command to elude the network installation issue. (e) After reboot, an option to not install the network is available. (f) Windows 11 VM installation completed.



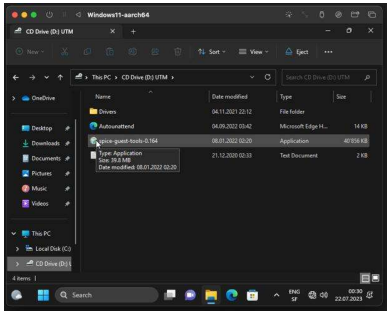
(e)



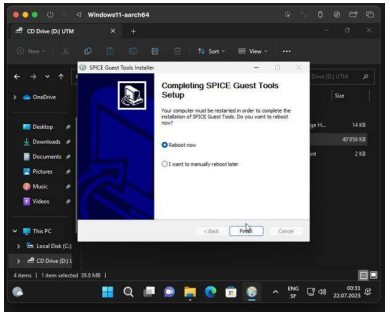
(f)

Figure 7.2: Installation of a Windows 11 VM on UTM. (a) Start of the UTM sequence. (b) Beginning of a classiscal Windows installation. (c) Network installation issue. (d) Prompt and command to elude the network installation issue. (e) After reboot, an option to not install the network is available. (f) Windows 11 VM installation completed.

4. When in Windows 11, please note that the emulation of the mouse right-click consists of pressing the keypad with two fingers in diagonal (one down-left one up-right). At this point, the machine can not be extensively configured, e.g., screen resolution and thus the SPICE tools must be installed. In order to do so, select the File Explorer, and open the CD. Execute spice-guest-tools.0.164.exe (Figure 7.3(a)). Accept all pop-up prompts and wait; finally, reboot the VM (Figure 7.3(b)).



(a)



(b)

Figure 7.3: Installation of drivers and SPICE tools; (a) starting the process and (b) during the installation process.

With this last step completed, the VM can be configured (e.g., adapt the screen resolution) and can connect (e.g., USB). In order to connect using USB, the port must be activated using the "USB devices" icon located on the top of the window.

5. All software can be installed and used on the VM following the explanation in Section 1 through Section 4.

6. It is best to shutdown the VM using the classical Windows 11 shutdown button to gurantee restoration of the session at next boot, Figure 7.4.

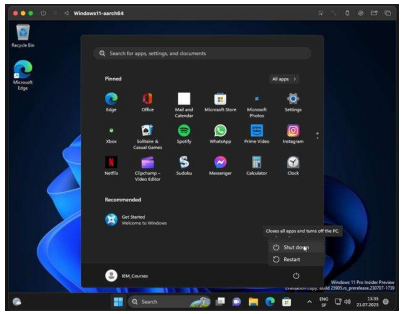


Figure 7.4: Shutting the VM down.