

# How to Install WANem on an APU1c

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## Overview

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

## Build the Box

apu1c

Install the cooling plate per instructions:

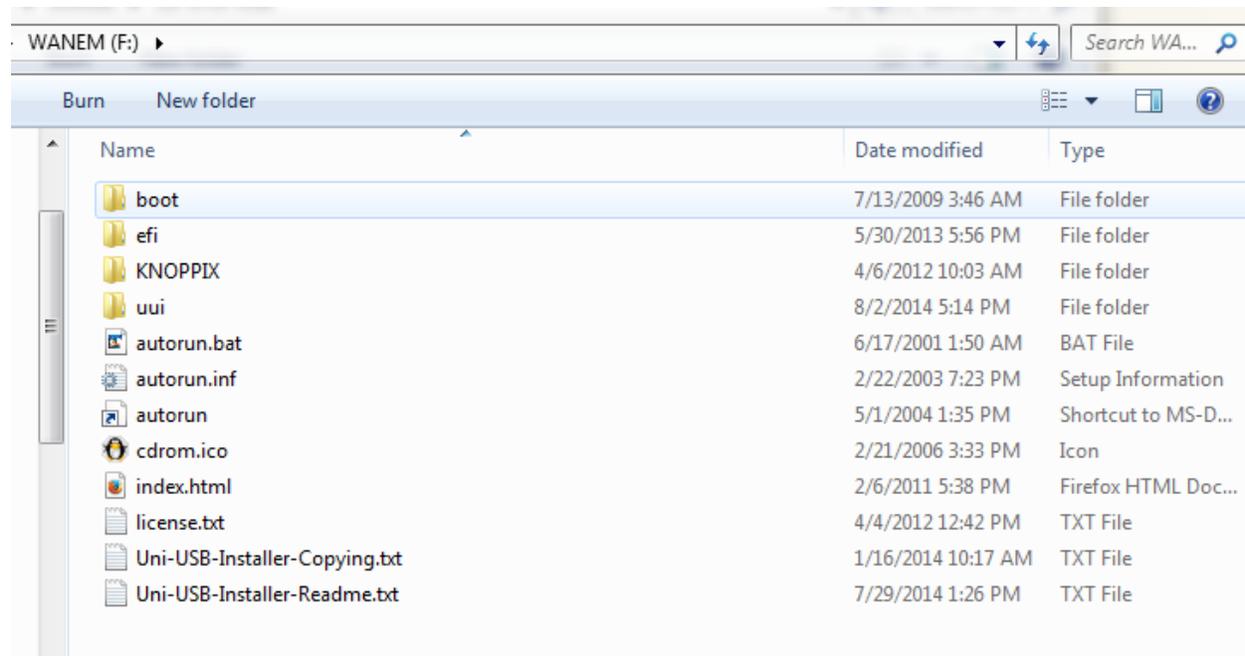
<http://www.pcengines.ch/apucool.htm>

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

## Prepare USB Stick

Create a bootable USB stick (1GB is sufficient) from the WANem ISO

- Download WANem 3.0b2  
<http://wanem.sourceforge.net/download.html>
- Under Windows, run *Universal-USB-Installer-1.9.5.exe* or similar
- Follow instructions to create the USB stick, which will look like this when you're done.



Grab *Customize-WANem.tar.gz*:

<http://www.skendric.com/app/wan-emulation/Customize-WANem.tar.gz>

And untar its files into the KNOPPIX directory on the USB stick. The directory will then look like this, although yours won't have the ssh key files yet:

WANEM (F:) > KNOPPIX > Search KN...

Burn New folder

| Name                           | Date modified      | Type                 | Size       |
|--------------------------------|--------------------|----------------------|------------|
| modules                        | 7/15/2010 4:26 PM  | File folder          |            |
| background.jpg                 | 6/30/2011 6:53 AM  | JPEG image           | 360 KB     |
| index.html                     | 10/10/2014 1:26 PM | Firefox HTML Doc...  | 1 KB       |
| KNOPPIX                        | 1/17/2014 4:50 PM  | File                 | 563,642 KB |
| knoppix.sh                     | 10/10/2014 1:57 PM | SH File              | 9 KB       |
| knoppix.sh.log                 | 10/10/2014 1:48 PM | LOG File             | 3 KB       |
| Knoppix67-wallpaper.flame      | 6/30/2011 6:30 AM  | FLAME File           | 3 KB       |
| Knoppix67-wallpaper-README.txt | 6/30/2011 7:14 AM  | TXT File             | 1 KB       |
| knoppix-cheatcodes.txt         | 2/17/2011 2:56 PM  | TXT File             | 10 KB      |
| knoppix-logo-medium.png        | 11/9/2009 5:45 AM  | PNG image            | 32 KB      |
| knoppix-logo-small.png         | 11/9/2009 5:53 AM  | PNG image            | 16 KB      |
| LICENSE.txt                    | 1/24/2009 8:10 PM  | TXT File             | 19 KB      |
| locatedb                       | 10/10/2014 1:27 PM | File                 | 1,297 KB   |
| profile                        | 10/10/2014 1:26 PM | File                 | 2 KB       |
| README_Security.txt            | 1/24/2009 8:10 PM  | TXT File             | 5 KB       |
| sha1sums                       | 1/17/2014 4:50 PM  | File                 | 2 KB       |
| SOURCES.txt                    | 1/24/2009 8:26 PM  | TXT File             | 2 KB       |
| ssh_host_dsa_key               | 10/8/2014 11:07 PM | File                 | 1 KB       |
| ssh_host_dsa_key.pub           | 10/8/2014 11:07 PM | Microsoft Publish... | 1 KB       |
| ssh_host_rsa_key               | 10/8/2014 11:07 PM | File                 | 2 KB       |
| ssh_host_rsa_key.pub           | 10/8/2014 11:07 PM | Microsoft Publish... | 1 KB       |
| wanem.sh.mod                   | 10/10/2014 1:27 PM | Movie Clip           | 9 KB       |
| wanem.sh.ori                   | 10/10/2014 1:27 PM | ORI File             | 8 KB       |
| wanem_init.sh.mod              | 10/10/2014 1:27 PM | Movie Clip           | 2 KB       |
| wanem_init.sh.ori              | 10/10/2014 1:27 PM | ORI File             | 3 KB       |

Edit /KNOPPIX/knoppix.sh and change the values of:

```
IPADDR
NETMASK
ROOT_PASSWD
TIMEZONE
```

to suit your preferences. You might also edit the username/password values in the *Add/Modify Users* section.

In theory, your USB stick is now ready not only to boot into WANem but also to add the customizations on which this document is focused, customizations which accomplish the following, via the *knoppix.sh* mechanism (*knoppix.sh* runs on boot).

- Set timezone
- Log everything to /var/log/syslog
- Assign a static IP address to p4p1 (Ethernet port closest to the DB9 connector)
- Build the bridge between p5p1 and p6p1
- Enable ssh & sftp
- Support pointing a browser at <http://a.b.c.d> as well as <http://a.b.c.d/WANem>

### Power On

- Insert the USB stick into one of the USB slots on the apu1c.
- Attach p4p1 (the Ethernet port closest to the DB-9 serial port) to your network.
- Attach a serial console<sup>1</sup>: 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
```

---

<sup>1</sup> Actually, this step isn't particularly useful. The WANem Knoppix ISO was compiled without serial console support. So all you see here are the BIOS hardware checks, follows by 'Loading How to Install WANem on an apu1c  
Stuart Kendrick

```

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

SYSLINUX 4.07 EDD 2013-07-25 Copyright (C) 1994-2013 H. Peter Anvin et al
boot:
Loading linux.....
Loading minirt.gz...ready.

```

At this point, you won't see anything else on the console, since this installation of Knoppix ships without serial console support.<sup>2</sup>

If we had a VGA port on this box, then we would see the boot process and resulting main screen just fine: the WANem developers intended their product to be booted on a machine equipped with a monitor.

## Trouble-shoot

At this point, you should be able to point a browser at the IP address you picked when you edited *knoppix.sh* and bring up the opening WANem page.

The screenshot shows the WANem web interface. At the top, there is a navigation bar with links: About, WANalyzer, Basic Mode, Advanced Mode, Save/Restore, Remote Terminal, and Help. The main content area is titled 'Bridges' and shows a dropdown menu for 'br0' and a 'Select bridge' button. Below this, there are three configuration sections for interfaces eth2, eth1, and eth0. Each section has a 'Bandwidth(BW)' section with a 'Choose BW' dropdown (set to 'Other') and a text input for 'Other: Specify BW(Kbps)' (set to '0'). To the right of each is a 'Delay' section with a 'Delay time(ms)' input (set to '0'). At the bottom of the configuration area, there are buttons for 'Apply settings', 'Reset settings', and 'Refresh settings', a checkbox for 'Display commands only, do not execute them', and a 'Check current status' button.

And you should be able to ssh into the box. When you ssh into the box as root, you'll see the following. At this point, *help* will give you WANem commands.

```
+-----+-----+
| Name | IP Address |
+-----+-----+
| eth0 | 192.168.1.21 |
+-----+-----+
| Name | IP Address |
+-----+-----+
```

<sup>2</sup> If anyone figures out how to enable serial console support, do let me know. I believe this could be done by creating a vanilla Knoppix install with serial console support, porting the WANem scripts into it, then mastering a Knoppix ISO.

```

+-----+-----+
+-----+-----+
| Name | IP Address |
+-----+-----+
+-----+-----+
+-----+-----+
| Name | IP Address |
+-----+-----+
+-----+-----+

```

```
WANemControl@PERC>
```

I propose typing *exit2shell*.

```

WANemControl@PERC>exit2shell
Type 'wanem' to return to WANem console
root@WANem_3-0:~#

```

And copying the current ssh keys; this will preserve them across reboots.

```

root@WANem_3-0:/mnt-system/KNOPPIX# cp /etc/ssh/ssh_host* .
root@WANem_3-0:/mnt-system/KNOPPIX#

```

If you encounter problems, consult */KNOPPIX/knoppix.sh.log* (or */mnt-system/KNOPPIX/knoppix.sh.log*, if you are ssh'ed into the WANem box) -- *knoppix.sh* writes this log as it runs. Also consult */var/log/syslog* for further clues. If you cannot ssh into the box, then consider using the Remote Terminal functionality (available from the main WANem browser screen) -- this link delivers a semi-functional shell session.

Notice that WANem helpfully relabels the Ethernet interfaces as follows:

```

p4p1 ==> eth0 (nearest to the DB9 port)
p5p1 ==> eth1 (in the middle)
p6p1 ==> eth2 (farthest from the DB9 port)

```

## Notes

We access the box via interface p4p1. In *knoppix.sh*, we bound interfaces p5p1 and p6p1 into a bridge. To perform our WAN emulation work, we plug a client into one of those interfaces and a server into the other. And then use the *WANem* browser interface 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 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.

The bridge takes a minute or so to come up; some DHCP clients have given up requesting addresses after this long. So you may need to unplug/re-insert the Ethernet cable into any clients trying to acquire DHCP addresses \*across\* the WANem box, once the bridge is running.