User Guide for tools installation

VirtualBox andVirtual Machine with Xenomai

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Warning: The downloading can be very long, from 20min to 2h! Do all the downloads long before you are planning to install the software. For example, during the breakfast, or dinner, or your sport hour.
You must have root install rights to perform this step.

This guide was tested in host machines with Ubuntu Linux, Apple Macintosh and Microsoft Windows platforms. There are 4 steps and a FAQ at the end of this pdf that you would check before call a teacher.
Remark: if you a find a different problem, try to explain your problem in this page: Wiki - Software
https://lms.isae.fr/mod/wiki/view.php?pageid=732&group=0

Step 1. Create a folder "xenomai803"
Remark: If you want to use a terminal, see box "Open a terminal in the host computer" in section 4.3.

Step 2. Install VirtualBox (VB):
You can download the last version of VirtualBox for your OS in Oracle website. It allows to run any virtual machine.VirtualBox is available for Linux, Macintosh, and Windows. Here, some shortcuts if the last version does not work for you:
Windows: https://download.virtualbox.org/virtualbox/6.1.4/VirtualBox-6.1.4-136177-Win.exe
MacOSX: https://download.virtualbox.org/virtualbox/6.1.4/VirtualBox-6.1.4-136177-OSX.dmg
Linux: https://www.virtualbox.org/wiki/Linux_Downloads

On Linux (Ubuntu) open the virtualBox installer (.deb) with "Software Install (default option)
On Windows, an icon is added to the Desktop after the installation.
In Mac, after putting the software in the Application folder, you can add the icon to the **Dock**

Step 3. Add the Xenomai VM (Virtual Machine) to VirtualBox

3.1 Download the Xenomai VM:
If you did not download the Xenome VM, here is the link.
Hint: The ZIP file has 506.4MB, but once installed it needs about 900MB. If you don't have enough space in your computer, you can install Xenomai on an external hard disk (it was what I did). If you install it in an external disk, do the step 1 in the external disk.

3.2 Decompress (unzip)
On Linux (Ubuntu), in the opened terminal: `unzip Xenomai.2.4.3.zip`
On Mac, according to the version (or browser option), the file may be already decompressed. If not, execute the above command.

Now you have a folder mae803/ Xenomai.2.4.3 with two files: the Virtual Machine definition for your OS (linux-macos-host.vbox, windows-host.vbox) and the Virtual Machine disk format (disk_image.vmdk)

3.3 Launch VirtualBox:
Double-click in the icon, or type the command `virtualbox` in a terminal.
In Windows, the icon is on the Desktop, in MacOSX in Application folder.
You'll see the starting window of VirtualBox (see Figure *1*).

Figure 1: VirtualBox 6.1 starting window

3.4. Add the Xenomai Virtual Machine (VM):

On Window, Linux or MacOSX: Click the **Add** button in the VB window (see right arrow in Figure *1*) and browse the file `*-host.vbox` (the *decompressed* Xenomai VM obtained in **Step 3.2**). The window of Figure 5 pops out. Notice that `xenomai` is Powered Off (on the left). You can enlarge this window in the vertical sense for seeing all information. For Network, you have: Adapter 1: Intel PRO ... (Host-only Adapter, ...).
Remark: Check if the vboxnet0 is well configured: Put the mouse on the left side of Figure *1*, in the blue zone with the icon Tools, right-click on the pin, choose Network. It the following line appears, skip section 3.5 (otherwise follow the instructions):

Nom	Address	
VB Ethernet ...	192.168.56.1/24	X Activated

3.5. Configure vboxnet0: "Host only network adapter"

If the 2 lines in section 3.4 does not appear, you need to configure vboxnet0 a network between your host computer (Mac, Linux, Windows) and your Xenomai Virtual Machine (where the RTOS Xenomai is installed).

*On MacOSX: Press the **Ctrl** button, Right-click on Icon "Tools" (see left side of* Figure *1) and choose "* **Host Network Manager***". The window (*Figure 2*) pops out. Click the "***Create***" button: the fields will be filled automatically as depicted on* Figure 3. Be sure "**Enable**" is set. Notice that the IPv6 address is empty. Click on **Properties** in the window on Figure 3. The resulting window is depicted on Figure 4; press **Close**.

On Windows: *In Windows 10, instead of* Figure 2*, is* Figure 3 *or* Figure 4 that *appears when you click on Icon "Tools"; press* **Close**. *Otherwise, follow the same instructions that for MacOSX above. You can also click on icon "Pin" in of* Figure *1 and choose* **Network**, *or go to Menu "Machine", menu "Network".*

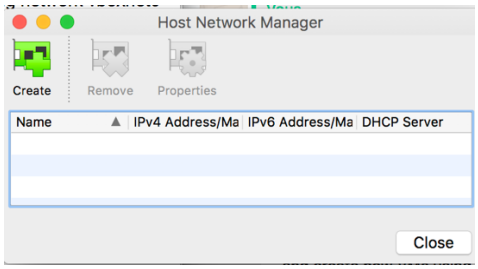


Figure 2: Click on "Create" button

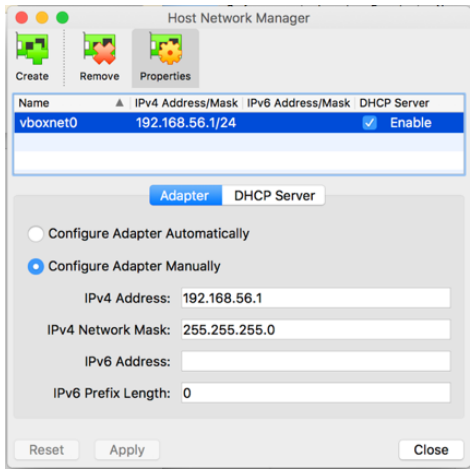


Figure 4: Content of "Properties".

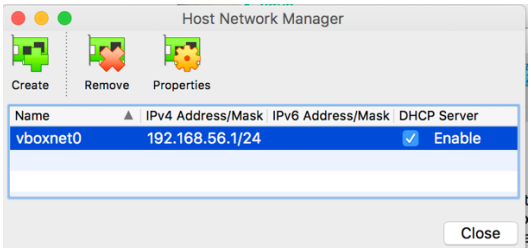


Figure 3: Creating a host only network

3.6. Launch the VM:

*Press the **Start** button (on the right of Figure 5). At this point, it* may happen *that the warning of Figure 6 pops out; do not worry and press "***Change network settings***". The window depicted in Figure 7 appears. Click **OK**.*

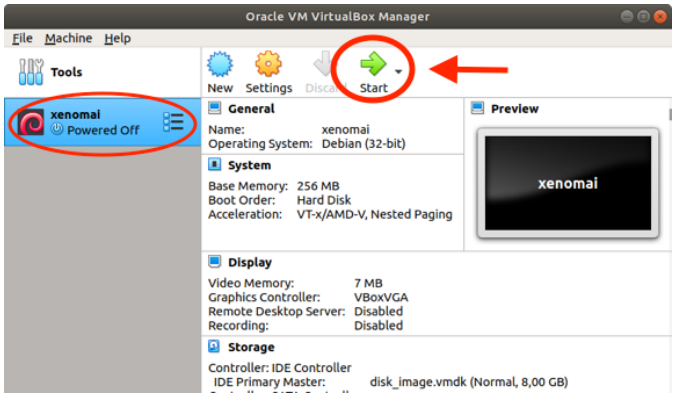


Figure 5: VM with Xenomai

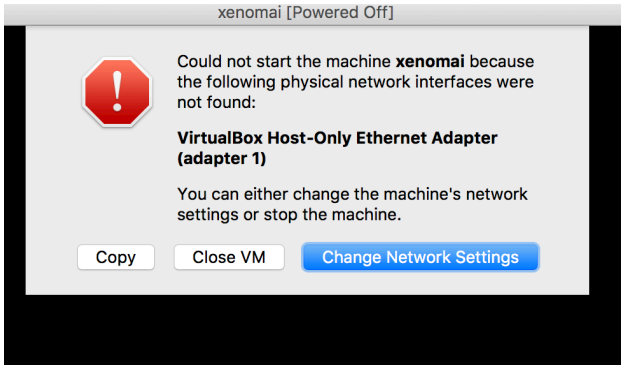


Figure 6: This warning can appear when **Start** button is pressed on Figure 5).

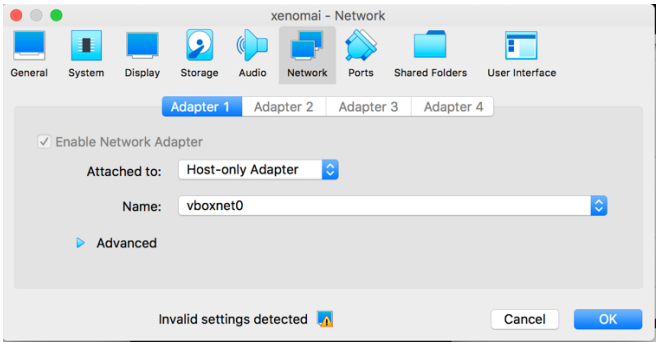


Figure 7: Xenomai Network settings

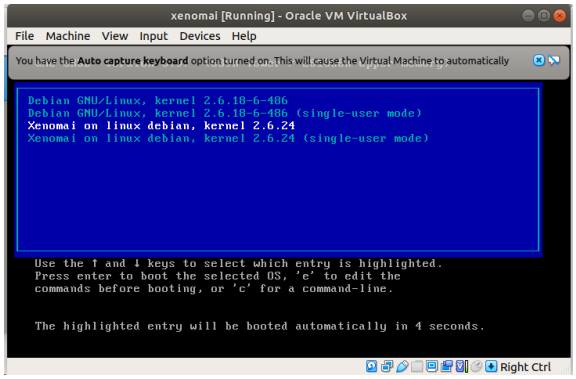


Figure 8: Default choice is highlighted

The windows of Figure 8 pops out: the default choice is the highlighted line (Xenomai on Linux debian, kernel 2.6.24). The terminal of your Xenomai VM pops out (*Figure 9*). If the message of *Figure 10* appears, just press **yes**.

Congratulations! You are ready to check if everything is OK, and then, run the code!

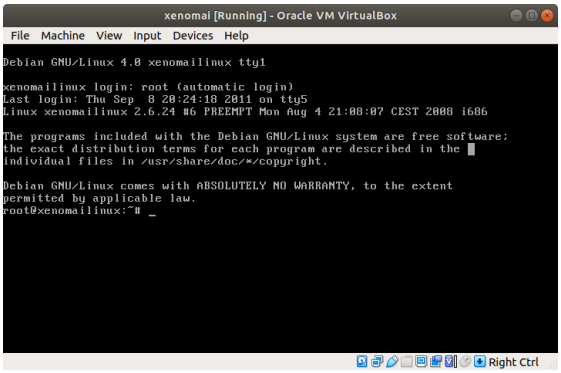


Figure 9: Xenomai VM.

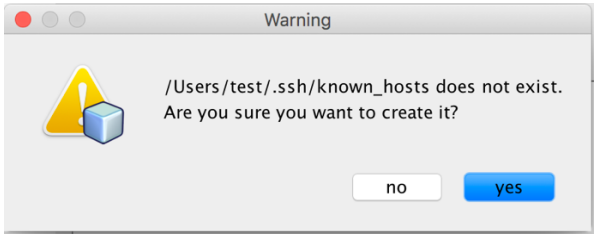


Figure 10: Warning while "Connecting...."

Remark: At this point, you would have a virtual machine (VM) with the *real time operational system* Xenomai, and moreover, a network called vboxnet0 between this VM and your host computer.

Step 4: Final checking
Remark: The default keyboard on the Xenomai VM is qwerty. If you want to use the French keyboard azerty, see FAQ, section 1.

The IP number of the network card `eth3` in the VM is 192.168.56.101 and the IP number of the network card `vboxnet0` in your (host) computer is 192.168.56.1. So, `eth3` and `vboxnet0` are in the same network. Notice that they are the same, except the VM has "101" instead of "1". Let us check if everything is ready for running a code using Xenomai through NetBeans in your computer!

4.1. Check if Xenomai VM works:
In the terminal of your VM (*Figure 9*), type the command line `latency` and check if the results correspond to the printing bellow. For stop printing, press CTRL-C.

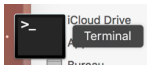
```
root@xenomailinux:~#  latency
== Sampling period: 100 us
== Test mode: periodic user-mode task
== All results in microseconds
warming up...
RTT|  00:00:01 (periodic user-mode task, 100 us period, priority 99)
RTH|-----lat min|-----lat avg|-----lat max|-overrun|----lat best|----lat worst
RTD|     -98.683|     -10.511|     137.416|       8|    -98.683|      137.416
```

4.2. Check the IP number of your VM:
In the terminal of your VM (*Figure 9*), type the command line `ifconfig`. It must appear `192.168.56.101`.
You can also type: `ifconfig | grep 192`

4.3. Check the IP number of your host computer. It must appear `192.168.56.1`

Open a terminal in the host computer
On Windows, open cmd.exe
On linux (Ubuntu), open a terminal window. HINT: do a rigth-click in your desktop.

On MacOSX, open Applications/Utilitaires/Terminal.app. Sugestion: put this app in the **Dock**



On Windows, type in a terminal: ipconfig/all
On MacOSX and Linux: type in a terminal ifconfig. *You may need to install it in your host computer.*
Hint: if the listing is too big, you can type the command line ifconfig | grep 192.168.56.1

4.4. Check if the networks works between your host (Mac, Windows or Linux) **and the VM**
In any terminal in your computer, type:
ping 192.168.56.101.

You would have something like this in your terminal (for stopping the printing, type ctrl-c):

```
j.cardoso$ ping 192.168.56.101
PING 192.168.56.101 (192.168.56.101): 56 data bytes
64 bytes from 192.168.56.101: icmp_seq=0 ttl=64 time=0.346 ms
64 bytes from 192.168.56.101: icmp_seq=1 ttl=64 time=0.678 ms
^C
```

Next step: Install NetBeans. See document InstallingNetBeans8.pdf.
After installing NetBeans, you need to "Import a project" and "Connect to the target (Xenomai)", see GettingStartedNetBeansWithVMxenomai_v1.pdf. Then you will be able to run the examples

FAQ and Problems found:

If you don't find your question in this FAQ, and in the LMS FAQ, please take as much information that you can (screenshot, copy of the message, etc.) and put your question in the LMS FAQ with the following information: OS and version of your machine, version of the softwares (VB, NetBeans).
Your question can help other people! Help us to improve this section.

1. Hot to change the keyboard for the Xenomai VM for azerty?
The default keyboard is set to qwerty. If you want to use azerty (French keyboard), there are two ways.
Open a terminal:
1) `loadkeys fr` (for azerty) `loadkeys en` (for qwerty)
No need to reboot the Xenomai VM, but you need to do each time you start the VM.
2) `cp /usr/share/keymaps/i386/azerty/fr-latin9.kmap.gz /etc/console/boottime.kmaps.gz`
Then reboot the Xenomai VM. Next time the VM starts, the keyboard will be azerty.

2. What is a virtual machine (VM)?
https://en.wikipedia.org/wiki/Virtual_machine: "A VM is an emulation of a computer system. (...) (VMs) provide a substitute for a real machine. They provide functionality needed to execute entire operating systems.". In this course, we will use a VM for providing the real time operational system Xenomai.

3. Bad size of VM window (Figure 11**)**

Problem: The Xenomai terminal doesn't fit the size of the window and it is almost impossible to read.
Solution: Install the 6.1.4 Oracle VM VirtualBox Extension Pack. There are two ways:
a) Directly at https://www.virtualbox.org/wiki/Downloads
b) Download the the file Oracle_VM_VirtualBox_Extension_Pack-6.1.4.vbox-extpack, then add this file in the VirtualBox Menu Parameters /Extensions
Launch the Xenomai VM again. Menu **VirtualBox/View** (see Figure 12), choose **Full-screen Mode** (Host+F) or **Scaled Mode** (Host+C). For coming back to the normal screen, press Host+C.
On MacOSX: The host key is "Command".
On Windows: The host key is "Control".

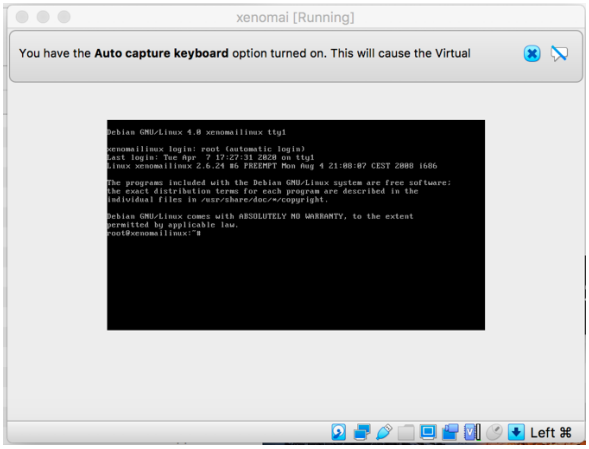


Figure 11: The Xenomai terminal doesn't fit the window

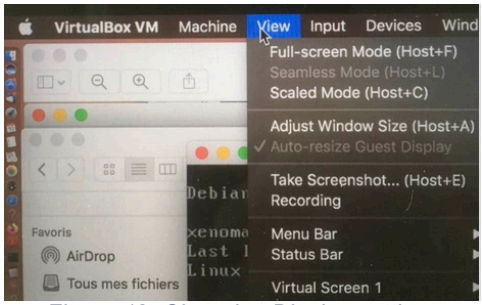


Figure 12: Changing Display settings

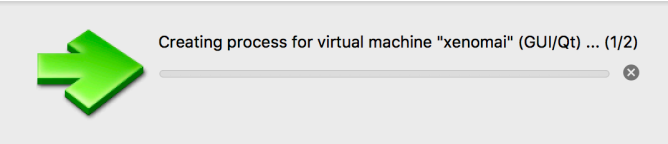


Figure 13: Message while the VM is being created.

4. Message of Figure 13**:**
When: This message may appear.
Solution: It is not a problem, just wait, or, if there is another window, press a key (button) according to the instructions in this guide.

5. Warnings in Xenomai VM
Problem: the warning of Figure 14 (MacOSX) or Figure 15 (Windows 10), or similar, appears.
Solution: Read carefully the message.
The "host key is different according to the OS:
In Linux, is the key "Control" in the **left** part of the keyboard.
In MacOSX, is the key "Command", in the **left** part of the keyboard.
In Windows, is the key "Control" in the **right** part of the keyboard.

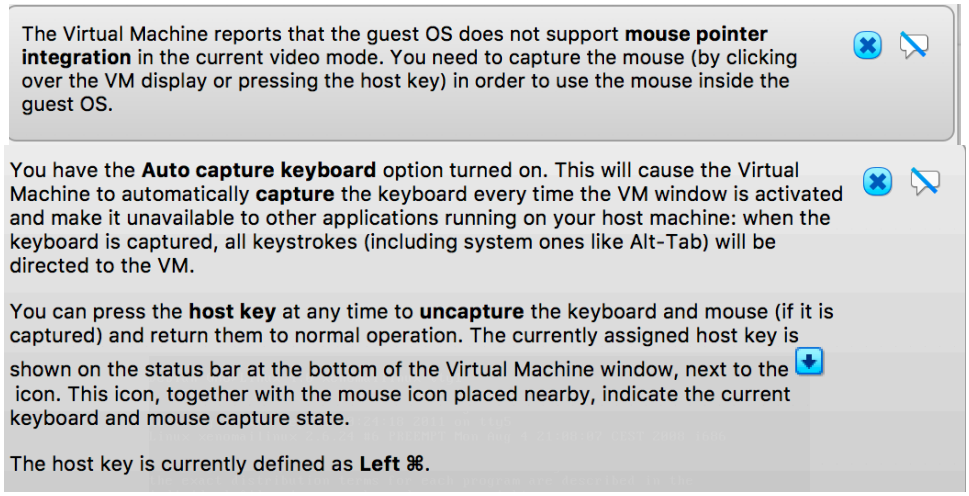


Figure 14: ***MacOSX***: Message on the Xenomai VM (mouse+keyboard)