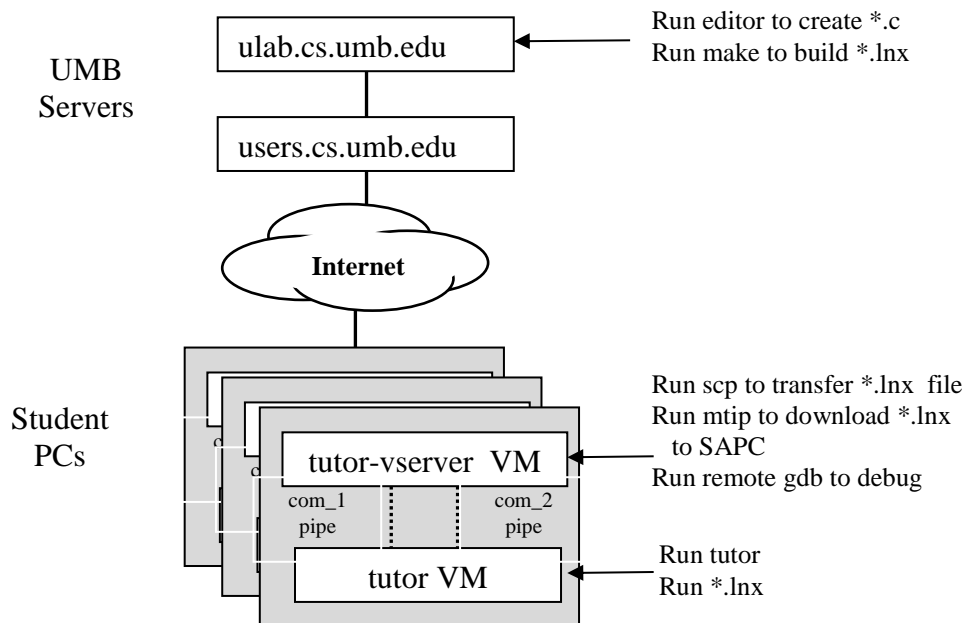


How to Run a Virtualized SAPC using VMWare (3/23/2017)

This document is modified from Professor O'Neil's CS444-Fall 14 VMWare-for-Tutor.html file. It provides updated instructions on the modified OS software development environment that utilizes a virtualized SAPC. The original document is derived from [instructions to run Xinu](#). Xinu is a small Linux OS developed by Dennis Comer at Perdue. The Perdue team has gotten Xinu to run on VMWare, using a virtualized Linux host called xinu-vserver, and we are using it to run mtip and remote gdb to communicate with the SAPC VM.

1. The development environment

We'll use the setup as shown below. The *.c and *.lnx programs are developed on the UMB ulab server using an editor and the UNIX make utility. Then *.lnx files are transferred to the xinu-vserver VM and they are subsequently loaded onto the tutor VM using the tutor ~d command. The tutor ~r function for resetting the SAPC is replaced by selecting the Cntl-Alt-Del button on the tutor VM.



2. Downloading and Installing VMWare application

If you are using a PC, use a Windows Secure File Transfer Client (e.g. WinSCP or SSH Secure File Transfer Client) to transfer the VMWare Workstation .exe file from

the users.cs.umb.edu server(directory: /nobackup/blade71/cheungr/) to your desktop. Then install the application by double clicking the .exe file.

If you are using a MAC, at the terminal window, type the following to transfer the file to your MAC:

```
scp your_username@users.cs.umb.edu:/nobackup/blade71/cheungr/VMware-Fusion-8.0.0-2985594.dmg .
```

Please note there is a “.” at the end of the line. Install the application by double clicking the .dmg file.

3. Downloading and Installing the VMs

Download the tutor and tutor-vserver directories from the class web page and store them on your home machine. Among others, you should have tutor.ovf and tutor-vserver.ovf in the directories. Install and configure the tutor and tutor-vserver VMs as follows:

- i) Download the tutor and tutor-vserver directories to your PC.
- ii) To install the tutor-vserver VM, import the tutor-vserver.ovf (Open Virtualization Format) file.
 - a) In VMWare Workstation, select **File > Open**.
 - b) In the drop-down to the right of the File Name: box, Choose to Open Virtual Machine Format Images (*.ovf, .ova), browse to **tutor-vserver.ovf**, and click **Open**.
 - c) Click **Import** at the next screen.
 - d) the tutor-vserver VM should be installed. Please note the VM files are stored in directory C:\Users\user_name\Documents\Virtual Machines\tutor-vserver\tutor-vserver.vmx.
- iii) To install the tutor VM on a separate window. Select File > New Window and then follow the same procedures in ii) to import **tutor.ovf**. After installation, the VM files are stored in the directory C:\Users\user_name\Documents\Virtual Machines\tutor\tutor.vmx. After installation, we can see the 2 VM windows side by side.

4. Configure the VMs

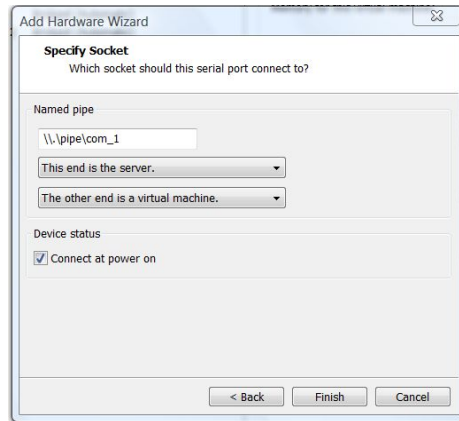
On a real SAPC, server ulab.cs.umb.edu connects to the SAPC using serial port COM2 for monitoring and serial port COM1 for remote gdb. In the VM environment, we connect the serial ports of the 2 VMs using name pipes. The VMs as provided do not have serial ports configured. We need to add them first and configure their connectivity using name pipes.

In the **tutor-vserver VM**:

- i) Select the virtual machine **tutor-vserver** and select **VM > Settings**.

ii) On the **Hardware** tab, select **ADD**. On the next screen, select **serial port** and **next**

iii) Select **Output to name pipes** and **next** and enter data into the next screen as follows:



iv) Select **Finish** when done.

v) Repeat the same to add and configure serial port 2. The name pipe is `\\.pipe\com_2`. Then select **OK**.

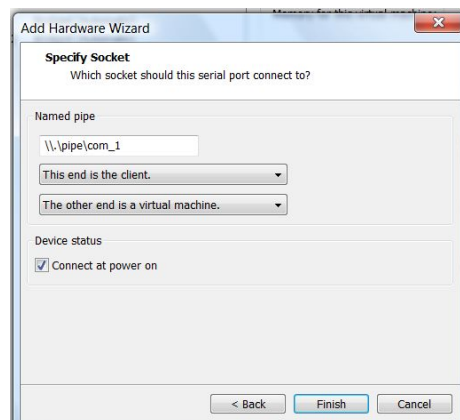
vi) Go back to **VM > Setting**, on the **Hardware** tab, select **Network Adapter 2**.

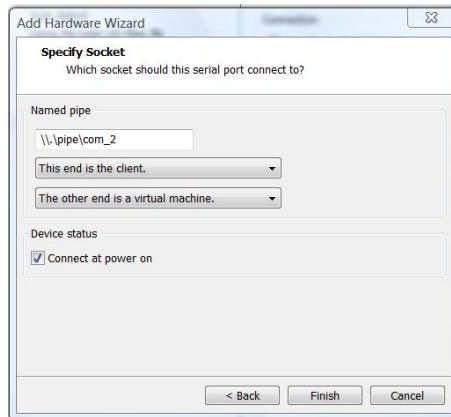
vii) Select **Connected**, **Connected at Power on** and **NAT**. Then select **OK**.

viii) Now switch to configure the tutor VM.

In the **tutor VM**:

i) Add the serial ports using the same procedures as above and then configure the 2 serial ports as follows:





ii) There is no need to configure the network adapter for this VM since it only connects to tutor-vserver via the serial ports.

5. Running the VMs

i) Power on **tutor-vserver** and logon to its xinu installation using user name **tuser** (for Tutor user) and the password **cs444**. You may need to move the cursor to the window and select it first. At any point, you can do Cntl+Alt to move the cursor out of the VM window. xinu is a Linux distribution and you can use regular Linux commands such as ls, mkdir, ssh, script, scp etc. The mtip and gdb command is also available. Run mtip and you should see the normal print out. There is no need to select a board since it always talks to board 1.

ii) You can transfer your .lnx file (e.g. test.lnx) from ulab's /home/username/csXXX/ directory to the tutor-vserver VM by entering the following command at the tutor-vserver VM (XXX stands for the course number 341 or 444):

```
scp username@users.cs.umb.edu:csXXX/*.lnx .
```

Please note there is a "." at the end of the line. Issue the ls command to verify the presence of the transferred file.

iii) Power on tutor VM (leave the tutor-vserver VM by Cntl+Alt first). Note that it offers you the chance to enter a <CR> and make this screen the Tutor console. You can do the <CR> here (after clicking on that window) and play with Tutor there, but the really useful way to use Tutor is by talking to it on COM2 using tutor-vserver VM. In this case, do the <CR> at the tutor-vserver VM. If you want to reset the tutor VM, select the "Send Cntl+Alt+Del to this VM" button on the VM's menu bar.

iv) Go back to the Linux VM "tutor-vserver" by clicking on its window. Now you should be able to talk to Tutor using mtip via the COM2-COM2 connection

between the two systems. Try out the tutor commands "dd", "md" and "h" to see how they work. Type "~q" or two control-Cs to exit back to the Linux prompt.

v) To test the downloading command, type "mtip -f test.lnx" and "~d" to download the test.lnx file to the tutor VM. To run test.lnx, issue "go 100100".

6. Running Remote GDB

See remgdb-testio_mod.script at the class webpage for an example on how to run remote gdb on the VM. To use remote gdb in the VM environment, build your program (e.g. test.c) on ulab using the gcc -g option. Transfer the executable (e.g. test.lnx) and c file (e.g. test.c) to the VM using the scp command at the tutor-vserver VM. Then the .lnx and .c files should be in the home directory of tuser.

In vm-vserver VM shell:

Run /sbin/ifconfig to find the ip address on your local net: the one for LAN adapter eth1 (e.g. 192.168.1.131). Then issue:

```
mtip -f test.lnx
```

After clicking "sending cntl-al-del to VM" at the tutor VM, and clicking <CR> at the vm-server VM, you should see the Tutor prompt

```
~d
```

This downloads the test.lnx to the tutor VM

```
Tutor> gdb
```

This gets tutor to accept remote gdb commands.
----get out of this VM with alt+ctrl---

In your host PC:

- i) Run putty or other communication application to ssh to the tutor-vserver VM at 192.168.1.131
- ii) Login the VM as tuser with password cs444
- iii) Go to the directory that has the lnx and c file. Enter the following to run remote gdb:

```
gdb test.lnx
tar rem /dev/ttyS0
set $eip = 0x100100
b main
```

```
c
<stops at main>
c
...
```

7. Setting a Larger Display Size on theVserver VM Window

The Vserver VM is a Linux distribution and the resolution of the console window is defaulted to be 640x480. It only displays 25 rows and each row has 80 characters. In order to display more rows, you need to change the resolution to a higher one. This [blog](#) gives detailed instructions on how to change the resolution to 1024x768x16. Make sure you edit the grub file as a super user (su), save the new grub setting using the command update-grub, and then reboot.