



## Application Note

# Using ML-IP Concentrator Software to Create ML-IP Broadband CPE Appliances

## 1 Introduction

The ePipe Multilink IP (ML-IP) technology is embedded in 2344 CPE appliances for bandwidth aggregation up to 5Mbits/sec across 3 broadband links. ML-IP is also available as Concentrator software (10, 50, 100 subscribers) for Intel-based Linux systems. In addition, it is possible to create your own ML-IP appliance, using the ML-IP software (Concentrator-10) for Linux and integrating it into a generic embedded Intel architecture computer that supports up to 4 broadband links.

The benefits of this approach include the ability to lock down the system for this dedicated purpose, so that it requires no keyboard, monitor or disk drive. This reduces the risk of tampering, lowers the maintenance overhead and eliminates several possible points of failure. It also enables providers to create a template for installation at multiple office locations.

The appliance solution is particularly useful for providers and larger multi-site organizations where there is a requirement to provide ultra high-speed broadband services (10-20 Mbits/sec) at each site. This application note provides some technical tips for installing the ePipe ML-IP Concentrator for Linux software on an appliance-style device.

## 2 Sourcing Your ML-IP CPE Appliance

There are a number of commercially available single board Intel appliances in a variety of formats. Many are based around Intel reference designs such as the Intel 810/815 Value Communications Appliance Reference Design.

Related Intel URLs:

<http://www.intel.com/platforms/applied/eiacomm/value1/value1.htm>  
<http://www.intel.com/platforms/applied/eiacomm/value2/value2.htm>

A sample of vendors of compatible boards:

<http://www.win-ent.com/Datasheet%20WIN%20810E%204LAN.pdf>  
<http://www.itox.com/pages/products/mothers/370/gcs15.cfm>  
<http://www.ami.com/indium/>

Other platforms may be available that meet the hardware requirements listed below.

Once you have chosen the motherboard, you will need the following minimum requirements to implement an ML-IP CPE appliance capable of delivering 10-20 Mbits/sec broadband bandwidth.

- Celeron 1GHz CPU minimum (or Pentium III)
- 256 MB SDRAM
- 64-128MB non-volatile storage configured as an IDE drive. A CompactFlash card is often a good way of meeting this requirement, and this document is based on using such a card.
- Two or more onboard PCI Ethernet NICs with drivers for Linux available
- Optional RS232 ports for serial links.
- Optional PCI slot for more NICs or serial ports

Consult documentation to be certain that standard desktop peripherals are suitable for the motherboard used, or that you have suitable peripherals available. Many embedded devices require low-voltage peripherals (eg. 3.3volt PCI cards or SDRAM DIMMs).

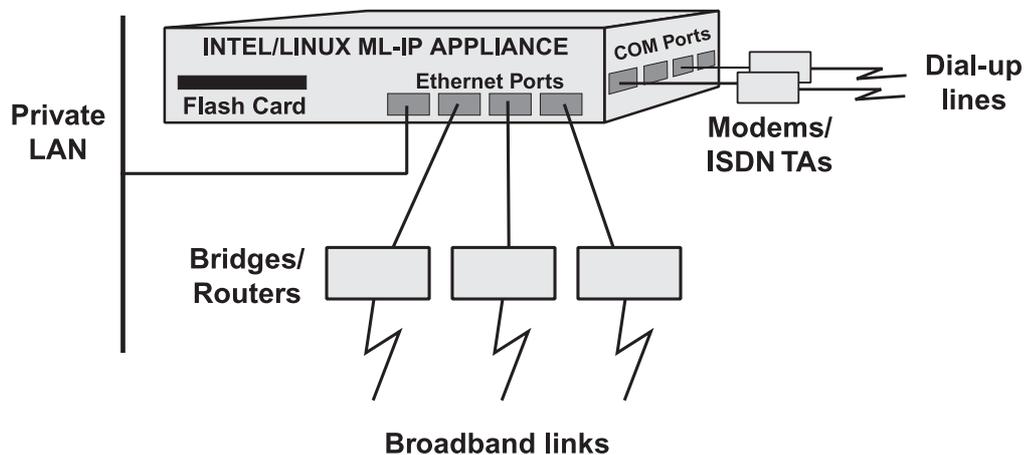


Figure 1: Typical ML-IP Broadband CPE Appliance Configuration

### 3 Setting Up Your ML-IP CPE Appliance

The required amounts of flash memory and main RAM space depend on how it is used. There are two ways to set up your system:

- Although the flash memory card is a silicon disk, the system treats it as a logical hard drive. This uses less main RAM but requires a higher capacity flash card.
- Load the contents of the flash card onto a RAM disk, i.e. the system is running with a volatile ram-disk taken from main memory as its "hard drive". The flash memory card holds a compressed copy of the run-time file system, which is used to boot the device. Since the contents of the RAM disk will be lost when you reboot, you must make provision for copying configuration changes back to the flash card. This approach requires less flash memory space, but considerably more main RAM. It also means the flash memory is written to less often, which may improve reliability if a storage technology with a limited number of erase/write cycles is used.

Some embedded motherboard BIOS ROMs make use of the serial port for configuration or management purposes instead of the video card, monitor and keyboard. In this case, ensure that all serial port features (such as copying screen text to the port automatically) are disabled if you intend using the serial ports with MLIP as dial backup links (in addition to aggregating broadband connections, ML-IP can also aggregate dial-up connections).

Disable any motherboard peripherals (serial ports, parallel ports, USB ports, etc.) that are not being used, to free up interrupt resources.

### ***Installation tips for a CompactFlash based system:***

CompactFlash cards can act as logical IDE hard drives that are solid state (containing no moving parts), which provides greater protection of data than conventional magnetic disk drives and saves space. Using an inexpensive adaptor device, CompactFlash cards can be connected straight to the hard drive cable of a PC. They can also (again, with the aid of an adaptor) be plugged into a PCMCIA slot (for example, on a notebook computer) or they can be inserted into special CF card slots on embedded motherboards. For complete information see: -

<http://www.compactflash.org/info/cfinfo.htm>

ML-IP for Linux is supported on Red Hat Linux distributions. The easiest way to install Red Hat on a CompactFlash card is to use a system with PCMCIA slots. Install Red Hat in exactly the same manner as installing it on a normal system. Do not create any swap space, as there will be no disk in the target system and swapping to CompactFlash is typically not a good idea, as it is slow and can cause errors on the card.

It is also possible to install Red Hat to a hard drive partition that is the same size as a flash card, and later copy the filesystem to the flash card. If you are using a RAM disk for your run-time filesystem, then you **MUST** use this method.

You can also purchase "flash drives" that are NOT CompactFlash cards, but which still plug straight onto an IDE hard disk drive cable. These may be a cheaper alternative than CompactFlash, especially in larger capacities, and may also be more suitable for long term use with many erase/write cycles.

## Suggested methods for creating smaller Linux Images

It should be safe to remove the following packages from a Red Hat 7.3 "minimum install" (a custom installation with no packages selected during the install routine process):

MAKEDEV	gpm	parted
apmd	hdparm	pciutils
ash	hesiod	quota
authconfig	hwdata	raidtools
bdflush	indexhtml	redhat-logos
bzip2	kbdconfig	redhat-release
cyrus-sasl	krb5-libs	reiserfs-utils
cyrus-sasl-md5	kudzu	sendmail
cyrus-sasl-plain	libuser	slocate
db1	lilo	specspo
db2	lokkit	tcsh
dhcpcd	mkbootdisk	timeconfig
dosfstools	mouseconfig	usbutils
file	mt-st	usermode
gdbm	ntsysv	vim-common
glib2	openldap	vim-minimal

If you do not require the ability to make system configuration changes in the future, the following packages could also be removed:

eject  
hotplug  
netconfig  
syslinux

If you do not require a help system available on the Linux system, the following packages could also be removed:

groff  
man  
man-pages

It may be advisable to add these packages to a minimal installation (if you need these services):

openssh  
openssh-server  
ftp  
telnet

## Booting Red Hat Linux

When the Linux boot-loader invokes the Linux kernel, it alerts the kernel as to which disk drive to use as the root file system. To use a CompactFlash card as the root file system, specify the card as you would any other hard drive. The way that the root file system is specified will depend on the hardware configuration of the device. Some example parameters passed by the boot-loader are

```
root=/dev/hda1
```

for a device with the CompactFlash card as the first IDE device (controller) attached to the system, or

```
root=/dev/hdc1
```

if the CompactFlash card is the third.

If you wish to use a RAM disk, the following parameters must be passed:

```
ramdisk_size=<desired_size_of_ramdisk>  
initrd=<name_of_ramdisk_image> root=/dev/ram0
```

Systems that boot with a RAM disk usually store the disk image on a DOS format partition. Using a DOS partition allows the CompactFlash card to be easily modified using an inexpensive USB CompactFlash writer and a standard Windows PC, instead of requiring a PCMCIA slot and a PC that understands Linux file systems.

If using a DOS-format card, we recommend the use of the "syslinux" boot-loader, which is intended for booting Linux from DOS-format disks. If using a Linux-format card, use the "LILO" or "GRUB" bootloaders. All these programs ship as part of Red Hat Linux.

## Installing and activating the ML-IP Concentrator application

Once you have installed Red Hat Linux, install the ML-IP Concentrator application as you would on any other computer running RedHat Linux. See the ML-IP Concentrator documentation for more details.

After the application is installed, you may need to modify the Ethernet allocations (/etc/serverware.config) to suit the target system, if the PC that generated the Red Hat image was not the target appliance itself.

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