

# How to Install WANsim on an APU1c

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## Overview

This document sketches the steps I took to install WANsim on a PC Engines apu1c.

## Build the Box

apu1c with a 16MB mSATA SSD disk and 4GB RAM.<sup>1</sup>

Install the cooling plate per instructions:

<http://www.pcengines.ch/apucol.htm>

<http://www.yeasoft.com/site/article:apup1>

Insert the mSATA SSD disk into the slot closest to the serial port. I tried the other two slots, but the Ubuntu installer didn't see it -- I don't know why.

## Install Linux

### Prepare USB Stick

I replicate the instructions from this Web site here:

<http://pcengines.info/forums/?page=post&id=E25612E9-84F0-4DCF-A876-1E92FD1D065C>

- Create bootable USB stick (1GB is plenty large enough) running Linux
  - Under Windows, run unetbootin-windows-xxx.exe
  - Point it at an .iso of your favorite Linux distro; I used ubuntu-14.04.1-server-amd64.iso
  - Edit three .cfg files per these instructions

```
# download ubuntu-14.04-server-amd64.iso
# use unetbootin-windows-585 to create a LiveUSB stick
# modify isolinux.cfg, txt.cfg and syslinux.cfg
isolinux.cfg:
# D-I config version 2.0
CONSOLE 0
SERIAL 0 115200 0
include menu.cfg
default vesamenu.c32
prompt 0
timeout 0

txt.cfg:
default install
label install
  menu label ^Install Ubuntu Server
  kernel /install/vmlinuz
```

---

<sup>1</sup> I predict that 1 GB RAM would be plenty for this application.

```
append file=/cdrom/preseed/ubuntu-server.seed vga=788
initrd=/install/initrd.gz -- console=ttyS0,115200n8 quiet -
```

```
syslinux.cfg:
```

```
# D-I config version 2.0
```

```
CONSOLE 0
```

```
SERIAL 0 115200 0
```

```
default menu.c32
```

```
prompt 0
```

```
menu title UNetbootin
```

```
timeout 100
```

```
label unetbootindefault
```

```
kernel /install/netboot/ubuntu-installer/amd64/linux
```

```
append initrd=/install/netboot/ubuntu-installer/amd64/initrd.gz
```

```
tasks=standard pkgset/language-pack-patterns= pkgset/install-language-
```

```
support=false vga=788 -- console=ttyS0,115200n8 -- quiet
```

## Power On

- Insert the USB stick into one of the USB slots on the apulc.
- Attach eth0 (the Ethernet port closest to the DB-9 serial port) to your network.
- Attach a serial console: 115200,n,8,1
- Insert the power plug.

```
PC Engines APU BIOS build date: Apr  5 2014
```

```
Reading data from file [bootorder]
```

```
SeaBIOS (version ?-20140405_120742-frink)
```

```
SeaBIOS (version ?-20140405_120742-frink)
```

```
Found coreboot cbmem console @ df150400
```

```
Found mainboard PC Engines APU
```

```
Relocating init from 0x000e8e71 to 0xdf1065e0 (size 39259)
```

```
Found CBFS header at 0xfffffb90
```

```
found file "bootorder" in cbmem
```

```
CPU Mhz=1000
```

```
Found 27 PCI devices (max PCI bus is 05)
```

```
Copying PIR from 0xdf160400 to 0x000f27a0
```

```
Copying MPTABLE from 0xdf161400/df161410 to 0x000f25b0 with length 1ec
```

```
Copying ACPI RSDP from 0xdf162400 to 0x000f2590
```

```
Copying SMBIOS entry point from 0xdf16d800 to 0x000f2570
```

```
Using pmtimer, ioport 0x808
```

```
Scan for VGA option rom
```

```
EHCI init on dev 00:12.2 (regs=0xf7f04420)
```

```
Found 1 lpt ports
```

```
Found 2 serial ports
```

```
AHCI controller at 11.0, iobase f7f04000, irq 11
```

```
EHCI init on dev 00:13.2 (regs=0xf7f04520)
```

```
EHCI init on dev 00:16.2 (regs=0xf7f04620)
```

```
Searching bootorder for: /pci@i0cf8/*@11/driver@0/disk@0
```

```
AHCI/0: registering: "AHCI/0: SB mSATA SSD ATA-10 Hard-Disk (14318 MiBytes)"
```

```
Searching bootorder for: /rom@img/setup
```

```
Searching bootorder for: /rom@img/memtest
Searching bootorder for: /pci@i0cf8/usb@12,2/storage@1/*@0/*@0,0
Searching bootorder for: /pci@i0cf8/usb@12,2/usb-*@1
OHCI init on dev 00:12.0 (regs=0xf7f00000)
OHCI init on dev 00:13.0 (regs=0xf7f01000)
OHCI init on dev 00:14.5 (regs=0xf7f02000)
USB MSC vendor='Generic' product='USB Flash Disk' rev='7.76' type=0
removable=1
OHCI init on dev 00:16.0 (regs=0xf7f03000)
USB MSC blksize=512 sectors=16825728
Searching bootorder for: /pci@i0cf8/usb@16,2/storage@1/*@0/*@0,0
Searching bootorder for: /pci@i0cf8/usb@16,2/usb-*@1
USB MSC vendor='Multiple' product='Card Reader' rev='1.00' type=0
removable=1
Device reports MEDIUM NOT PRESENT
scsi_is_ready returned -1
Unable to configure USB MSC drive.
Unable to configure USB MSC device.
All threads complete.
Scan for option roms
```

```
Build date: Apr 5 2014
System memory size: 4592 MB
```

Press F12 for boot menu.

```
Searching bootorder for: HALT
drive 0x000f24d0: PCHS=0/0/0 translation=lba LCHS=1024/255/63 s=16825728
drive 0x000f2500: PCHS=16383/16/63 translation=lba LCHS=1024/255/63
s=29323728
Space available for UMB: c0000-ee800, f0000-f24d0
Returned 253952 bytes of ZoneHigh
e820 map has 7 items:
 0: 0000000000000000 - 000000000009fc00 = 1 RAM
 1: 000000000009fc00 - 00000000000a0000 = 2 RESERVED
 2: 00000000000f0000 - 0000000000100000 = 2 RESERVED
 3: 0000000000100000 - 00000000df14e000 = 1 RAM
 4: 00000000df14e000 - 00000000e0000000 = 2 RESERVED
 5: 00000000f8000000 - 00000000f9000000 = 2 RESERVED
 6: 0000000100000000 - 000000011f000000 = 1 RAM
enter handle_19:
  NULL
Booting from Hard Disk...
Booting from 0000:7c00
[...]
```

### [Navigate Basic Install Screens](#)

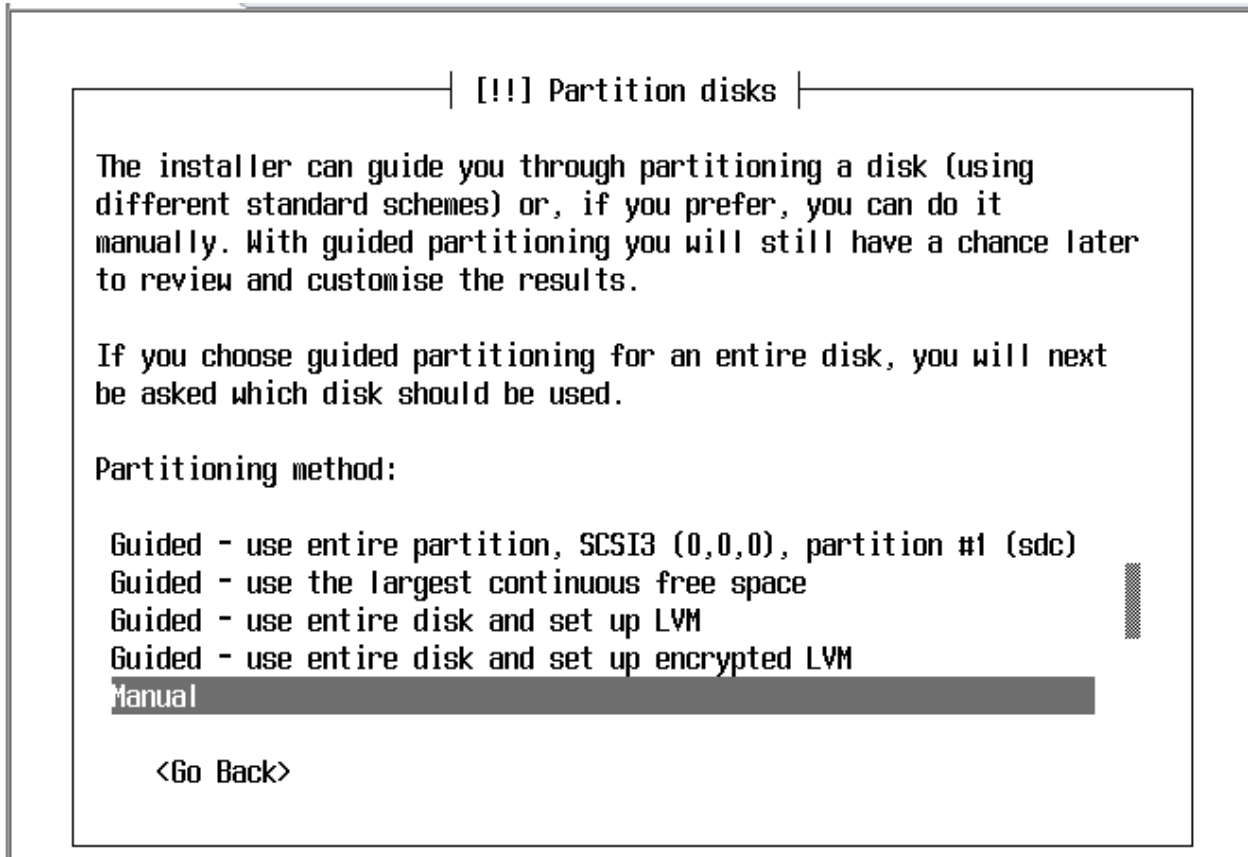
Eventually, you'll reach an install menu, and if you wait a little longer, the install will start on its own. You can hit Space and Enter at appropriate moments to speed things along if you like.

I forgot to grab screen shots along most of the way ... but most of the choices are fairly easy. The partitioning is where I spent a lot of time.

[...]

## Partitioning

Select Manual for the Partitioning method.



You can see the 16 GB (well, 15.0 GB in the screen below) mSATA SSD as device sdc below -- the 1GB flash stick shows up as device sda. My mSATA SSD has already suffered through a number of Ubuntu installs and thus already has a file system (ext4) on it -- yours may be pristine and show as FREE SPACE or similar.

```
| [!!!] Partition disks |
This is an overview of your currently configured partitions and mount
points. Select a partition to modify its settings (file system, mount
point, etc.), a free space to create partitions, or a device to
initialize its partition table.

Configure encrypted volumes
Configure iSCSI volumes

SCSI1 (0,0,0) (sda) - 1.0 GB Generic Flash Disk
> #1 primary 650.0 MB B fat32
> pri/log 396.0 MB FREE SPACE
SCSI3 (0,0,0) (sdc) - 15.0 GB ATA SB mSATA SSD
> #1 primary 15.0 GB B ext4

Undo changes to partitions

<Go Back>
```

<F1> for help; <Tab> moves; <Space> selects; <Enter> activates buttons

Highlight the *#1 primary 15.0 GB B* line and hit Enter. Then, make the following screen look as follows. I chose to set noatime and nodiratime figuring that this would reduce the number of writes to the SSD drive, and that reducing writes to an SSD drive increases its longevity. But I'm just guessing here. I believe that Label is cosmetic -- leave it blank or enter your own string. I left the Reserved blocks and Typical usage entries at their defaults.

[!!] Partition disks

You are editing partition #1 of SCSI3 (0,0,0) (sdc). This partition is formatted with the Ext4 journaling file system. All data in it WILL BE DESTROYED!

Partition settings:

|                       |                             |
|-----------------------|-----------------------------|
| Use as:               | Ext4 journaling file system |
| Format the partition: | yes, format it              |
| Mount point:          | /                           |
| Mount options:        | noatime,nodiratime          |
| Label:                | WANEmulator                 |
| Reserved blocks:      | 5%                          |
| Typical usage:        | standard                    |
| Bootable flag:        | on                          |

<Go Back>

<F1> for help; <Tab> moves; <Space> selects; <Enter> activates buttons

Scroll down to find and highlight *Done setting up the partition.*

```
| [!!] Partition disks |
You are editing partition #1 of SCSI3 (0,0,0) (sdc). This partition
is formatted with the Ext4 journaling file system. All data in it
WILL BE DESTROYED!

Partition settings:

Reserved blocks:      5%
Typical usage:       standard
Bootable flag:       on

Resize the partition (currently 15.0 GB)
Copy data from another partition
Erase data on this partition
Delete the partition
Done setting up the partition

<Go Back>
```

<F1> for help; <Tab> moves; <Space> selects; <Enter> activates buttons

Scroll down the ensuing screen to find and highlight the *Finish partitioning and write changes to disk* line.



```
| [!!] Partition disks |
This is an overview of your currently configured partitions and mount
points. Select a partition to modify its settings (file system, mount
point, etc.), a free space to create partitions, or a device to
initialize its partition table.

Configure iSCSI volumes

SCSI1 (0,0,0) (sda) - 1.0 GB Generic Flash Disk
> #1 primary 650.0 MB B fat32
> pri/log 396.0 MB FREE SPACE
SCSI3 (0,0,0) (sdc) - 15.0 GB ATA SB mSATA SSD
> #1 primary 15.0 GB B F ext4 /

Undo changes to partitions
Finish partitioning and write changes to disk

<Go Back>
```

<F1> for help; <Tab> moves; <Space> selects; <Enter> activates buttons

I don't believe in swap anymore -- as far as my understanding goes, swap was useful back when RAM was expensive and disk was (comparatively) cheap; these days, RAM is cheap ... we configure our boxes with plenty of RAM ... and if a box runs out of RAM, then something is seriously wrong, and swapping to disk ain't going to help.

[!!] Partition disks

You have not selected any partitions for use as swap space. Enabling swap space is recommended so that the system can make better use of the available physical memory, and so that it behaves better when physical memory is scarce. You may experience installation problems if you do not have enough physical memory.

If you do not go back to the partitioning menu and assign a swap partition, the installation will continue without swap space.

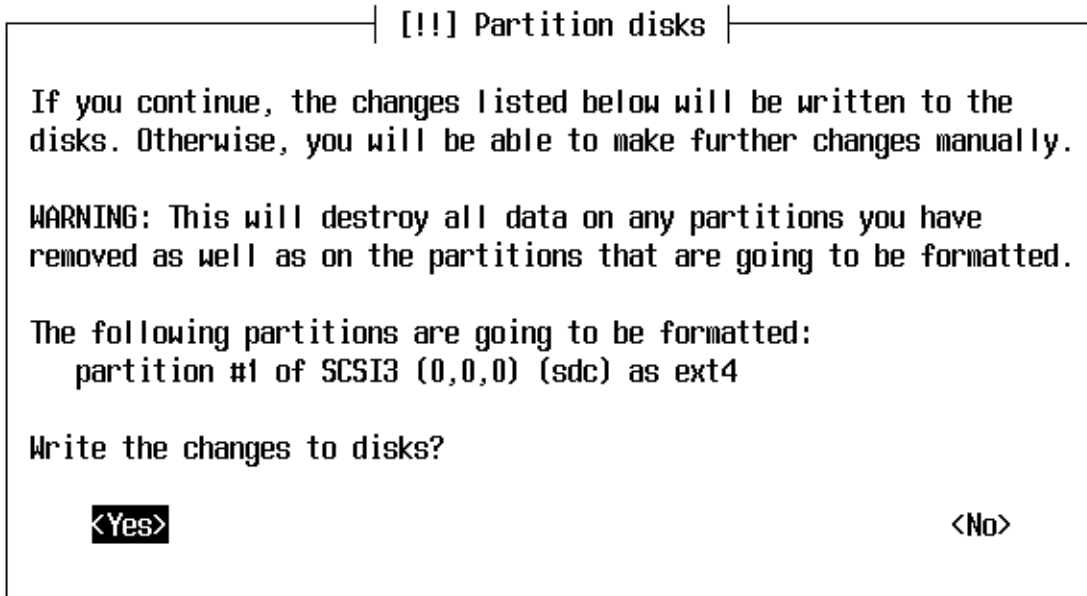
Do you want to return to the partitioning menu?

<Go Back>

<Yes>

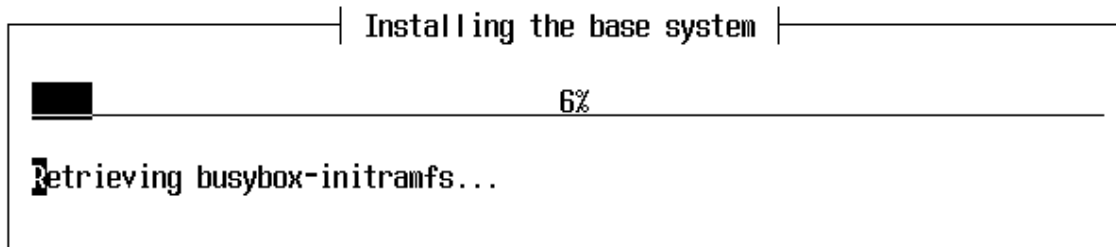


<Tab> moves; <Space> selects; <Enter> activates buttons



<Tab> moves; <Space> selects; <Enter> activates buttons

This takes a while:



I chose 'No automatic updates', figuring that I wanted to do this manually.

---

[!] Configuring discover

Applying updates on a frequent basis is an important part of keeping your system secure.

By default, updates need to be applied manually using package management tools. Alternatively, you can choose to have this system automatically download and install security updates, or you can choose to manage this system over the web as part of a group of systems using Canonical's Landscape service.

How do you want to manage upgrades on this system?

- No automatic updates
- Install security updates automatically**
- Manage system with Landscape

<Go Back>

<Tab> moves; <Space> selects; <Enter> activates buttons

The next screen toodles along for a long time, downloading and installing software.

OK, the box is almost ready to go; *grub* is about to write the master boot record. This is where I blew a lot of time -- I admit that my procedure is messy ... if you discover a cleaner way to go, please drop me a note and educate me.

[!] Install the GRUB boot loader on a hard disk

It seems that this new installation is the only operating system on this computer. If so, it should be safe to install the GRUB boot loader to the master boot record of your first hard drive.

Warning: If the installer failed to detect another operating system that is present on your computer, modifying the master boot record will make that operating system temporarily unbootable, though GRUB can be manually configured later to boot it.

Install the GRUB boot loader to the master boot record?

<Go Back>

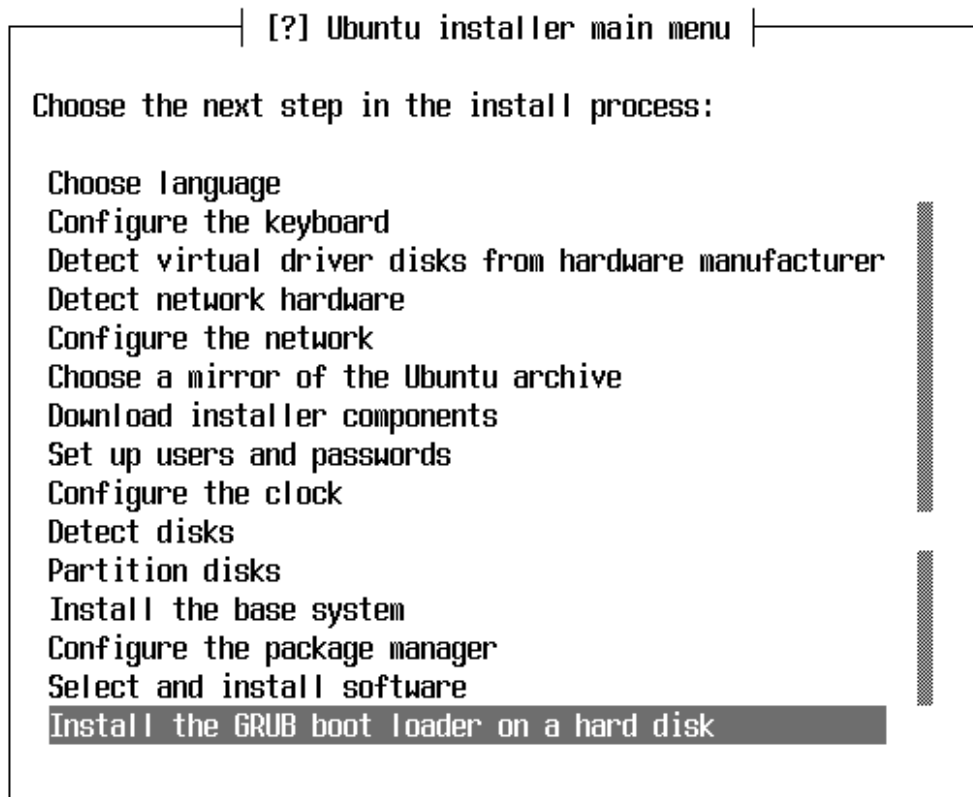
<Yes>

<No>

<Tab> moves; <Space> selects; <Enter> activates buttons

I remove the USB stick at this point. When I left it in, the installer tried to write the master boot record on /dev/sda, which is the USB stick. This operation fails ... and, more to the point, I don't want the MBR on the USB stick: I want it on /dev/sdc, i.e. the mSATA SSD inside the case.

Anyway, remove the USB stick, and hit Enter. The installer will try to install the MBR onto /dev/sda, this will fail. Hit <Continue> and then <Go Back> to reach the followings screen:



<Tab> moves; <Space> selects; <Enter> activates buttons

Hit Enter, the Installer will talk about installing the grub2 package again, and we'll reach the following:

[!] Install the GRUB boot loader on a hard disk

It seems that this new installation is the only operating system on this computer. If so, it should be safe to install the GRUB boot loader to the master boot record of your first hard drive.

Warning: If the installer failed to detect another operating system that is present on your computer, modifying the master boot record will make that operating system temporarily unbootable, though GRUB can be manually configured later to boot it.

Install the GRUB boot loader to the master boot record?

<Go Back>

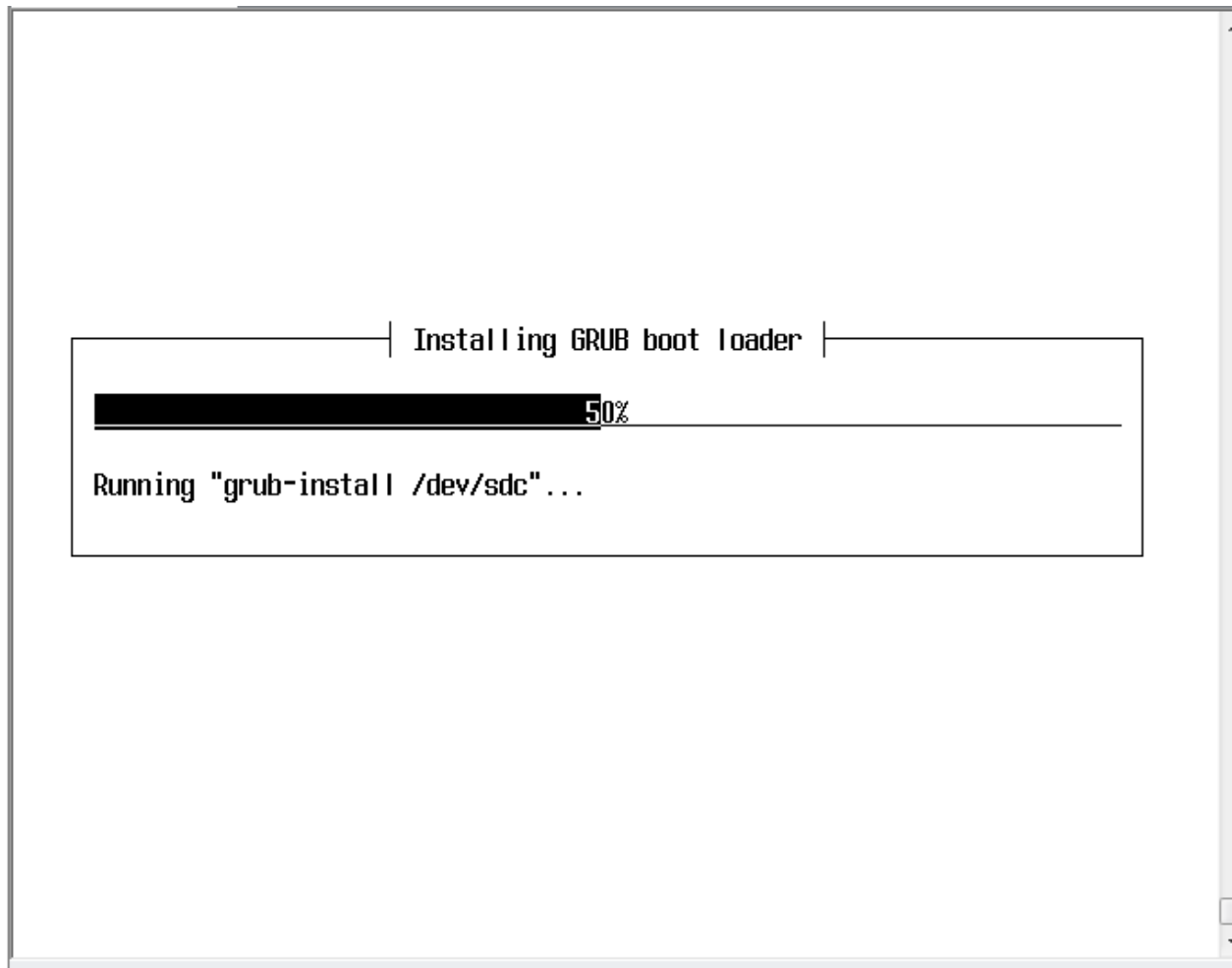
<Yes>

<No>

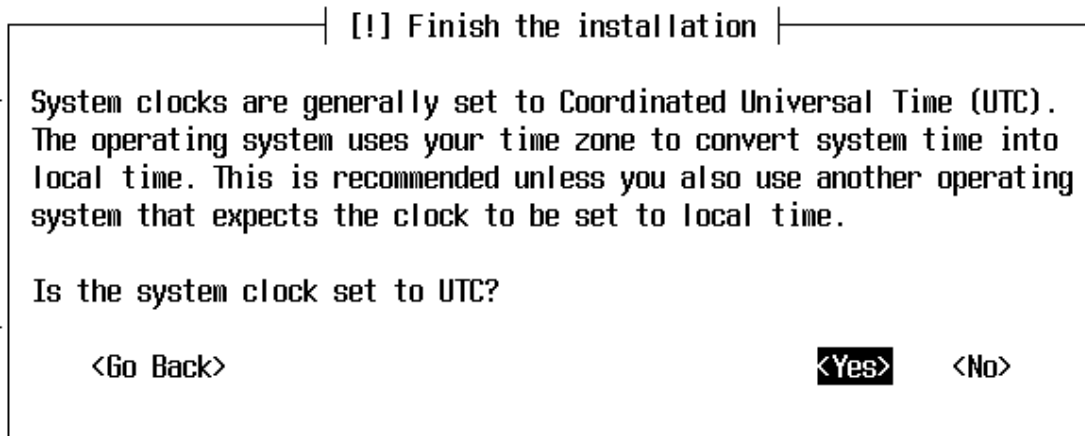
<Tab> moves; <Space> selects; <Enter> activates buttons

Hit Enter on <Yes> again. This time, the Installer places the MBR on /dev/sdc:





Set time.



<Tab> moves; <Space> selects; <Enter> activates buttons

---

Looks successful. Hit Continue and see if it boots.



<Tab> moves; <Space> selects; <Enter> activates buttons

---

After a minute or so, you should see the login prompt to your new Linux box:

```
Ubuntu 14.04.1 LTS hayneman ttyS0
```

```
hayneman login: █
```

## Configure Linux

root

Login, set the root password.<sup>2</sup>

```
Ubuntu 14.04.1 LTS hayneman ttyS0
```

```
hayneman login: stuart
```

```
Password:
```

```
Last login: Sat Sep 6 16:29:56 PDT 2014 on ttyS0
```

```
Welcome to Ubuntu 14.04.1 LTS (GNU/Linux 3.13.0-35-generic x86_64)
```

```
* Documentation: https://help.ubuntu.com/
```

```
stuart@hayneman:~$ sudo su -
```

```
[sudo] password for stuart:
```

```
root@hayneman:~#
```

---

<sup>2</sup> Feel free to skip this step; it does not affect WANSim. In fact, some folks like to leave root without a password -- means no one can login as root; you have to perform all rootly functions via sudo -- this works fine.

## ssh

Install ssh<sup>3</sup>

```
root@hayneman:~# install ssh
install: missing destination file operand after âsshâ
Try 'install --help' for more information.
root@hayneman:~# apt-get install ssh
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
  libck-connector0 libwrap0 ncurses-term openssh-server openssh-sftp-server
  python-requests python-urllib3 ssh-import-id tcpd
Suggested packages:
  ssh-askpass rssh molly-guard monkeysphere
The following NEW packages will be installed:
  libck-connector0 libwrap0 ncurses-term openssh-server openssh-sftp-server
  python-requests python-urllib3 ssh ssh-import-id tcpd
0 upgraded, 10 newly installed, 0 to remove and 0 not upgraded.
Need to get 768 kB of archives.
After this operation, 4,099 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://us.archive.ubuntu.com/ubuntu/ trusty/main libck-connector0 amd64 0.
4.5-3.1ubuntu2 [10.5 kB]
Get:2 http://us.archive.ubuntu.com/ubuntu/ trusty/main libwrap0 amd64 7.6.q-25 [
46.2 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu/ trusty/main ncurses-term all 5.9+2014
```

Enable ssh at boot

```
root@hayneman:~# update-rc.d ssh enable
update-rc.d: warning: start runlevel arguments (none) do not match ssh
Default-
Start values (2 3 4 5)
System start/stop links for /etc/init.d/ssh do not exist.
root@hayneman:~#
```

## Install WANSim

Install the WANSim dependencies:

---

<sup>3</sup> I like to be able to ssh to my gear, which is why I perform this step. But if you only want to access WANSim via the serial console, skip this step.

```

root@hayneman:~# apt-get install bash bridge-utils iproute net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
bash is already the newest version.
net-tools is already the newest version.
The following NEW packages will be installed:
  bridge-utils iproute
0 upgraded, 2 newly installed, 0 to remove and 0 not upgraded.
Need to get 31.6 kB of archives.
After this operation, 187 kB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://us.archive.ubuntu.com/ubuntu/ trusty/main bridge-utils amd64
1.5-6u
buntu2 [29.2 kB]
Get:2 http://us.archive.ubuntu.com/ubuntu/ trusty/main iproute all 1:3.12.0-2
[2
,384 B]
Fetched 31.6 kB in 0s (79.0 kB/s)
Selecting previously unselected package bridge-utils.
(Reading database ... 52098 files and directories currently installed.)
Preparing to unpack .../bridge-utils_1.5-6ubuntu2_amd64.deb ...
Unpacking bridge-utils (1.5-6ubuntu2) ...
Selecting previously unselected package iproute.
Preparing to unpack .../iproute_1%3a3.12.0-2_all.deb ...
Unpacking iproute (1:3.12.0-2) ...
Processing triggers for man-db (2.6.7.1-1) ...
Setting up bridge-utils (1.5-6ubuntu2) ...
Setting up iproute (1:3.12.0-2) ...
root@hayneman:~#

```

Figure out the IP address of your box; 192.168.1.121 in this case

```

root@hayneman:~# ifconfig
lo          Link encap:Local Loopback
            inet addr:127.0.0.1  Mask:255.0.0.0
            inet6 addr: ::1/128 Scope:Host
            UP LOOPBACK RUNNING  MTU:65536  Metric:1
            RX packets:16 errors:0 dropped:0 overruns:0 frame:0
            TX packets:16 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:0
            RX bytes:1184 (1.1 KB)  TX bytes:1184 (1.1 KB)

p4p1       Link encap:Ethernet  HWaddr 00:0d:b9:35:88:9c
            inet addr:192.168.1.121  Bcast:192.168.1.255  Mask:255.255.255.0
            inet6 addr: fe80::20d:b9ff:fe35:889c/64 Scope:Link
            UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
            RX packets:1309 errors:0 dropped:0 overruns:0 frame:0
            TX packets:386 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:893848 (893.8 KB)  TX bytes:29756 (29.7 KB)

root@hayneman:~#

```

Use sftp or similar to copy the WANsim package to your box:

```
C:\Temp>sftp stuart@192.168.1.121
Enter password for stuart@192.168.1.121:
/home/stuart>put *.deb
Transferring wansim_2.0.1-1_all.deb
Uploaded C:\Temp\wansim_2.0.1-1_all.deb to /home/stuart
/wansim_2.0.1-1_all.deb (10.37kB 0.00 B/s 00:00:01)
/home/stuart>
```

Install the WANsim package:

```
root@hayneman:/home/stuart# dpkg -i wansim_2.0.1-1_all.deb
Selecting previously unselected package wansim.
(Reading database ... 52127 files and directories currently installed.)
Preparing to unpack wansim_2.0.1-1_all.deb ...
Unpacking wansim (2.0.1-1) ...
Setting up wansim (2.0.1-1) ...
Adding system user `wansim' (UID 104) ...
Adding new group `wansim' (GID 111) ...
Adding new user `wansim' (UID 104) with group `wansim' ...
Creating home directory `/var/lib/wansim' ...
update-rc.d: warning: stop runlevel arguments (0) do not match wansim
Default-S
top values (0 1 6)
Adding system startup for /etc/init.d/wansim ...
/etc/rc0.d/K60wansim -> ../init.d/wansim
/etc/rc2.d/S10wansim -> ../init.d/wansim
/etc/rc3.d/S10wansim -> ../init.d/wansim
/etc/rc4.d/S10wansim -> ../init.d/wansim
/etc/rc5.d/S10wansim -> ../init.d/wansim
Processing triggers for man-db (2.6.7.1-1) ...
Processing triggers for ureadahead (0.100.0-16) ...
root@hayneman:/home/stuart#
```

Assign a password to the wansim user:

```
root@hayneman:/home/stuart# passwd wansim
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
root@hayneman:/home/stuart#
```

## Validation

Verify that your box boots:

```
root@hayneman:/home/stuart# reboot
```

```
Broadcast message from skendric@hayneman
(/dev/ttyS0) at 16:43 ...
```

The system is going down for reboot NOW!  
root@hayneman:/home/stuart#

```
PC Engines APU BIOS build date: Apr  5 2014
Reading data from file [bootorder]
SeaBIOS (version ?-20140405_120742-frink)
SeaBIOS (version ?-20140405_120742-frink)
Found coreboot cbmem console @ df150400
Found mainboard PC Engines APU
Relocating init from 0x000e8e71 to 0xdf1065e0 (size 39259)
Found CBFS header at 0xfffffb90
found file "bootorder" in cbmem
CPU Mhz=1000
Found 27 PCI devices (max PCI bus is 05)
Copying PIR from 0xdf160400 to 0x000f27a0
Copying MPTABLE from 0xdf161400/df161410 to 0x000f25b0 with length 1ec
Copying ACPI RSDP from 0xdf162400 to 0x000f2590
Copying SMBIOS entry point from 0xdf16d800 to 0x000f2570
Using pmtimer, ioport 0x808
Scan for VGA option rom
EHCI init on dev 00:12.2 (regs=0xf7f08420)
Found 1 lpt ports
Found 2 serial ports
AHCI controller at 11.0, iobase f7f08000, irq 11
EHCI init on dev 00:13.2 (regs=0xf7f08520)
EHCI init on dev 00:16.2 (regs=0xf7f08620)
Searching bootorder for: /pci@i0cf8/*@11/drive@0/disk@0
AHCI/0: registering: "AHCI/0: SB mSATA SSD ATA-10 Hard-Disk (14318 MiBytes)"
Searching bootorder for: /rom@img/setup
Searching bootorder for: /rom@img/memtest
OHCI init on dev 00:12.0 (regs=0xf7f04000)
OHCI init on dev 00:13.0 (regs=0xf7f05000)
OHCI init on dev 00:14.5 (regs=0xf7f06000)
OHCI init on dev 00:16.0 (regs=0xf7f07000)
Searching bootorder for: /pci@i0cf8/usb@16,2/storage@1/*@0/*@0,0
Searching bootorder for: /pci@i0cf8/usb@16,2/usb-*@1
USB MSC vendor='Multiple' product='Card Reader' rev='1.00' type=0
removable=1
Device reports MEDIUM NOT PRESENT
scsi_is_ready returned -1
Unable to configure USB MSC drive.
Unable to configure USB MSC device.
All threads complete.
Scan for option roms
Running option rom at c000:0003

iPXE (http://ipxe.org) 00:00.0 C000 PCI2.10 PnP PMM pmm call arg1=1
pmm call arg1=0
+DF0E94B0pmm call arg1=1
pmm call arg1=0
```



+DF0494B0 C000

Searching bootorder for: /rom@genroms/pxeboot.com

Build date: Apr 5 2014  
System memory size: 4592 MB

Press F12 for boot menu.

Searching bootorder for: HALT  
drive 0x000f2500: PCHS=16383/16/63 translation=lba LCHS=1024/255/63  
s=29323728

Space available for UMB: c1000-ee800, f0000-f2500  
Returned 253952 bytes of ZoneHigh

e820 map has 7 items:

- 0: 0000000000000000 - 000000000009fc00 = 1 RAM
- 1: 000000000009fc00 - 00000000000a0000 = 2 RESERVED
- 2: 00000000000f0000 - 0000000000100000 = 2 RESERVED
- 3: 0000000000100000 - 00000000df14e000 = 1 RAM
- 4: 00000000df14e000 - 00000000e0000000 = 2 RESERVED
- 5: 00000000f8000000 - 00000000f9000000 = 2 RESERVED
- 6: 0000000100000000 - 000000011f000000 = 1 RAM

enter handle\_19:

NULL

Booting from Hard Disk...  
Booting from 0000:7c00

Ubuntu 14.04.1 LTS hayneman ttyS0

hayneman login: root  
Password:

My box reaches the 'Booting from 0000:7c00 line in seconds ... blanks the screen for ~3 minutes, and then displays the login prompt -- if you figure out why, do let me know.

And then verify that you can log into the box as the user *wansim*. Here is the result of an ssh session to the box, logging in as *wansim*:

Welcome to Ubuntu 14.04.1 LTS (GNU/Linux 3.13.0-35-generic x86\_64)

\* Documentation: <https://help.ubuntu.com/>  
Last login: Sun Sep 7 05:06:49 2014 from 192.168.1.209

#####

# (t) Type of system (bridge)  
# (V) Verbose (no)  
# (0) Interface 0 (eth0)  
# (1) Interface 1 (eth1)

How to Install WANSim on an apulc  
Stuart Kendrick

```
# (2) Bridge Interface (br0)
# (3) Bridge IP Address (0.0.0.0)
# (4) Bridge Default Gateway (0.0.0.0)
# (5) Bridge Mask (255.255.255.0)
# (m) MTU Size (1500 bytes)
# (b) WAN Bandwidth (150000 kbit/s)
# (l) WAN Latency (0 ms)
# (v) WAN Variation (0 ms)
# (L) WAN Packet Loss (0 %)
# (D) WAN Packet Duplication (0 %)
# (C) WAN Packet Corruption (0 %)
# (O) WAN Packet Re-Order (0 %)
# (K) WAN Packet Loss Correlation (0 %)
# (S) WAN Packet Duplication Correlation (0 %)
# (F) WAN Packet Corruption Correlation (0 %)
# (I) WAN Packet Re-Order Correlation (0 %)
# (i) WAN Information
# (d) WANsim Configuration Load
# (s) WANsim Configuration Save
# (r) WANsim Restart
# (a) WANsim About
# (q) Quit / Logout
```

Option?

## Basic Linux Housekeeping

### Patching

Your Linux box is fully patched at this point. But every now and then, you might want to run the following; doing this will install the latest patches.

```
# apt-get upgrade
[...]
# apt-get update
```

### IPv6

I disable IPv6 because I like to disable stuff I'm not using -- this step has nothing to do with getting WANsim to work; feel free to ignore it.

Add these lines to the bottom of `sysctl.conf`

```
net.ipv6.conf.all.disable_ipv6 = 1
net.ipv6.conf.default.disable_ipv6 = 1
net.ipv6.conf.lo.disable_ipv6 = 1
```

### Network Interfaces

Edit `/etc/network/interfaces` and make it look as follows:

```
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).
```

```
# The loopback network interface
```

```
auto lo
iface lo inet loopback
```

```
# The primary network interface
```

```
auto p4p1
iface p4p1 inet dhcp
```

```
# The secondary network interface
```

```
auto p5p1
iface p5p1 inet dhcp
```

```
# The tertiary network interface
```

```
auto p6p1
iface p6p1 inet dhcp
```

Plug each of the apu1c's NICs into your network.

Reload networking:

```
/etc/init.d/networking restart
```

Use ifconfig to admire the interfaces. WANsim added the 'br0' interface.

```
root@hayneman:/var/lib/wansim# ifconfig
br0      Link encap:Ethernet  HWaddr 06:94:ef:ce:62:73
         UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
         RX packets:0 errors:0 dropped:0 overruns:0 frame:0
         TX packets:8 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:0
         RX bytes:0 (0.0 B)  TX bytes:648 (648.0 B)

lo       Link encap:Local Loopback
         inet addr:127.0.0.1  Mask:255.0.0.0
         UP LOOPBACK RUNNING  MTU:65536  Metric:1
         RX packets:16 errors:0 dropped:0 overruns:0 frame:0
         TX packets:16 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:0
         RX bytes:1184 (1.1 KB)  TX bytes:1184 (1.1 KB)

p4p1     Link encap:Ethernet  HWaddr 00:0d:b9:35:88:9c
         inet addr:192.168.1.121  Bcast:192.168.1.255  Mask:255.255.255.0
         UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
         RX packets:2434 errors:0 dropped:0 overruns:0 frame:0
         TX packets:813 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:1000
         RX bytes:1546125 (1.5 MB)  TX bytes:101007 (101.0 KB)
```

```

p5p1      Link encap:Ethernet  HWaddr 00:0d:b9:35:88:9d
          inet addr:192.168.1.120  Bcast:192.168.1.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:714 errors:0 dropped:0 overruns:0 frame:0
          TX packets:10 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:61496 (61.4 KB)  TX bytes:1332 (1.3 KB)

p6p1      Link encap:Ethernet  HWaddr 00:0d:b9:35:88:9e
          inet addr:192.168.1.122  Bcast:192.168.1.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:683 errors:0 dropped:0 overruns:0 frame:0
          TX packets:10 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:59356 (59.3 KB)  TX bytes:1332 (1.3 KB)

```

```
root@hayneman:/var/lib/wansim#
```

OK, but now that we've admired our interfaces, we want to disable two of them. So edit `/etc/network/interfaces` again, and make it look as follows:

```

# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto p4p1
iface p4p1 inet dhcp

# The secondary network interface
# auto p5p1
# iface p5p1 inet dhcp

# The tertiary network interface
# auto p6p1
# iface p6p1 inet dhcp

```

If you wanted to assign a static address to p4p1, then you might type make the p4p1 stanza look like this:

```

# The primary network interface
auto p4p1
iface p4p1 inet static
    address 192.168.1.10
    mask 255.255.255.0
    gateway 192.168.1.1

```

Reboot<sup>4</sup>.

Now, the interfaces look as follows:

```
root@hayneman:/var/lib/wansim# ifconfig
br0      Link encap:Ethernet  HWaddr 00:0d:b9:35:88:9d
         UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
         RX packets:1419 errors:0 dropped:0 overruns:0 frame:0
         TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:0
         RX bytes:102774 (102.7 KB)  TX bytes:0 (0.0 B)

lo       Link encap:Local Loopback
         inet addr:127.0.0.1  Mask:255.0.0.0
         UP LOOPBACK RUNNING  MTU:65536  Metric:1
         RX packets:16 errors:0 dropped:0 overruns:0 frame:0
         TX packets:16 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:0
         RX bytes:1184 (1.1 KB)  TX bytes:1184 (1.1 KB)

p4p1    Link encap:Ethernet  HWaddr 00:0d:b9:35:88:9c
         inet addr:192.168.75.121  Bcast:192.168.75.255  Mask:255.255.255.0
         UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
         RX packets:861 errors:0 dropped:0 overruns:0 frame:0
         TX packets:75 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:1000
         RX bytes:70573 (70.5 KB)  TX bytes:10703 (10.7 KB)

p5p1    Link encap:Ethernet  HWaddr 00:0d:b9:35:88:9d
         UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
         RX packets:2679813 errors:0 dropped:0 overruns:0 frame:0
         TX packets:277076 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:1000
         RX bytes:3808792544 (3.8 GB)  TX bytes:16649258 (16.6 MB)

p6p1    Link encap:Ethernet  HWaddr 00:0d:b9:35:88:9e
         UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
         RX packets:277077 errors:0 dropped:1 overruns:0 frame:0
         TX packets:2679808 errors:0 dropped:0 overruns:0 carrier:0
         collisions:0 txqueuelen:1000
         RX bytes:16649318 (16.6 MB)  TX bytes:3808792244 (3.8 GB)

root@hayneman:/var/lib/wansim#
```

## Configure WANSim

Edit `/var/lib/wansim/wansim.conf` and change the following two lines:

---

<sup>4</sup> Yeah, I know, running `/etc/init.d/networking restart` should be sufficient ... but for me, `p5p1` remained stubbornly on-line, with a DHCP-assigned address, while rebooting fixed the issue.

From:  
IFACE0=eth0  
IFACE1=eth1

To:  
IFACE0=p5p1  
IFACE1=p6p1

I edit the BANDWIDTH line and change it to 350000, because the maximum throughput I can get through the apu1c has been 327Mb/s (measured using iPerf2) -- changing this line to 350000 acts as a reminder on the box's ceiling:

```
BANDWIDTH=350000
```

Now, when you log into the box as user wansim, you'll see the following:

```
Welcome to Ubuntu 14.04.1 LTS (GNU/Linux 3.13.0-35-generic x86_64)
```

```
* Documentation: https://help.ubuntu.com/  
Last login: Sun Sep 7 05:06:49 2014 from 192.168.75.20
```

```
#####  
# (t) Type of system (bridge)  
# (V) Verbose (no)  
# (0) Interface 0 (p5p1)  
# (1) Interface 1 (p6p1)  
# (2) Bridge Interface (br0)  
# (3) Bridge IP Address (0.0.0.0)  
# (4) Bridge Default Gateway (0.0.0.0)  
# (5) Bridge Mask (255.255.255.0)  
# (m) MTU Size (1500 bytes)  
# (b) WAN Bandwidth (500000 kbit/s)  
# (l) WAN Latency (0 ms)  
# (v) WAN Variation (0 ms)  
# (L) WAN Packet Loss (0 %)  
# (D) WAN Packet Duplication (0 %)  
# (C) WAN Packet Corruption (0 %)  
# (O) WAN Packet Re-Order (0 %)  
# (K) WAN Packet Loss Correlation (0 %)  
# (S) WAN Packet Duplication Correlation (0 %)  
# (F) WAN Packet Corruption Correlation (0 %)  
# (I) WAN Packet Re-Order Correlation (0 %)  
# (i) WAN Information  
# (d) WANsim Configuration Load  
# (s) WANsim Configuration Save  
# (r) WANsim Restart  
# (a) WANsim About  
# (q) Quit / Logout
```

Option?

## Concepts

We access the box via interface p4p1. WANsim has bound interfaces p5p1 and p6p1 into a bridge. To perform our WAN emulation work, we plug a client into one of those interfaces, and server into the other (configure each with static IP addresses on the same subnet -- you pick the subnet). And then use the *wansim* user's menu to twink with parameters -- bandwidth, latency, loss, whatever.

If we only had two NICs, we could assign the br0 interface an IP address, gateway, and mask using the *wansim* menu and ssh to that IP address, mingling our management traffic with the client/server traffic -- but since the apu1c has three NICs, we can afford to skip this step.

There is a routing mode which I haven't explored yet.

## Caveats

After all this ... WANsim isn't working for me. Oh, the menu comes up, but no matter what options I pick, throughput across the box remains the same: ~325-350Mbps, likely the box's maximum throughput.

I traded mail with Ferris, the author, who was quite helpful but then got distracted with other projects. If your installation ends up working, do drop me a note -- I'd like to hear how you did it.