

V2616 Linux User's Manual

First Edition, October 2011

www.moxa.com/product



© 2011 Moxa Inc. All rights reserved.

V2616 Linux User's Manual

The software described in this manual is furnished under a license agreement and may be used only in accordance with the terms of that agreement.

Copyright Notice

© 2011 Moxa Inc. All rights reserved.

Trademarks

The MOXA logo is a registered trademark of Moxa Inc.
All other trademarks or registered marks in this manual belong to their respective manufacturers.

Disclaimer

Information in this document is subject to change without notice and does not represent a commitment on the part of Moxa.

Moxa provides this document as is, without warranty of any kind, either expressed or implied, including, but not limited to, its particular purpose. Moxa reserves the right to make improvements and/or changes to this manual, or to the products and/or the programs described in this manual, at any time.

Information provided in this manual is intended to be accurate and reliable. However, Moxa assumes no responsibility for its use, or for any infringements on the rights of third parties that may result from its use.

This product might include unintentional technical or typographical errors. Changes are periodically made to the information herein to correct such errors, and these changes are incorporated into new editions of the publication.

Technical Support Contact Information

www.moxa.com/support

Moxa Americas

Toll-free: 1-888-669-2872
Tel: +1-714-528-6777
Fax: +1-714-528-6778

Moxa Europe

Tel: +49-89-3 70 03 99-0
Fax: +49-89-3 70 03 99-99

Moxa China (Shanghai office)

Toll-free: 800-820-5036
Tel: +86-21-5258-9955
Fax: +86-21-5258-5505

Moxa Asia-Pacific

Tel: +886-2-8919-1230
Fax: +886-2-8919-1231

Table of Contents

1. Introduction	1-1
Overview	1-2
Software Specifications	1-2
Software Components	1-3
2. Software Configuration	2-1
The Read-only File System.....	2-2
Starting from a VGA Console.....	2-2
Connecting from a Telnet Console.....	2-2
Connecting from an SSH Console.....	2-3
Windows Users	2-3
Linux Users	2-4
Adjusting the System Time	2-4
Setting the Time Manually	2-4
NTP Client	2-5
Updating the Time Automatically	2-5
Enabling and Disabling Daemons	2-6
Setting the Run-Level.....	2-8
Cron—Daemon for Executing Scheduled Commands.....	2-9
Inserting a USB Storage Device into the Computer	2-10
Checking the Linux Version	2-11
APT—Installing and Removing Packages	2-11
3. Managing Communications	3-1
Detecting Network Interfaces	3-2
Changing the Network Settings	3-2
Changing the “interfaces” Configuration File	3-2
Static IP Address	3-3
Dynamic IP Address using DHCP	3-3
Adjusting IP Addresses with “ifconfig”	3-3
Telnet/TFTP Server	3-3
Enabling the Telnet/TFTP Server.....	3-4
Disabling the Telnet/TFTP Server.....	3-4
DNS Client	3-4
etc/hostname	3-4
etc/resolv.conf	3-5
etc/nsswitch.conf	3-5
Apache Web Server	3-6
Default Homepage.....	3-6
Disabling the CGI Function	3-6
Saving Web Pages to a USB Storage Device.....	3-7
IPTABLES	3-8
IPTABLES Hierarchy	3-9
IPTABLES Modules.....	3-10
Observe and Erase Chain Rules.....	3-10
Define Policy for Chain Rules.....	3-11
Append or Delete Rules	3-11
NAT (Network Address Translation).....	3-12
NAT Example	3-12
Enabling NAT at Bootup.....	3-13
PPP (Point to Point Protocol).....	3-13
Connecting to a PPP Server over a Simple Dial-up Connection.....	3-14
Connecting to a PPP Server over a Hard-wired Link.....	3-15
Checking the Connection	3-15
Setting up a Machine for Incoming PPP Connections	3-16
PPPoE.....	3-17
NFS (Network File System) Client	3-19
SNMP (Simple Network Management Protocol)	3-20
OpenVPN	3-20
Ethernet Bridging for Private Networks on Different Subnets.....	3-21
Ethernet Bridging for Private Networks on the Same Subnet	3-24
Routed IP	3-25
4. Programming Guide	4-1
RTC (Real Time Clock).....	4-2
UART	4-2
Digital I/O	4-2
Special Note	4-4
Examples	4-4
WDT (Watch Dog Timer).....	4-4

Introduction	4-4
How the WDT Works	4-4
The user API	4-4
Special Note	4-5
Examples	4-5
5. RAID 0/1 Function Configuration	5-1
dm-raid	5-2
Creating RAID from the BIOS.....	5-2
Mounting the RAID Volume	5-5
Replacing a Failed Disk.....	5-6
Software RAID—mdadm	5-7
Creating Software RAID Volume	5-7
Checking the Software RAID Status	5-8
Replacing a Failed Disk.....	5-9
6. System Recovery.....	6-1
Recovery Environment	6-2
Recovery Procedure	6-2
Saving the System to the USB Drive	6-9
A. Software Components	A-1

Introduction

Thank you for purchasing the Moxa V2616 series of x86 ready-to-run embedded computers. This manual introduces the software configuration and management of the V2616-LX, which runs the Linux operating system. For hardware installation, connector interfaces, setup, and upgrading the BIOS, please refer to the "V2616 Hardware User's Manual."

Linux is an open, scalable operating system that allows you to build a wide range of innovative, small footprint devices. Software written for desktop PCs can be easily ported to the Linux-based embedded computer with a GNU cross compiler and a minimum of source code modifications. A typical Linux-based device is designed for a specific use, and is often not connected to other computers, or a number of such devices connect to a centralized, front-end host. Examples include enterprise tools such as industrial controllers, communications hubs, point-of-sale terminals, and display devices, which include HMIs, advertisement appliances, and interactive panels.

The following topics are covered in this chapter:

- ❑ **Overview**
- ❑ **Software Specifications**
- ❑ **Software Components**

Overview

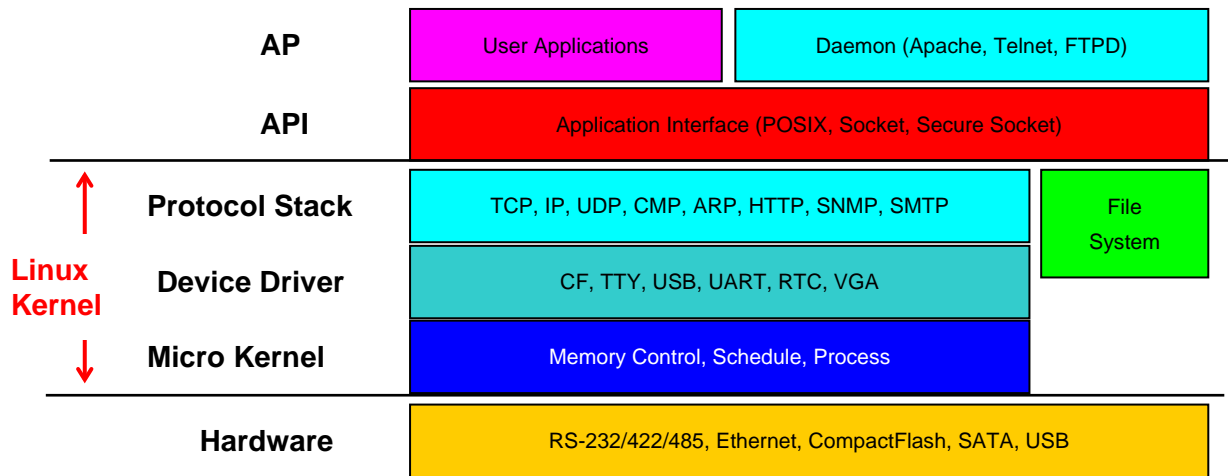
V2616 embedded computers are based on the Intel Core 2 Duo SP9300 x86 processor and feature two serial ports, dual 10/100 or 10/100/1000 Mbps LAN ports, three USB 2.0 hosts, and a CF socket. The V2616 series offers both VGA and DVI-D outputs, making it exceptionally well suited for industrial applications such as SCADA and factory automation.

The V2616's 2 serial ports make it ideal for connecting a wide range of serial devices, and the dual 10/100/1000 Mbps Ethernet ports offer a reliable solution for network redundancy, which taken together promise continuous data communication and management operations. For added convenience, the V2616 computers have 6 DIs and 2 DOs for connecting digital input/output devices. In addition, the CF and USB ports provide V2616 computers with data buffering and storage expansion, which provide the necessary reliability for industrial applications.

Pre-installed with Linux, the V2616 series provides programmers with a friendly environment for developing sophisticated, bug-free application software at a lower cost.

Software Specifications

The Linux operating system pre-installed on the V2616 embedded computers is the **Debian Squeeze 6.0** distribution. The Debian project involves a worldwide group of volunteers who endeavor to produce an operating system distribution composed entirely of free software. The Debian GNU/Linux follows the standard Linux architecture, making it easy to use programs that meet the POSIX standard. Program porting can be done with the GNU Tool Chain provided by Moxa. In addition to Standard POSIX APIs, device drivers for Moxa UART and other special peripherals are also included. An example software architecture is shown below:



ATTENTION

Refer to <http://www.debian.org/> and <http://www.gnu.org/> for information and documentation related to Debian GNU/Linux and the free software concept.



ATTENTION

The above software architecture is only an example. Different models or different build revisions of the Linux operating system may include components not shown in the above graphic.

Software Components

The V2616-LX are pre-installed with the Debian Squeeze 6.0 Linux distribution. For the software components, see "Appendix A."

Software Configuration

In this chapter, we explain how to operate a V2616-LX computer directly from your desktop. There are three ways to connect to the V2616-LX computer: through a VGA monitor, via Telnet over the network, or with an SSH console from a Windows or Linux machine. This chapter describes basic Linux operating system configurations. Advanced network management and configuration instructions will be described in the next chapter, “Managing Communications.”

The following topics are covered in this chapter:

- ❑ **The Read-only File System**
- ❑ **Starting from a VGA Console**
- ❑ **Connecting from a Telnet Console**
- ❑ **Connecting from an SSH Console**
 - Windows Users
 - Linux Users
- ❑ **Adjusting the System Time**
 - Setting the Time Manually
 - NTP Client
 - Updating the Time Automatically
- ❑ **Enabling and Disabling Daemons**
- ❑ **Setting the Run-Level**
- ❑ **Cron—Daemon for Executing Scheduled Commands**
- ❑ **Inserting a USB Storage Device into the Computer**
- ❑ **Checking the Linux Version**
- ❑ **APT—Installing and Removing Packages**

The Read-only File System

The root file system (/) in Moxa's embedded system is mounted as read-only to prevent unexpected crashes. Take the following steps to make it writable temporarily:

1. Make the root file system (/) writable:

```
Moxa:~# mount -o remount,rw /
```

2. Perform your operations, such as apt-get or disk-access.
3. Umount the root file system as read-only:

```
Moxa:~# umount /
```

Starting from a VGA Console

Connect the display monitor to the V2616-LX VGA connector, and then power it up by connecting it to the power adaptor. It takes approximately 30 to 60 seconds for the system to boot up. Once the system is ready, a login screen will appear on your monitor.

To log in, type the login name and password as requested. The default values are both **root**.

Login: root

Password: root

```
Moxa login: root
Password:
Last login: Thu Sep 15 22:46:00 CST 2011 on tty1
Linux Moxa 2.6.32-5-amd64 #1 SMP Tue Jun 14 09:42:28 UTC 2011 x86_64
The programs included with the Debian GNU/Linux system are free software;
The exact distribution terms for each program are described in the
Individual files in /usr/share/doc/*/copyright.
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
Permitted by applicable law.
root@Moxa:~#
```

Connecting from a Telnet Console

The V2616-LX computers come with two Gigabit ports named LAN1 and LAN2. The default IP addresses and netmasks of the network interfaces are as follows:

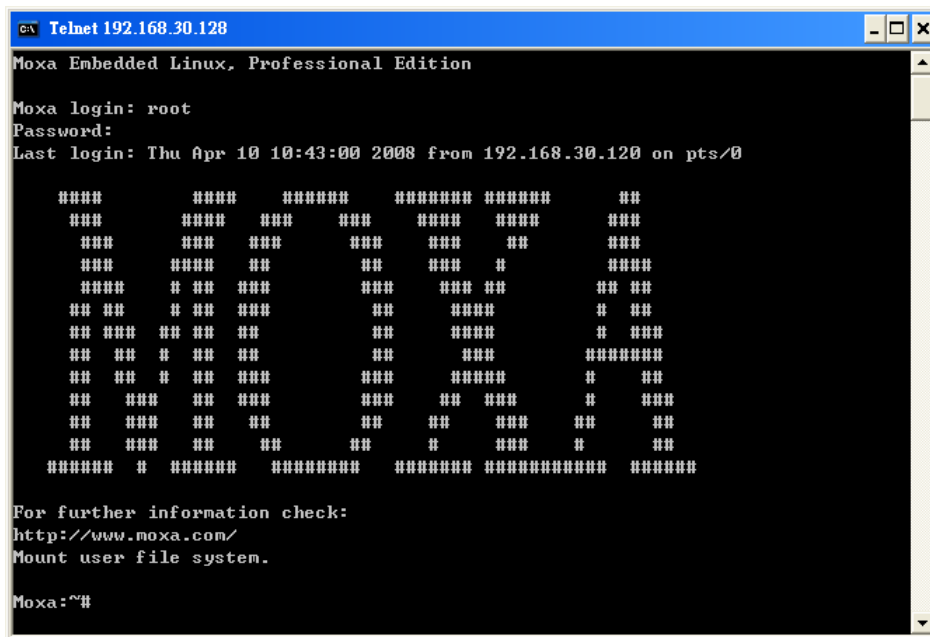
	Default IP Address	Netmask
LAN 1	192.168.3.127	255.255.255.0
LAN 2	192.168.4.127	255.255.255.0

Before using the Telnet client, you should change the IP address of your development workstation so that the network ports are on the same subnet as the IP address for the LAN port that you will connect to. For example, if you will connect to LAN1, you could set your PC's IP address to 192.168.3.126, and the netmask to 255.255.255.0. If you will connect to LAN2, you could set your PC's IP address to 192.168.4.126, and the netmask to 255.255.255.0.

Use a cross-over Ethernet cable to connect your development workstation directly to the target computer, or use a straight-through Ethernet cable to connect the computer to a LAN hub or switch. Next, use a Telnet client on your development workstation to connect to the target computer. After a connection has been established, type the login name and password as requested to log on to the computer. The default values are both **root**.

Login: root

Password: root

A screenshot of a Telnet window titled "Telnet 192.168.30.128". The window shows a terminal session with the following text:

```
Moxa Embedded Linux, Professional Edition
Moxa login: root
Password:
Last login: Thu Apr 10 10:43:00 2008 from 192.168.30.120 on pts/0

#####          #####          #####          #####          #####          ##
###           ###           ###           ###           ###           ###
###           ###           ###           ###           ###           ###
###           ###           ###           ###           ###           ###
#####        # ##        #####        #####        #####        ## ##
## ##        # ##        ##           ##           ##           # ##
## ##        # ##        ##           ##           ##           # ##
## ##        # ##        ##           ##           ##           # ##
## ##        # ##        ##           ##           ##           # ##
#####        # #####        #####        #####        #####        #####
#####        # #####        #####        #####        #####        #####

For further information check:
http://www.moxa.com/
Mount user file system.

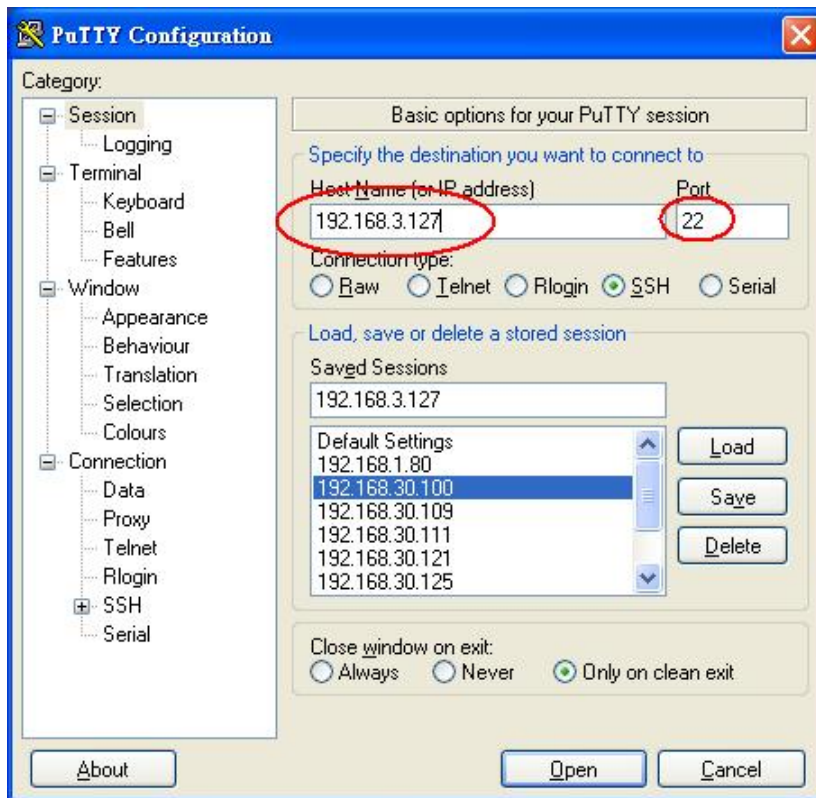
Moxa:~#
```

Connecting from an SSH Console

The V2616-LX computers support an SSH console to offer users better network security compared to Telnet.

Windows Users

Click on the link <http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html> to download **PuTTY** (free software) to set up an SSH console for the V2616-LX in a Windows environment. The following screen shows an example of the configuration that is required.



Linux Users

From a Linux machine, use the **ssh** command to access the V2616-LX's console utility via SSH.

```
#ssh 192.168.3.127
```

Select **yes** to open the connection.

```
[root@bee_notebook root]# ssh 192.168.3.127
The authenticity of host '192.168.3.127 (192.168.3.127)' can't be established.
RSA key fingerprint is 8b:ee:ff:84:41:25:fc:cd:2a:f2:92:8f:cb:1f:6b:2f.
Are you sure you want to continue connection (yes/no)? yes_
```

Adjusting the System Time

The V2616-LX has two time settings. One is the system time, and the other is provided by an RTC (Real Time Clock) built into the V2616-LX's hardware.

Setting the Time Manually

Use the **date** command to query the current system time or to set a new system time. Use **hwclock** to query the current RTC time or to set a new RTC time.

Use the following command to set the system time.

```
# date MMDDhhmmYYYY
```

```
MM:      Month
DD:      Date
hhmm:    Hour and Minute
YYYY:    Year
```

Use the following command to write the current system time to the RTC.

```
# hwclock -w
```

```
MOXA:~# date
      Wed Dec 16 03:34:46 CST 2009

MOXA:~# hwclock
Wed 16 Dec 2009 03:35:16 AM CST  -0.017600 seconds
MOXA:~# date 121616352009
Wed Dec 16 16:35:00 CST 2009
MOXA:~# hwclock -w
MOXA:~# date ; hwclock
Wed Dec 16 16:36:12 CST 2009
Wed 16 Dec 2009 03:38:13 AM CST -0.016751 seconds
MOXA:~#
```

NTP Client

The V2616-LX has a built-in NTP (Network Time Protocol) client that is used to initialize a time request to a remote NTP server. Use **ntpdate** to update the system time.

```
#ntpdate time.stdtime.gov.tw
```

```
#hwclock -w
```

Visit <http://www.ntp.org> for more information about NTP and NTP server addresses.

```
MOXA:~# date ; hwclock
Wed Dec 16 16:36:12 CST 2009
Wed 16 Dec 2009 03:38:13 AM CST -0.016751 seconds
MOXA:~#
MOXA:~# ntpdate time.stdtime.gov.tw
 16 Dec 03:49:48 ntpdate[2510]: step time server 220.130.158.52 offset 155905087.9
84256 sec
MOXA:~#
MOXA:~# hwclock -w
MOXA:~# date ; hwclock
Wed Dec 16 03:51:07 CST 2009
Wed 16 Dec 2009 03:51:07 AM CST  -0.016771 seconds
MOXA:~#
```



ATTENTION

Before using the NTP client utility, check your IP address and network settings (gateway and DNS) to make sure an Internet connection is available.

Updating the Time Automatically

This section describes how to use a shell script to update the time automatically.

Example shell script for updating the system time periodically

```
#!/bin/sh
ntpdate time.stdtime.gov.tw
# You can use the time server's ip address or domain
# name directly. If you use domain name, you must
```

```
# enable the domain client on the system by updating
# /etc/resolv.conf file.
hwclock -w
sleep 100
# Updates every 100 seconds. The min. time is 100 seconds.
# Change 100 to a larger number to update RTC less often.
```

Save the shell script using any file name. For example, **fixtime**.

How to run the shell script automatically when the kernel boots up

Because the root file system is mounted in Read-only mode, we need to re-mount it using writable permission.

```
# mount -o remount,rw /
```

Copy the example shell script **fixtime** to the directory **/etc/init.d**, and then use **chmod 755 fixtime** to change the shell script mode.

```
# chmod 755 fixtime
```

Next, use **vi** editor to edit the file **/etc/inittab**.

```
# vi /etc/inittab
```

Add the following line to the bottom of the file:

```
ntp : 2345 : respawn : /etc/init.d/fixtime
```

After you finish writing or modifying the code, remember to execute **umount /** to change the root directory back to Read-only mode.

```
# umount /
```

Use the command **#init q** to re-initialize the kernel.

```
# init q
```

Enabling and Disabling Daemons

The following daemons are enabled when the V2616-LX boots up for the first time.

Snmpd: SNMP Agent Daemon

Telnetd: Telnet Server/Client Daemon

Inetd: Internet Daemons

Ftpd: FTP Server/Client Daemon

Sshd: Secure Shell Server Daemon

Httpd: Apache WWW Server Daemon

Type the command **ps -ef** to list all processes currently running.

```
Moxa:~# ps -ef
UID          PID  PPID  C  STIME TTY          TIME CMD
root          1     0  0  00:02 ?           00:00:00 init [2]
root          2     0  0  00:02 ?           00:00:00 [kthreadd]
root          3     2  0  00:02 ?           00:00:00 [migration/0]
root          4     2  0  00:02 ?           00:00:00 [ksoftirqd/0]
root          5     2  0  00:02 ?           00:00:00 [watchdog/0]
root          6     2  0  00:02 ?           00:00:00 [migration/1]
root          7     2  0  00:02 ?           00:00:00 [ksoftirqd/1]
root          8     2  0  00:02 ?           00:00:00 [watchdog/1]
root          9     2  0  00:02 ?           00:00:00 [events/0]
root         10     2  0  00:02 ?           00:00:00 [events/1]
root         11     2  0  00:02 ?           00:00:00 [cpuset]
```

```

root      12      2  0 00:02 ?      00:00:00 [khelper]
root      13      2  0 00:02 ?      00:00:00 [netns]
root      14      2  0 00:02 ?      00:00:00 [async/mgr]
root      15      2  0 00:02 ?      00:00:00 [pm]
root      17      2  0 00:02 ?      00:00:00 [sync_supers]
root      18      2  0 00:02 ?      00:00:00 [bdi-default]
root      19      2  0 00:02 ?      00:00:00 [kintegrityd/0]
root      20      2  0 00:02 ?      00:00:00 [kintegrityd/1]
root      21      2  0 00:02 ?      00:00:00 [kblockd/0]
root      22      2  0 00:02 ?      00:00:00 [kblockd/1]
root      23      2  0 00:02 ?      00:00:00 [kacpid]
root      24      2  0 00:02 ?      00:00:00 [kacpi_notify]
root      25      2  0 00:02 ?      00:00:00 [kacpi_hotplug]
root      26      2  0 00:02 ?      00:00:00 [ata/0]
root      27      2  0 00:02 ?      00:00:00 [ata/1]
www-data 2707 2664 0 00:03 ?      00:00:00 /usr/sbin/apache2 -k start
www-data 2708 2664 0 00:03 ?      00:00:00 /usr/sbin/apache2 -k start
www-data 2709 2664 0 00:03 ?      00:00:00 /usr/sbin/apache2 -k start
www-data 2710 2664 0 00:03 ?      00:00:00 /usr/sbin/apache2 -k start
root      2720 2700 0 00:15 tty1    00:00:00 -bash
root      2724      2  0 00:15 ?      00:00:00 [flush-8:0]
root      2745 2536 1 00:21 ?      00:00:00 sshd: root@pts/0
root      2747 2745 0 00:21 pts/0    00:00:00 -bash
root      2751 2747 0 00:21 pts/0    00:00:00 ps -ef
Moxa:~#

```

To run a private daemon, you can edit the file **rc.local**, as shown below:

1. Because the root file system is mounted in Read-only mode, you need to re-mount it with write permission.

```
MOXA:~# mount -o remount,rw /
```

2. Type **cd /etc/** to change directories.

```
MOXA:~# cd /etc/
```

3. Type **vi rc.local** to edit the configuration file with vi editor.

```
MOXA:/etc/# vi rc.local
```

4. Next, add the application daemon that you want to run. We use the example program **tcps2-release**, which you can find on the CD, to illustrate, and configure it to run in the background.

```
# !/bin/sh
# Add you want to run daemon
/home/your program &
```

5. After you finish writing or modifying the code, remember to execute **umount /** to change the root directory back to Read-only mode.

```
MOXA:~# umount /
```

6. You should be able to find the enabled daemon after you reboot the system.

```
MOXA:~# ps -ef
  PID  Uid      VmSize Stat  Command
   1  root      1296  S    init
```

```

 2 root          S    [keventd]
 3 root          S    [ksoftirqd_CPU0]
 4 root          S    [kswapd]
 5 root          S    [bdflush]
 6 root          S    [kupdated]
 7 root          S    [mtdblockd]
 8 root          S    [khubd]
10 root          S    [jffs2_gcd_mtd3]
32 root          D    [ixp425_csr]
38 root         1256 S    stdef
47 root         1368 S    /usr/sbin/inetd
53 root         4464 S    /usr/sbin/httpd
63 nobody       4480 S    /usr/sbin/httpd
64 nobody       4480 S    /usr/sbin/httpd
65 nobody       4480 S    /usr/sbin/httpd
66 nobody       4480 S    /usr/sbin/httpd
67 nobody       4480 S    /usr/sbin/httpd
92 bin          1460 S    /sbin/portmap
97 root         1264 S    /root/tcps2-release
105 root        1556 S    /usr/sbin/rpc.statd
109 root        4044 S    /usr/sbin/snmpd -s -l /dev/null
111 root        2832 S    /usr/sbin/snmptrapd -s
140 root        1364 S    /sbin/cardmgr
144 root        1756 S    /usr/sbin/rpc.nfsd
146 root        1780 S    /usr/sbin/rpc.mountd
153 root        2960 S    /usr/sbin/sshd
161 root        1272 S    /bin/reportip
162 root        3464 S    /bin/massupfirm
163 root        1532 S    /sbin/getty 115200 ttyM0
164 root        1532 S    /sbin/getty 115200 ttyM1
166 root        3464 S    /bin/massupfirm
168 root        3464 S    /bin/massupfirm
171 root        3652 S    /usr/sbin/sshd
172 root        2200 S    -bash
174 root        1592 S    ps -ef
MOXA:~#

```

Setting the Run-Level

To set the Linux run-level and execution priority of a program, use the following command (because the root file system is mounted in Read-only mode, we need to re-mount it with write permission).

```
MOXA:~# mount -o remount,rw /
```

Edit a shell script to execute `/root/tcps2-release` and save it to `tcps2` as an example.

```
#cd /etc/rc2.d
#ln -s /etc/root/tcps2 s60tcps2
```

or

```
#ln -s /etc/root/tcps2 k30tcps2
```

```
MOXA:~# cd /etc/rc2.d
MOXA:/etc/rc2.d#
```

```
MOXA:/etc/rc2.d# ls
S19nfs-common      S25nfs-user-server  S99showreadyled
S20snmpd           S55ssh
S24pcmcia          S99rmnologin
MOXA:/etc/rc2.d#
MOXA:/etc/rc2.d# ln -s /root/tcps2-release S60tcps2
MOXA:/etc/rc2.d# ls
S19nfs-common      S25nfs-user-server  S99rmnologin
S20snmpd           S55ssh              S99showreadyled
S24pcmcia          S60tcps2
```

The command **SxxRUNFILE** has the following meaning:

S: **Start the run file while Linux boots up.**
xx: **A number between 00 and 99. The smaller number has a higher priority.**
RUNFILE: **The script file name**

The command **KxxRUNFILE** has the following meaning:

K: **Start the run file while Linux shuts down or halts.**
xx: **A number between 00 and 99. The smaller number has a higher priority.**
RUNFILE: **The script file name**

To remove the daemon, use the following command to remove the run file from /etc/rc2.d by:

```
MOXA:~# rm -f /etc/rc2.d/S60tcps2
```

After you finish writing or modifying the code, remember to execute **umount /** to change the root directory back to Read-only mode.

```
MOXA:~# umount /
```

Cron—Daemon for Executing Scheduled Commands

The Cron daemon will search **/etc/crontab** for crontab files.

Cron wakes up every minute and checks each command to see if it should be run at that time. When executing commands, output is mailed to the owner of the **crontab** (or to the user named in the MAILTO environment variable in the **crontab**, if such a user exists).

Modify the file **/etc/crontab** to set up your scheduled applications. **Crontab** files have the following format:

mm	h	dom	mon	dow	user	command
minute	hour	date	month	week	user	command
0-59	0-23	1-31	1-12	0-6 (0 is Sunday)		

For example, issue the following command if you want to launch a program at 8:00 every day:

```
#minute hour date month dow user command
*      8    *    *    *    root  /path/to/your/program
```

The following example demonstrates how to use **Cron** to update the system time and RTC time every day at 8:00.

1. Write a shell script named `fixtime.sh` and save it to **/home/**.


```
#!/bin/sh
ntpdate time.stdtime.gov.tw
```



```
hwclock -w
exit 0
```

2. Change the mode of `fixtime.sh`
`# chmod 755 fixtime.sh`
3. Modify the `/etc/crontab` file to run `fixtime.sh` at 8:00 every day.
Add the following line to the end of crontab:

```
* 8 * * *root    /home/fixtime.sh
```

Inserting a USB Storage Device into the Computer

Since mounting USB storage devices manually can be difficult, a Debian package named **usbmount** is used to mount the USB drivers automatically. **usbmount** relies on **udev** to mount USB storage devices automatically at certain mount points. The USB storage devices will be mounted on `/media/usb0`, `/media/usb1`, etc.

```
MOXA:~# mount
/dev/hda1 on / type ext2 (rw,errors=remount-ro)
tmpfs on /lib/init/rw type tmpfs (rw,nosuid,mode=0755)
proc on /proc type proc (rw,noexec,nosuid,nodev)
sysfs on /sys type sysfs (rw,noexec,nosuid,nodev)
procbususb on /proc/bus/usb type usbfs (rw)
udev on /dev type tmpfs (rw,mode=0755)
tmpfs on /dev/shm type tmpfs (rw,nosuid,nodev)
devpts on /dev/pts type devpts (rw,noexec,nosuid,gid=5,mode=620)
/dev/hdb2 on /home type ext2 (rw)
nfsd on /proc/fs/nfsd type nfsd (rw)
rpc_pipefs on /var/lib/nfs/rpc_pipefs type rpc_pipefs (rw)
/dev/sda1 on /media/usb0 type vfat
(rw,noexec,nodev,sync,noatime,gid=25,dmask=0007,fmask=0117)
/dev/sdb1 on /media/usb1 type vfat
(rw,noexec,nodev,sync,noatime,gid=25,dmask=0007,fmask=0117)
MOXA:~#
```

Note that `usbmount` is a light-weight solution for text mode, and does not fully support the gnome desktop environment. For better supportability, install `gnome-volume-manager` instead of `usbmount`:

```
MOXA:~# mount -o,remount rw /
MOXA:~# apt-get remove usbmount
MOXA:~# apt-get install gnome-volume-manager
MOXA:~# umount /
```



ATTENTION

Remember to type the command `# sync` before you disconnect the USB storage device. If you do not issue the command, you may lose data.



ATTENTION

Remember to exit the `/media/usb0` or `/media/usb1` directory when you disconnect the USB storage device. If you stay in `/media/usb0` or `/media/usb1`, the automatic un-mount process will fail. If that happens, type `# umount /media/usb0` to un-mount the USB device manually.

Checking the Linux Version

The program **uname**, which stands for “Unix Name” and is part of the Unix operating system, prints the name, version, and other details about the operating system running on the computer. Use the **-a** option to generate a response similar to the one shown below:

```
MOXA:~# uname -a
Linux Moxa 2.6.32-5-amd64 #1 SMP Tue Jun 14 09:42:28 UTC 2011 x86_64 GNU/Linux
MOXA:~#
```

APT—Installing and Removing Packages

APT is the Debian tool used to install and remove packages. Before installing a package, you need to configure the apt source file, **/etc/apt/sources.list**, which is located in the read-only partition.

1. Mount the root file system with write permission.

```
MOXA:~# mount -o remount,rw
```

2. Next, use vi editor to configure **/etc/apt/sources.list**.

```
MOXA:~# vi /etc/apt/sources.list
#
# deb cdrom:[Debian GNU/Linux 6.0.2.1 _Squeeze_ - Official amd64 NETINST Binary-1
20110628-12:58]/ Squeeze main
#deb cdrom:[Debian GNU/Linux 6.0.2.1 _Squeeze_ - Official amd64 NETINST Binary-1
20110628-12:58]/ Squeeze main
deb http://ftp.us.debian.org/debian/ squeeze main
deb-src http://ftp.us.debian.org/debian/ squeeze main
deb http://security.debian.org/ squeeze/updates main
deb-src http://security.debian.org/ squeeze/updates main
# squeeze-updates, previously known as 'volatile'
deb http://ftp.us.debian.org/debian squeeze-updates main
deb-src http://ftp.us.debian.org/debian squeeze-updates main
```

3. Update the source list after you configure it.

```
MOXA:~# apt-get update
MOXA:~#
```

4. Once you indicate which package you want to install (**openswan**, for example), type:

```
MOXA:~# apt-get install openswan
MOXA:~#
```

5. Use one of the following commands to remove a package:
 - a. For a simple package removal:

```
MOXA:~# apt-get remove openswan
MOXA:~#
```

- b. For a complete package removal:

```
MOXA:~# apt-get remove openswan --purge
MOXA:~#
```

6. If the installation is complete, remember to unmount the root directory back to read-only mode.

```
MOXA:~# umount /
MOXA:~#
```



ATTENTION

The APT cache space `/var/cache/apt` is located in `tmpfs`. If you need to install a huge package, link `/var/cache/apt` to USB mass storage or mount it to an NFS space to generate more free space. Use `df -h` to check how much free space is available on `tmpfs`.

```
Moxa:~# df -h
Filesystem      Size  Used Avail Use% Mounted on
rootfs          1.5G 1001M  440M  70% /
udev            10M   748K   9.3M   8% /dev
/dev/sda1       1.5G 1001M  440M  70% /
tmpfs           501M     0  501M   0% /lib/init/rw
tmpfs           501M     0  501M   0% /dev/shm
none            501M   19M  482M   4% /tmp
/dev/sda2       270M  130M  126M  51% /home
Moxa:~#
```



ATTENTION

You can free up the cache space with the command `# apt-get clean`.

```
MOXA:~# apt-get clean
MOXA:~#
```

Managing Communications

The V2616-LX ready-to-run embedded computer is a network-centric platform designed to serve as a front-end for data acquisition and industrial control applications. This chapter describes how to configure the various communication functions supported by the Linux operating system.

The following topics are covered in this chapter:

- ❑ **Detecting Network Interfaces**
- ❑ **Changing the Network Settings**
 - Changing the “interfaces” Configuration File
 - Adjusting IP Addresses with “ifconfig”
- ❑ **Telnet/TFTP Server**
 - Enabling the Telnet/TFTP Server
 - Disabling the Telnet/TFTP Server
- ❑ **DNS Client**
 - /etc/hostname
 - /etc/resolv.conf
 - /etc/nsswitch.conf
- ❑ **Apache Web Server**
 - Default Homepage
 - Disabling the CGI Function
 - Saving Web Pages to a USB Storage Device
- ❑ **IPTABLES**
 - IPTABLES Hierarchy
 - IPTABLES Modules
 - Observe and Erase Chain Rules
 - Define Policy for Chain Rules
 - Append or Delete Rules
- ❑ **NAT (Network Address Translation)**
 - NAT Example
 - Enabling NAT at Bootup
- ❑ **PPP (Point to Point Protocol)**
 - Connecting to a PPP Server over a Simple Dial-up Connection
 - Connecting to a PPP Server over a Hard-wired Link
 - Checking the Connection
 - Setting up a Machine for Incoming PPP Connections
- ❑ **PPPoE**
- ❑ **NFS (Network File System) Client**
- ❑ **SNMP (Simple Network Management Protocol)**
- ❑ **OpenVPN**
 - Ethernet Bridging for Private Networks on Different Subnets
 - Ethernet Bridging for Private Networks on the Same Subnet
- **Routed IP**

Detecting Network Interfaces

Linux systems use **udev** to detect new network interfaces, including Ethernet interfaces and wireless interfaces. The result is saved in `/etc/udev/rules.d/70-persistent-net.rules`. The content is similar to the following:

```
# PCI device 0x10ec:0x8168 (r8168)
SUBSYSTEM=="net", ACTION=="add", DRIVERS=="?*",
ATTR{address}=="00:90:e8:00:00:20", ATTR{dev_id}=="0x0", ATTR{type}=="1",
KERNEL=="eth*", NAME="eth0"

# PCI device 0x10ec:0x8168 (r8168)
SUBSYSTEM=="net", ACTION=="add", DRIVERS=="?*",
ATTR{address}=="00:90:e8:00:00:21", ATTR{dev_id}=="0x0", ATTR{type}=="1",
KERNEL=="eth*", NAME="eth1"
```

The above example indicates that the system has detected two Ethernet interfaces.



ATTENTION

When replacing or connecting a network interface, the system may keep the old record in `/etc/udev/rules.d/70-persistent-net.rules`, which could cause network interfaces to be detected abnormally. To avoid this problem, delete the content of the file `/etc/udev/rules.d/70-persistent-net.rules` and reboot the system.

Changing the Network Settings

The V2616-LX computer has two 10/100/1000 Ethernet ports named LAN1 and LAN2. The default IP addresses and netmasks of these network interfaces are:

	Default IP Address	Netmask
LAN1	192.168.3.127	255.255.255.0
LAN2	192.168.4.127	255.255.255.0

These network settings can be modified by changing the **interfaces** configuration file, or they can be adjusted temporarily with the **ifconfig** command.

Changing the “interfaces” Configuration File

1. Type `cd /etc/network` to change directories.

```
MOXA:~# cd /etc/network
```

2. Type `vi interfaces` to edit the network configuration file with **vi** editor. You can configure the V2616-LX's Ethernet ports for static or dynamic (DHCP) IP addresses.

```
MOXA:/etc/network# vi interfaces
```

Static IP Address

As shown in the following example, the default static IP addresses can be modified.

```
# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet static
    address 192.168.3.127
    netmask 255.255.255.0
    broadcast 192.168.3.255

auto eth1
iface eth1 inet static
    address 192.168.4.127
    netmask 255.255.255.0
    broadcast 192.168.4.255
```

Dynamic IP Address using DHCP

To configure one or both LAN ports to request an IP address dynamically, replace **static** with **dhcp** and then delete the rest of the lines.

```
# The primary network interface
auto eth0
iface eth0 inet dhcp
```

After modifying the boot settings of the LAN interface, issue the following command to activate the LAN settings immediately.

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

```
MOXA:~# /etc/init.d/networking restart
```

Adjusting IP Addresses with “ifconfig”

IP settings can be adjusted during run-time, but the new settings will not be saved to the flash ROM without modifying the file `/etc/network/interfaces`. For example, type the command `# ifconfig eth0 192.168.1.1` to change the IP address of LAN1 to 192.168.1.1.

```
MOXA:~# ifconfig eth0 192.168.1.1
MOXA:~#
```

Telnet/TFTP Server

In addition to supporting Telnet client/server and FTP client/server, the V2616-LX also supports SSH and sftp client/server. To enable or disable the Telnet/ftp server, you need to edit the file `/etc/inetd.conf`.

1. Mount the root file system with write permission.

```
MOXA:~# mount -o remount,rw /
```

2. Type `# cd /etc` to change the directory.

```
MOXA:~# cd /etc
```

3. Type `# vi inetd.conf` to edit the configuration file.

```
MOXA:/etc# vi inetd.conf
```

Enabling the Telnet/TFTP Server

The following example shows the default content of the file `/etc/inetd.conf`. The default is to “enable the Telnet/ftp server:”

```
telnet      stream tcp    nowait telnetd /usr/sbin/tcpd
/usr/sbin/in.telnetd
tftp       dgram  udp    wait   nobody /usr/sbin/tcpd
/usr/sbin/in.tftpd /srv/tftp
```

Disabling the Telnet/TFTP Server

Disable the daemon by typing “#” in front of the first character of the row to comment out the line. For example, to disable the **TFTP** server, use the following commands:

```
telnet      stream tcp    nowait telnetd /usr/sbin/tcpd
/usr/sbin/in.telnetd
#tftp       dgram  udp    wait   nobody /usr/sbin/tcpd
/usr/sbin/in.tftpd /srv/tftp
```

After you finish writing or modifying the code, remember to execute “`umount /`” to change the root directory back to Read-only mode.

```
MOXA:~# umount /
```

DNS Client

The V2616-LX supports DNS client (but not DNS server). To set up DNS client, you need to edit three configuration files: `/etc/hostname`, `/etc/resolv.conf`, and `/etc/nsswitch.conf`.

`/etc/hostname`

1. Mount the root file system with write permission.

```
MOXA:~# mount -o remount,rw /
```

2. Edit `/etc/hostname`:

```
MOXA:~# vi /etc/hostname
MOXA
```

3. After you finish writing or modifying the code, remember to execute “`umount /`” to change the root directory back to Read-only mode.

```
MOXA:~# umount /
```

4. Re-configure the hostname.

```
MOXA:~# /etc/init.d/hostname.sh start
```

5. Check the new hostname.

```
MOXA:~# hostname
```

/etc/resolv.conf

This is the most important file that you need to edit when using DNS. For example, before using **# ntpdate time.stdtime.gov.tw** to update the system time, you will need to add the DNS server address to the file. Ask your network administrator which DNS server address you should use. The DNS server's IP address is specified with the **nameserver** command. For example, add the following line to **/etc/resolv.conf** (assuming the DNS server's IP address is 168.95.1.1):

```
nameserver 168.95.1.1
```

```
MOXA:/etc# cat resolv.conf
#
# resolv.conf This file is the resolver configuration file
# See resolver(5).
#
#nameserver 192.168.1.16
nameserver 168.95.1.1
nameserver 140.115.1.31
nameserver 140.115.236.10
MOXA:/etc#
```

/etc/nsswitch.conf

This file defines the sequence of files, **/etc/hosts** or **/etc/resolv.conf**, to be read to resolve the IP address. The **hosts** line in **/etc/nsswitch.conf** means use **/etc/host** first and DNS service to resolve the address.

```
# /etc/nsswitch.conf
#
# Example configuration of GNU Name Service Switch functionality.
# If you have the `glibc-doc-reference' and `info' packages installed, try:
# `info libc "Name Service Switch"' for information about this file.

passwd:          compat
group:           compat
shadow:         compat

hosts:          files dns
networks:       files

protocols:      db files
services:       db files
ethers:         db files
rpc:            db files

netgroup:       nis
```


Apache Web Server

Default Homepage

The Apache web server's main configuration file is `/etc/apache2/sites-enabled/000-default`, with the default homepage located at `/var/www/apache2-default/index.html`.

Save your own homepage to the following directory:

```
/var/www
```

Save your CGI page to the following directory:

```
/var/www
```

Before you modify the homepage, use a browser (such as Microsoft Internet Explore or Mozilla Firefox) from your PC to test if the Apache web server is working. Type the LAN1 IP address in the browser's address box to open the homepage. For example, if the default IP address 192.168.3.127 is still active, type:

```
http://192.168.3.127/
```

To test the default CGI page, type:

```
http://192.168.3.127/cgi-bin/w3mmail.cgi
```

Disabling the CGI Function

The CGI function is enabled by default. If you want to disable the function, modify the file `/etc/apache2/sites-enabled/000-default`.

1. Mount the root file system with write permission.

```
MOXA:~# mount -o remount,rw
```

2. Type `# vi/etc/apache2/sites-enabled/000-default` to edit the configuration file. Comment out the following lines:

```
#ScriptAlias /cgi-bin/ /var/www/cgi-bin/
#<Directory "/var/www/cgi-bin/">
# AllowOverride None
# Options ExecCGI -MultiViews +SymLinksIfOwnerMatch
# #Order allow,deny
# Order deny,allow
# Allow from all
#</Directory>
```

```
MOXA:/etc# vi /etc/apache2/sites-available/default
#ScriptAlias /cgi-bin/ /var/www/cgi-bin/
#<Directory "/var/www/cgi-bin/">
# AllowOverride None
# Options ExecCGI -MultiViews +SymLinksIfOwnerMatch
# #Order allow,deny
# Order deny,allow
# Allow from all
#</Directory>
```

3. After you finish writing or modifying the code, remember to execute `"umount /"` to change the root directory back to Read-only mode.

```
MOXA:~# umount /
```

4. Re-start the apache server.

```
MOXA:~# /etc/init.d/apache2 restart
```



ATTENTION

When you develop your own CGI application, make sure your CGI file is executable.

Saving Web Pages to a USB Storage Device

Some applications may have web pages that take up a lot of storage space. This section describes how to save web pages to the USB mass storage device, and then configure the Apache web server's DocumentRoot to open these pages. The files used in this example can be downloaded from Moxa's website.

1. Prepare the web pages and then save the pages to the USB storage device. Click on the following link to download the web page test suite: <http://www.w3.org/MarkUp/Test/HTML401.zip>.
2. Uncompress the zip file to your desktop PC, and then use FTP to transfer it to the V2616-LX's `/media/usb0` directory.
3. Mount the root file system with write permission.

```
MOXA:~# mount -o remount,rw /
```

4. Type `# vi /etc/apache2/sites-available/default` and `# vi /etc/apache2/sites-available/default-ssl` to edit the configuration file.

```
MOXA:/etc# MOXA:/etc# vi /etc/apache2/sites-available/default
MOXA:/etc# vi /etc/apache2/sites-available/default-s
```

5. Change the DocumentRoot directory to the USB storage directory `/media/usb0/www`.

```
...
<VirtualHost *:80>
...
...
    DocumentRoot /media/usb0/www
    <Directory />
        Options FollowSymLinks
        AllowOverride None
    </Directory>
...
...
    ScriptAlias /cgi-bin/ /media/usb0/www/cgi-bin/
    <Directory "/media/usb0/www/cgi-bin/">
        AllowOverride None
        Options ExecCGI -MultiViews +SymLinksIfOwnerMatch
        Order allow,deny
        Allow from all
    </Directory>
...
</VirtualHost>
"etc/apache2/sites-available/default"
<VirtualHost *:443>
...
...
    DocumentRoot /media/usb0/www
```

```

<Directory />
    Options FollowSymLinks
    AllowOverride None
</Directory>
...
...
ScriptAlias /cgi-bin/ /media/usb0/www/cgi-bin/
<Directory "/media/usb0/www/cgi-bin/">
    AllowOverride None
    Options ExecCGI -MultiViews +SymLinksIfOwnerMatch
    Order allow,deny
    Allow from all
</Directory>
...
</VirtualHost>
/etc/apache2/sites-available/default-ssl"

```

6. Use the following commands to restart the Apache web server:

```
#cd /etc/init.d
#./apache2 restart
```

7. Start your browser and connect to the V2616-LX by typing the current LAN1 IP address in the browser's address box.
8. Remember to execute "umount /" to change the root directory back to Read-only mode.

```
MOXA:~# umount /
```

9. Re-start the apache server.

```
MOXA:~# /etc/init.d/apache2 restart
```



ATTENTION

Visit the Apache website at <http://httpd.apache.org/docs/> for more information about setting up Apache servers.

IPTABLES

IPTABLES is an administrative tool for setting up, maintaining, and inspecting the Linux kernel's IP packet filter rule tables. Several different tables are defined, with each table containing built-in chains and user-defined chains.

Each chain is a list of rules that apply to a certain type of packet. Each rule specifies what to do with a matching packet. A rule (such as a jump to a user-defined chain in the same table) is called a **target**.

The V2616-LX supports three types of IPTABLES: Filter tables, NAT tables, and Mangle tables.

Filter Table—includes three chains:

- **INPUT** chain
- **OUTPUT** chain
- **FORWARD** chain

NAT Table—includes three chains:

- **PREROUTING** chain—transfers the destination IP address (DNAT).
- **POSTROUTING** chain—works after the routing process and before the Ethernet device process to transfer the source IP address (SNAT).

- **OUTPUT chain**—produces local packets.

Sub-tables

- **Source NAT (SNAT)**—changes the first source IP address of the packet.
- **Destination NAT (DNAT)**—changes the first destination IP address of the packet.
- **MASQUERADE**—a special form for SNAT. If one host can connect to the Internet, then the other computers that connect to this host can connect to the Internet when the computer does not have an actual IP address.
- **REDIRECT**—a special form of DNAT that re-sends packets to a local host independent of the destination IP address.

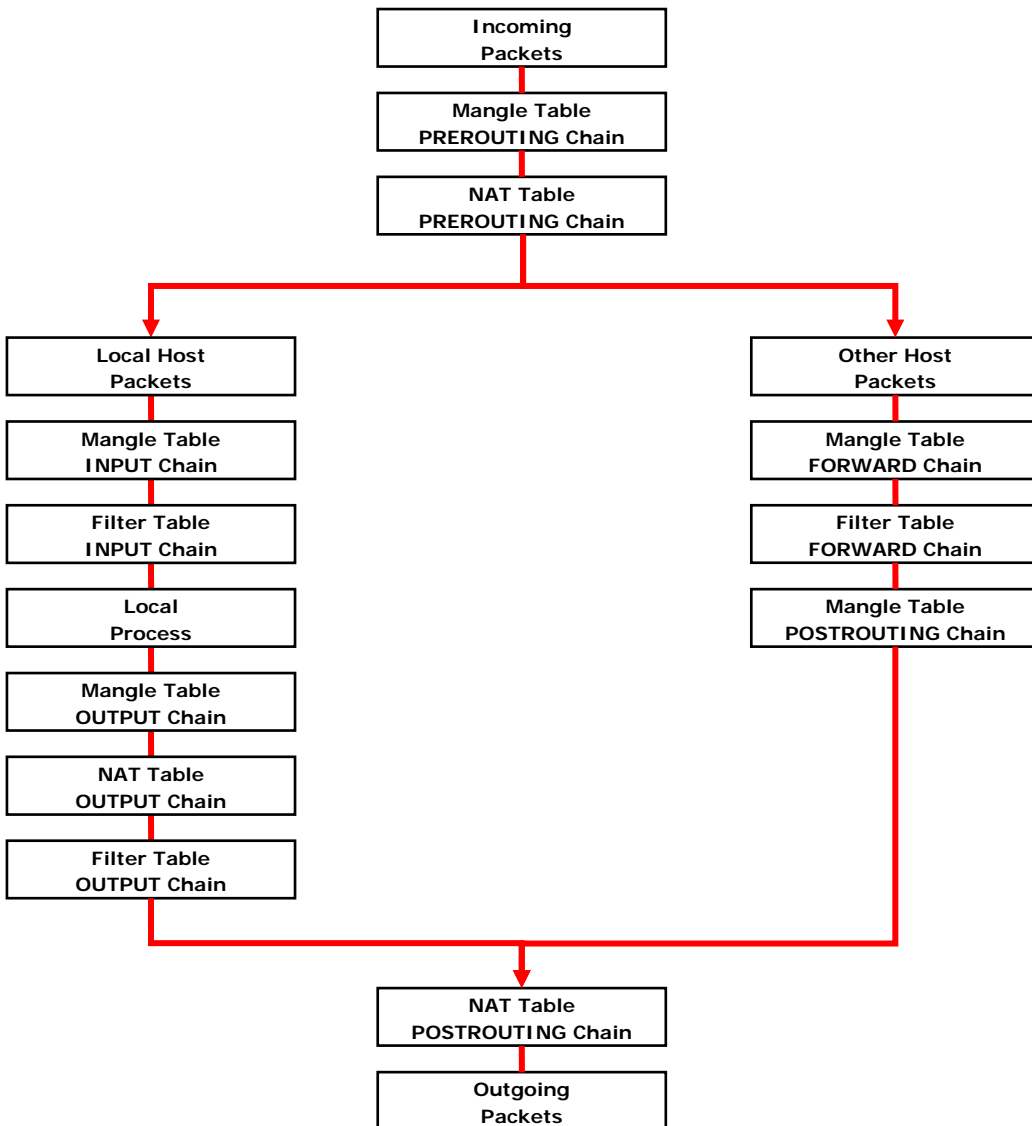
Mangle Table—includes two chains

- **PREROUTING chain**—pre-processes packets before the routing process.
- **OUTPUT chain**—processes packets after the routing process.

Mangle tables can have one of three extensions—TTL, MARK, TOS.

IPTABLES Hierarchy

The following figure shows the IPTABLES hierarchy.



IPTABLES Modules

The V2616-LX supports the following sub-modules. Be sure to use the module that matches your application.

arpable_filter.ko	arp_tables.ko	arpt_mangle.ko	ip_conntrack_amanda.ko
ip_conntrack_ftp.ko	ip_conntrack_h323.ko	ip_conntrack_irc.ko	ip_conntrack.ko
ip_conntrack_netbios_ns.ko	ip_conntrack_netlink.ko	ip_conntrack_pptp.ko	ip_conntrack_proto_sctp.ko
ip_conntrack_sip.ko	ip_conntrack_tftp.ko	ip_nat_amanda.ko	ip_nat_ftp.ko
ip_nat_h323.ko	ip_nat_irc.ko	ip_nat.ko	ip_nat_pptp.ko
ip_nat_sip.ko	ip_nat_snmp_basic.ko	ip_nat_tftp.ko	ip_queue.ko
iptables_filter.ko	iptables_mangle.ko	iptables_nat.ko	iptables_raw.ko
ip_tables.ko	ipt_addrtype.ko	ipt_ah.ko	ipt_CLUSTERIP.ko
ipt_dscp.ko	ipt_DSCP.ko	ipt_ecn.ko	ipt_ECN.ko
ipt_hashlimit.ko	ipt_iprange.ko	ipt_LOG.ko	ipt_MASQUERADE.ko
ipt_NETMAP.ko	ipt_owner.ko	ipt_recent.ko	ipt_REDIRECT.ko
ipt_REJECT.ko	ipt_SAME.ko	ipt_TCPMSS.ko	ipt_tos.ko
ipt_TOS.ko	ipt_ttl.ko	ipt_TTL.ko	ipt_ULOG.ko

The basic syntax to enable and load an IPTABLES module is as follows:

```
# lsmod
# modprobe ip_tables
# modprobe iptable_filter
#modprobe iptable_mangle
#modprobe iptable_nat
```

Use **lsmod** to check if the **ip_tables** module has already been loaded in the V2616-LX. Use **modprobe** to insert and enable the module.

Use **iptables**, **iptables-restore**, and **iptables-save** to maintain the database.



ATTENTION

IPTABLES plays the role of packet filtering or NAT. Be careful when setting up the IPTABLES rules. If the rules are not correct, remote hosts that connect via a LAN or PPP may be denied. We recommend using the VGA console to set up the IPTABLES. Click on the following links for more information about IPTABLES.

<http://www.linuxguruz.com/iptables/>

<http://www.netfilter.org/documentation/HOWTO//packet-filtering-HOWTO.html>

Since the IPTABLES command is very complex, to illustrate the IPTABLES syntax we have divided our discussion of the various rules into three categories: **Observe and erase chain rules**, **Define policy rules**, and **Append or delete rules**.

Observe and Erase Chain Rules

Usage:

```
# iptables [-t tables] [-L] [-n]
```

-t tables: Table to manipulate (default: 'filter'); example: nat or filter.

-L [chain]: List List all rules in selected chains. If no chain is selected, all chains are listed.

-n: Numeric output of addresses and ports.

```
# iptables [-t tables] [-FXZ]
```

-F: Flush the selected chain (all the chains in the table if none is listed).

-X: Delete the specified user-defined chain.

-Z: Set the packet and byte counters in all chains to zero.

Example:

```
# iptables -L -n
```

In this example, since we do not use the `-t` parameter, the system uses the default “filter” table. Three chains are included: INPUT, OUTPUT, and FORWARD. INPUT chains are accepted automatically, and all connections are accepted without being filtered.

```
# iptables -F
```

```
# iptables -X
```

```
# iptables -Z
```

Define Policy for Chain Rules

Usage:

```
# iptables [-t tables] [-P] [INPUT, OUTPUT, FORWARD, PREROUTING, OUTPUT, POSTROUTING]
[ACCEPT, DROP]
```

-P: Set the policy for the chain to the given target.

INPUT: For packets coming into the V2616-LX.

OUTPUT: For locally-generated packets.

FORWARD: For packets routed out through the V2616-LX.

PREROUTING: To alter packets as soon as they come in.

POSTROUTING: To alter packets as they are about to be sent out.

Example:

```
#iptables -P INPUT DROP
```

```
#iptables -P OUTPUT ACCEPT
```

```
#iptables -P FORWARD ACCEPT
```

```
#iptables -t nat -P PREROUTING ACCEPT
```

```
#iptables -t nat -P OUTPUT ACCEPT
```

```
#iptables -t nat -P POSTROUTING ACCEPT
```

In this example, the policy accepts outgoing packets and denies incoming packets.

Append or Delete Rules

Usage:

```
# iptables [-t table] [-AI] [INPUT, OUTPUT, FORWARD] [-io interface] [-p tcp, udp, icmp, all] [-s
IP/network] [--sport ports] [-d IP/network] [--dport ports] -j [ACCEPT, DROP]
```

-A: Append one or more rules to the end of the selected chain.

-I: Insert one or more rules in the selected chain as the given rule number.

-i: Name of an interface via which a packet is going to be received.

-o: Name of an interface via which a packet is going to be sent.

-p: The protocol of the rule or of the packet to check.

-s: Source address (network name, host name, network IP address, or plain IP address).

--sport: Source port number.

-d: Destination address.

--dport: Destination port number.

-j: Jump target. Specifies the target of the rules; i.e., how to handle matched packets.

For example, ACCEPT the packet, DROP the packet, or LOG the packet.

Examples:

Example 1: Accept all packets from the lo interface.

```
# iptables -A INPUT -i lo -j ACCEPT
```

Example 2: Accept TCP packets from 192.168.0.1.

```
# iptables -A INPUT -i eth0 -p tcp -s 192.168.0.1 -j ACCEPT
```

Example 3: Accept TCP packets from Class C network 192.168.1.0/24.

```
# iptables -A INPUT -i eth0 -p tcp -s 192.168.1.0/24 -j ACCEPT
```

Example 4: Drop TCP packets from 192.168.1.25.

```
# iptables -A INPUT -i eth0 -p tcp -s 192.168.1.25 -j DROP
```

Example 5: Drop TCP packets addressed for port 21.

```
# iptables -A INPUT -i eth0 -p tcp --dport 21 -j DROP
```

Example 6: Accept TCP packets from 192.168.0.24 to V2616-LX's port 137, 138, 139

```
# iptables -A INPUT -i eth0 -p tcp -s 192.168.0.24 --dport 137:139 -j ACCEPT
```

Example 7: Log TCP packets that visit V2616-LX's port 25.

```
# iptables -A INPUT -i eth0 -p tcp --dport 25 -j LOG
```

Example 8: Drop all packets from MAC address 01:02:03:04:05:06.

```
# iptables -A INPUT -i eth0 -p all -m mac --mac-source 01:02:03:04:05:06 -j DROP
```



ATTENTION

In Example 8, remember to issue the command `# modprobe ipt_mac` first to load the module `ipt_mac`.

NAT (Network Address Translation)

The NAT (Network Address Translation) protocol translates IP addresses used on one network into IP addresses used on a connecting network. One network is designated the inside network and the other is the outside network. Typically, the V2616-LX connects several devices on a network and maps local inside network addresses to one or more global outside IP addresses, and un-maps the global IP addresses on incoming packets back into local IP addresses.



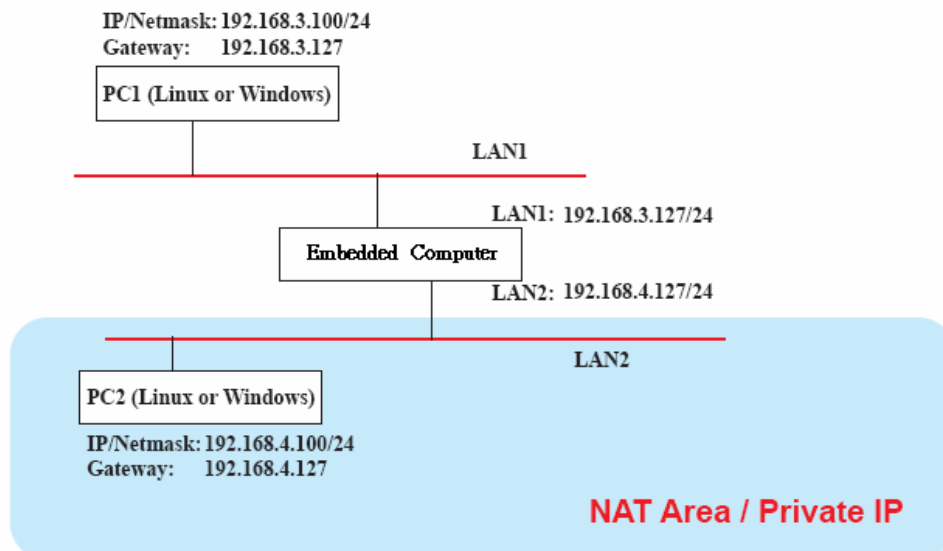
ATTENTION

Click on the following link for more information about NAT:

<http://www.netfilter.org/documentation/HOWTO//packet-filtering-HOWTO.html>

NAT Example

The IP address of all packets leaving LAN1 are changed to **192.168.3.127** (you will need to load the module `ipt_MASQUERADE`):



Enabling NAT at Bootup

In most real world situations, you will want to use a simple shell script to enable NAT when the V2616-LX boots up. The following script is an example.

```
#!/bin/bash
# If you put this shell script in the /home/nat.sh
# Remember to chmod 744 /home/nat.sh
# Edit the rc.local file to make this shell startup automatically.
# vi /etc/rc.local
# Add a line in the end of rc.local /home/nat.sh
EXIF= "eth0" #This is an external interface for setting up a valid IP address.
EXNET= "192.168.4.0/24" #This is an internal network address.
# Step 1. Insert modules.
# Here 2> /dev/null means the standard error messages will be dump to null device.
modprobe ip_tables 2> /dev/null
modprobe ip_nat_ftp 2> /dev/null
modprobe ip_nat_irc 2> /dev/null
modprobe ip_conntrack 2> /dev/null
modprobe ip_conntrack_ftp 2> /dev/null
modprobe ip_conntrack_irc 2> /dev/null
# Step 2. Define variables, enable routing and erase default rules.
PATH=/bin:/sbin:/usr/bin:/usr/sbin:/usr/local/bin:/usr/local/sbin
export PATH
echo "1" > /proc/sys/net/ipv4/ip_forward
/sbin/iptables -F
/sbin/iptables -X
/sbin/iptables -Z
/sbin/iptables -F -t nat
/sbin/iptables -X -t nat
/sbin/iptables -Z -t nat
/sbin/iptables -P INPUT ACCEPT
/sbin/iptables -P OUTPUT ACCEPT
/sbin/iptables -P FORWARD ACCEPT
/sbin/iptables -t nat -P PREROUTING ACCEPT
/sbin/iptables -t nat -P POSTROUTING ACCEPT
/sbin/iptables -t nat -P OUTPUT ACCEPT
# Step 3. Enable IP masquerade.
#ehco 1 > /proc/sys/net/ipv4/ip_forward#modprobe ipt_MASQUERADE#iptables -t nat -A
POSTROUTING -o eth0 -j MASQUERADE
```

PPP (Point to Point Protocol)

PPP (Point to Point Protocol) is used to run IP (Internet Protocol) and other network protocols over a serial link. PPP can be used for direct serial connections (using a null-modem cable) over a Telnet link, and links established using a modem over a telephone line.

Modem/PPP access is almost identical to connecting directly to a network through the V2616-LX Ethernet port. Since PPP is a peer-to-peer system, the V2616-LX can also use PPP to link two networks (or a local network to the Internet) to create a Wide Area Network (WAN).

**ATTENTION**

Click on the following links for more information about PPP:

<http://tldp.org/HOWTO/PPP-HOWTO/index.html>

<http://axion.physics.ubc.ca/ppp-linux.html>

Connecting to a PPP Server over a Simple Dial-up Connection

The following command is used to connect to a PPP server by modem. Use this command for old ppp servers that prompt for a login name (replace “username” with the correct name) and password (replace “password” with the correct password). Note that “debug crtscts” and “defaultroute 192.1.1.17” are optional.

```
#pppd connect 'chat -v "" ATDT5551212 CONNECT ""\ ogin: username word: password'
/dev/ttyM0 115200 debug crtscts modem defaultroute 192.1.1.17
```

If the PPP server does not prompt for the username and password, the command should be entered as follows (replace “username” with the correct username and replace “password” with the correct password):

```
#pppd connect 'chat -v "" ATDT5551212 CONNECT ""\ user username password password
/dev/ttyM0 115200 crtscts modem
```

The pppd options are described below:

connect 'chat etc...' This option gives the command to contact the PPP server. The **chat** program is used to dial a remote computer. The entire command is enclosed in single quotes because pppd expects a one-word argument for the **connect** option. The options for **chat** are given below:

-v verbose mode; log what we do to syslog
"" Double quotes—don't wait for a prompt, but instead do ... (note that you must include a space after the second quotation mark)

ATDT5551212 Dial the modem, and then ...

CONNECT Wait for an answer.

"" Send a return (null text followed by the usual return)

ogin: username word: password
 Log in with username and password.

Note: Refer to the chat man page, chat.8, for more information about the **chat** utility.

/dev/ Specify the callout serial port.

115200 The baud rate.

debug Log status in syslog.

crtscts Use hardware flow control between the computer and modem (at baudrate of 115200 this is a must).

modem Indicates that this is a modem device; pppd will hang up the phone before and after making the call.

defaultroute Once the PPP link is established, make it the default route; if you have a PPP link to the Internet, this is probably what you want.

192.1.1.17 This is a degenerate case of a general option of the form x.x.x.x:y.y.y.y. Here x.x.x.x is the local IP address and y.y.y.y is the IP address of the remote end of the PPP connection. If this option is not specified, or if just one side is specified, then x.x.x.x

defaults to the IP address associated with the local machine's hostname (located in `/etc/hosts`), and `y.y.y.y` is determined by the remote machine.

Connecting to a PPP Server over a Hard-wired Link

If a username and password are not required, use the following command (note that `noipdefault` is optional):

```
#pppd connect 'chat -v' " " " \ noipdefault /dev/ttyM0 19200 crtscts
```

If a username and password is required, use the following command (note that `noipdefault` is optional, and the username and password are both "root"):

```
#pppd connect 'chat -v' " " " \ user root password root noipdefault /dev/ttyM0 19200 crtscts
```

Checking the Connection

Once you have set up a PPP connection, there are some steps you can take to test the connection. First, type:

```
#!/sbin/ifconfig
```

Depending on your distribution, the command might be located elsewhere. After executing the command, you should be able to see all of the network interfaces that are UP.

`ppp0` should be one of the network interfaces. You should recognize the first IP address as the IP address of the computer, and **P-t-P address** is the IP address of the server. The output should be similar to the following:

```
lo          Link encap Local Loopback
            inet addr 127.0.0.1  Bcast 127.255.255.255 Mask 255.0.0.0
            UP LOOPBACK RUNNING  MTU 2000  Metric 1
            RX packets 0 errors 0 dropped 0 overrun 0

ppp0       Link encap Point-to-Point Protocol
            inet addr 192.76.32.3  P-t-P 129.67.1.165 Mask 255.255.255.0
            UP POINTOPOINT RUNNING  MTU 1500  Metric 1
            RX packets 33 errors 0 dropped 0 overrun 0
            TX packets 42 errors 0 dropped 0 overrun 0
```

Now, type:

```
#ping z.z.z.z
```

where `z.z.z.z` is the address of your name server. The output should be similar to the following:

```
MOXA:~# ping 129.67.1.165
PING 129.67.1.165 (129.67.1.165): 56 data bytes
64 bytes from 129.67.1.165: icmp_seq=0 ttl=225 time=268 ms
64 bytes from 129.67.1.165: icmp_seq=1 ttl=225 time=247 ms
64 bytes from 129.67.1.165: icmp_seq=2 ttl=225 time=266 ms
^C
--- 129.67.1.165 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 247/260/268 ms
MOXA:~#
```

Try typing:

```
#netstat -nr
```

You should see three routes similar to the following:

```
Kernel routing table
Destination  Gateway      Genmask          Flags    Metric  Ref  Use
iface
129.67.1.165 0.0.0.0      255.255.255.255 UH       0       0    6
ppp0
127.0.0.0    0.0.0.0      255.0.0.0       U       0       0    0 1o
0.0.0.0      129.67.1.165 0.0.0.0         UG      0       0   6298
ppp0
```

If your output looks similar but does not have the “destination 0.0.0.0” line (which refers to the default route used for connections), you may have run `pppd` without the `defaultroute` option. At this point, you can try using Telnet, ftp, or finger, bearing in mind that you will have to use numeric IP addresses unless you have configured `/etc/resolv.conf` correctly.

Setting up a Machine for Incoming PPP Connections

Method 1: pppd dial-in with pppd commands

This first example applies to using a modem, and requiring authorization with a username and password.

```
#pppd /dev/ttyM0 115200 crtscts modem 192.168.16.1:192.168.16.2 login auth
```

You should also add the following line to the file `/etc/ppp/pap-secrets`:

```
* * "" *
```

The first star (*) lets everyone login. The second star (*) lets every host connect. The pair of double quotation marks (“”) indicates that the file `/etc/passwd` can be used to check the password. The last star (*) is to let any IP connect.

The following example does not check the username and password:

```
# pppd/dev/ttyM0 115200 crtscts modem 192.168.16.1:192.168.16.2
```

Method 2: pppd dial-in with pppd script

Configure a dial-in script `/etc/ppp/peer/dialin`

```
# You usually need this if there is no PAP authentication
noauth
#auth
#login

# The chat script (be sure to edit that file, too!)
init "/usr/sbin/chat -v -f /etc/ppp/ppp-ttyM0.chat"

# Set up routing to go through this PPP link
defaultroute

# Default modem (you better replace this with /dev/ttySx!)
/dev/ttyM0

# Speed
115200

# Keep modem up even if connection fails
persist
crtscts
modem
```

```
192.168.16.1:192.168.16.2
debug
-detach
```

Configure the chat script `/etc/ppp/ppp-ttyMO.chat`

```
SAY      `Auto Answer ON\n`
``      ATSO=1
```

Start the **pppd** dial-in service.

```
# pppd call dialin
```



ATTENTION

If you would like to have auto dial-in service, you can launch the dial-in service in `/etc/inittab` with the `respawn` command.

```
MOXA:~# mount -o remount,rw /dev/hda1 /
MOXA:~# echo "p0:2345:respawn:pppd call dialin" >> /etc/inittab
MOXA:~# umount /
```

PPPoE

Use the following procedure to configure PPPoE:

1. Connect the V2616-LX's LAN port to an ADSL modem with a cross-over cable, HUB, or switch.
2. Log in to the V2616-LX as the root user.
3. Edit the file `/etc/ppp/chap-secrets` and add the following:

```
"username@hinet.net" * "password" *
```

```
# Secrets for authentication using CHAP
# client      server  secret          IP addresses
```

```
# PPPOE example, if you want to use it, you need to unmark it and modify it
"username@hinet.net" * "password" *
```

username@hinet.net is the username obtained from the ISP to log in to the ISP account. **password** is the corresponding password for the account.

4. Edit the file `/etc/ppp/pap-secrets` and add the following:

```
"username@hinet.net" * "password" *
```

```
# ATTENTION: The definitions here can allow users to login without a
# password if you don't use the login option of pppd! The mgetty Debian
# package already provides this option; make sure you don't change that.
```

```
# INBOUND connections
```

```
# Every regular user can use PPP and has to use passwords from /etc/passwd
```

```
*      hostname      ""      *
```

```
"username@hinet.net" * "password" *
```

```
# UserIDs that cannot use PPP at all. Check your /etc/passwd and add any
# other accounts that should not be able to use pppd!
```

```
guest  hostname      "*"    -
```

```

master hostname      "*" -
root  hostname       "*" -
support hostname     "*" -
stats  hostname      "*" -

# OUTBOUND connections

```

`username@hinet.net` is the username obtained from the ISP to log in to the ISP account. `password` is the corresponding password for the account.

5. Edit the file `/etc/ppp/options` and add the following line:

```
plugin rp-pppoe
```

```

# received. Note: it is not advisable to use this option with the persist
# option without the demand option. If the active-filter option is given,
# data packets which are rejected by the specified activity filter also
# count as the link being idle.
#idle <n>

# Specifies how many seconds to wait before re-initiating the link after
# it terminates. This option only has any effect if the persist or demand
# option is used. The holdoff period is not applied if the link was
# terminated because it was idle.
#holdoff <n>

# Wait for up n milliseconds after the connect script finishes for a valid
# PPP packet from the peer. At the end of this time, or when a valid PPP
# packet is received from the peer, pppd will commence negotiation by
# sending its first LCP packet. The default value is 1000 (1 second).
# This wait period only applies if the connect or pty option is used.
#connect-delay <n>

# Load the pppoe plugin
plugin rp-pppoe.so

# ---<End of File>---

```

6. If you use LAN1 to connect to the ADSL modem, add the file `/etc/ppp/options.eth0`, if you use LAN2 to connect to the ADSL modem, add `/etc/ppp/options.eth1`, etc.

```

name username@hinet.net
mtu 1492
mru 1492
defaultroute
noipdefault
~
~
"/etc/ppp/options.eth0" 5 lines, 67 characters

```

Type your username (the one you set in the `/etc/ppp/pap-secrets` and `/etc/ppp/chap-secrets` files) after the `name` option. You may add other options as needed.

7. Set up DNS.

If you are using DNS servers supplied by your ISP, edit the file `/etc/resolv.conf` by adding the following lines of code:

```

nameserver ip_addr_of_first_dns_server
nameserver ip_addr_of_second_dns_server

```

For example:

```
nameserver 168.95.1.1
nameserver 139.175.10.20
```

```
MOXA:/etc# cat resolv.conf
#
# resolv.conf This file is the resolver configuration file
# See resolver(5).
#
nameserver 168.95.1.1
nameserver 139.175.10.20
MOXA:/etc#
```

Use the following command to create a **pppoe** connection:

```
#pppd eth0
```

8. The ADSL modem is connected to the **LAN1** port, which is named **eth0**. If the ADSL modem is connected to **LAN2**, use **eth1**, etc.
9. Type **#ifconfig ppp0** to check if the connection is OK. If the connection is OK, you should see the IP address of ppp0. Use **#ping** to test the IP address.

```
ppp0      Link encap Point-to-Point Protocol
          inet addr 192.76.32.3  P-t-P 129.67.1.165 Mask 255.255.255.0
          UP POINTOPOINT RUNNING  MTU 1500  Metric 1
          RX packets 33 errors 0 dropped 0 overrun 0
          TX packets 42 errors 0 dropped 0 overrun 0
```

10. If you want to disconnect the connection, use the kill command to kill the **pppd** process.

NFS (Network File System) Client

The Network File System (NFS) is used to mount a disk partition on a remote machine (as if it were on a local hard drive), allowing fast, seamless sharing of files across a network. NFS allows users to develop applications for the V2616-LX without worrying about the amount of disk space that will be available. The V2616-LX only supports NFS client protocol.



ATTENTION

Click on the following links for more information about NFS.

<http://www.ietf.org/rfc/rfc1213.txt>

<http://www.faqs.org/rfcs/rfc1317.html>

The following procedures illustrate how to mount a remote NFS Server.

1. Scan the NFS Server's shared directory:


```
#showmount -e HOST
```

showmount: Shows the mount information of an NFS Server
 -e: Shows the NFS Server's export list.
 HOST: IP address or DNS address
2. Establish a mount point on the NFS Client site:


```
#mkdir -p /home/nfs/public
```
3. Mount the remote directory to a local directory:


```
# mount -t nfs -o nolock 192.168.3.100:/home/public /home/nfs/public
```

(This is where 192.168.3.100 is the example IP address of the NFS server.)

SNMP (Simple Network Management Protocol)

The V2616-LX comes with the SNMP V1 (Simple Network Management Protocol) agent software pre-installed. It supports **RFC 1213 MIB-II**. The following example shows an SNMP agent responding to a query from the SNMP browser on the host site:

```
SNMPv2-MIB::sysDescr.0 = STRING: Linux Moxa 2.6.32-5-amd64 #1 SMP Tue Jun 14 09:42:28
UTC 2011 x86_64
SNMPv2-MIB::sysObjectID.0 = OID: SNMPv2-SMI::enterprises.8691.12.2616
DISMAN-EVENT-MIB::sysUpTimeInstance = Timeticks: (523675) 1:27:16.75
SNMPv2-MIB::sysContact.0 = STRING: "Jared"
SNMPv2-MIB::sysName.0 = STRING: Moxa
SNMPv2-MIB::sysLocation.0 = STRING: "Fl.8 No.6, Alley 6, Lane 235, Pao-Chiao Rd.
, Shing Tien City, Taipei, Taiwan, R.O.C."
SNMPv2-MIB::sysORLastChange.0 = Timeticks: (1) 0:00:00.01
SNMPv2-MIB::sysORID.1 = OID: SNMP-FRAMEWORK-MIB::snmpFrameworkMIBCompliance
SNMPv2-MIB::sysORID.2 = OID: SNMP-MPD-MIB::snmpMPDCompliance
SNMPv2-MIB::sysORID.3 = OID: SNMP-USER-BASED-SM-MIB::usmMIBCompliance
SNMPv2-MIB::sysORID.4 = OID: SNMPv2-MIB::snmpMIB
SNMPv2-MIB::sysORID.5 = OID: TCP-MIB::tcpMIB
SNMPv2-MIB::sysORID.6 = OID: IP-MIB::ip
SNMPv2-MIB::sysORID.7 = OID: UDP-MIB::udpMIB
SNMPv2-MIB::sysORID.8 = OID: SNMP-VIEW-BASED-ACM-
...
```



ATTENTION

Click on the following links for more information about RFC1317 RS-232 like groups and RFC 1213 MIB-II:

<http://www.faqs.org/rfcs/rfc1317.html>

<http://www.ietf.org/rfc/rfc1213.txt>

OpenVPN

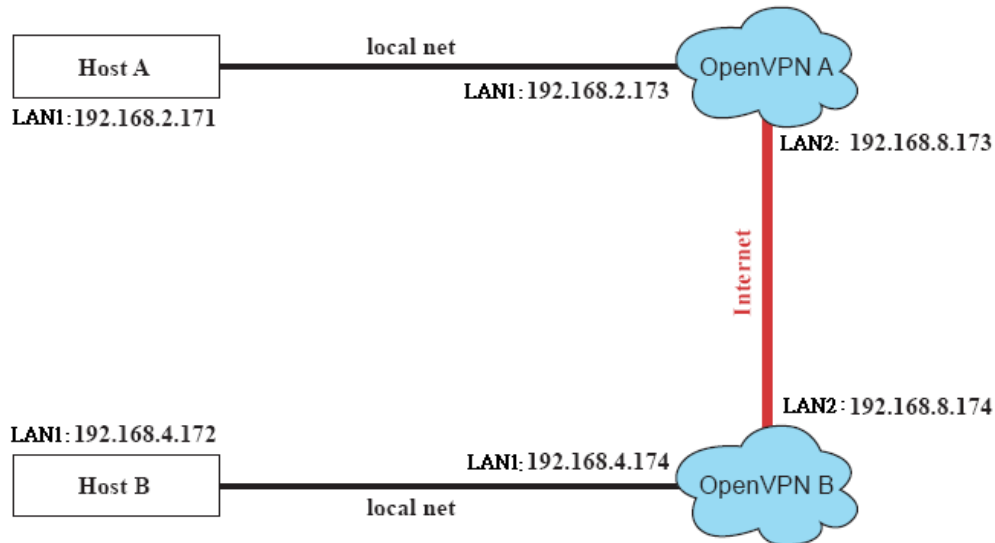
OpenVPN provides two types of tunnels for users to implement VPNS: **Routed IP Tunnels** and **Bridged Ethernet Tunnels**.

An Ethernet bridge is used to connect different Ethernet networks together. The Ethernets are bundled into one bigger, "logical" Ethernet. Each Ethernet corresponds to one physical interface (or port) that is connected to the bridge.

On each OpenVPN machine, you should carry out configurations in the `/etc/openvpn` directory, where script files and key files reside. Once established, all operations will be performed in that directory.

Ethernet Bridging for Private Networks on Different Subnets

1. Set up four machines, as shown in the following diagram.



Host A represents the machine that belongs to OpenVPN A, and Host B represents the machine that belongs to OpenVPN B. The two remote subnets are configured for a different range of IP addresses. When this configuration is moved to a public network, the external interfaces of the OpenVPN machines should be configured for static IPs, or connected to another device (such as a firewall or DSL box) first.

2. Generate a preset shared key by typing the following command:

```
# openvpn --genkey --secret secrouter.key
```
3. Copy the file that is generated to the OpenVPN machine:

```
# scp /etc/openvpn/secrouter.key 192.168.8.174:/etc/openvpn
```



ATTENTION

A preshared key is located at `/etc/openvpn/secrouter.key`. You can use it for testing purposes. We suggest creating a new key for non-testing purposes.

4. On machine OpenVPN A, modify the remote address in configuration file `/etc/openvpn/tap0-br.conf`.

```
# point to the peer
remote 192.168.8.174
dev tap0
port 1194
secret /etc/openvpn/secrouter.key
cipher DES-EDE3-CBC
auth MD5
tun-mtu 1500
tun-mtu-extra 64
ping 40
up /etc/openvpn/tap0-br.sh
#comp-lzo
```


5. Next, modify the routing table in `/etc/openvpn/tap0-br.sh` script.

```
#-----Start-----
#!/bin/sh
# value after "-net" is the subnet behind the remote peer
route add -net 192.168.4.0 netmask 255.255.255.0 dev br0
#-----end-----
```

And then configure the bridge interface in `/etc/openvpn/bridge`.

```
#!/bin/bash
# Create global variables
# Define Bridge Interface
br="br0"
# Define list of TAP interfaces to be bridged,
# for example tap="tap0 tap1 tap2".
tap="tap0"
# Define physical ethernet interface to be bridged
# with TAP interface(s) above.
eth="eth1"
eth_ip="192.168.8.173"
eth_netmask="255.255.255.0"
eth_broadcast="192.168.8.255"
#gw="192.168.8.174"
...
```

Start the bridge script file to configure the bridge interface:

```
# /etc/openvpn/bridge restart
```

On machine OpenVPN B, modify the remote address in configuration file `/etc/openvpn/tap0-br.conf`.

```
# point to the peer
remote 192.168.8.173
dev tap0
secret /etc/openvpn/secrouter.key
cipher DES-EDE3-CBC
auth MD5
tun-mtu 1500
tun-mtu-extra 64
ping 40
up /etc/openvpn/tap0-br.sh
#comp-lzo
```

6. Next modify the routing table in `/etc/openvpn/tap0-br.sh` script file.

```
#-----Start-----
#!/bin/sh
# value after "-net" is the subnet behind the remote peer
route add -net 192.168.2.0 netmask 255.255.255.0 dev br0
#-----end-----
```

And then configure the bridge interface in `/etc/openvpn/bridge`.

```
#!/bin/bash
# Create global variables
# Define Bridge Interface
br="br0"
# Define list of TAP interfaces to be bridged,
```

```
# for example tap="tap0 tap1 tap2".
tap="tap0"
# Define physical ethernet interface to be bridged
# with TAP interface(s) above.
eth="eth1"
eth_ip="192.168.8.174"
eth_netmask="255.255.255.0"
eth_broadcast="192.168.8.255"
#gw="192.168.8.173"
...
```

Start the bridge script file to configure the bridge interface.

```
# /etc/openvpn/bridge restart
```



ATTENTION

Select cipher and authentication algorithms by specifying cipher and auth. To see which algorithms are available, type:

```
# openvpn --show-ciphers
# openvpn --show-auths
```

- Start both OpenVPN peers on machine OpenVPN A and OpenVPN B.

```
# openvpn --config /etc/openvpn/tap0-br.conf&
```

If you see the line **Peer Connection Initiated with 192.168.8.173:5000** on each machine, the connection between OpenVPN machines has been established successfully on UDP port 5000.



ATTENTION

You can create link symbols to start the OpenVPN service at boot time:

```
# ln -sf /etc/init.d/openvpn /etc/rc2.d/S16openvpn
```

To stop the service, you should create these links:

```
# ln -sf /etc/init.d/openvpn /etc/rc0.d/K80openvpn
# ln -sf /etc/init.d/openvpn /etc/rc6.d/K80openvpn
```

- On each OpenVPN machine, check the routing table by typing the command `# route`

Destination	Gateway	Genmsk	Flags	Metric	Ref	Use	Iface
192.168.5.0	0.0.0.0	255.255.255.0	U	0	0	0	eth2
192.168.4.0	0.0.0.0	255.255.255.0	U	0	0	0	br0
192.168.3.0	0.0.0.0	255.255.255.0	U	0	0	0	eth0
192.168.30.0	0.0.0.0	255.255.255.0	U	0	0	0	eth3
192.168.8.0	0.0.0.0	255.255.255.0	U	0	0	0	br0

Interface **eth1** and device **tap0** both connect to the bridging interface, and the virtual device **tun** sits on top of **tap0**. This ensures that all traffic coming to this bridge from internal networks connected to interface **eth1** write to the TAP/TUN device that the OpenVPN program monitors. Once the OpenVPN program detects traffic on the virtual device, it sends the traffic to its peer.

- To create an indirect connection to Host B from Host A, you need to add the following routing item:

```
# route add -net 192.168.4.0 netmask 255.255.255.0 dev eth0
```

To create an indirect connection to Host A from Host B, you need to add the following routing item:

```
# route add -net 192.168.2.0 netmask 255.255.255.0 dev eth0
```

Now ping Host B from Host A by typing:

```
# ping 192.168.4.174
```

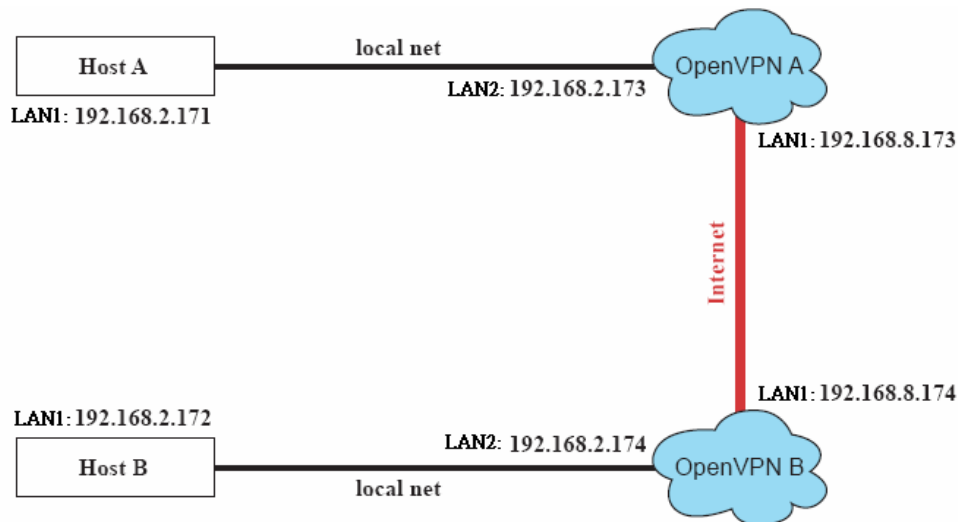
A successful ping indicates that you have created a VPN system that only allows authorized users from one internal network to access users at the remote site. For this system, all data is transmitted by UDP packets on port 5000 between OpenVPN peers.

- To shut down OpenVPN programs, type the command:

```
# killall -TERM openvpn
```

Ethernet Bridging for Private Networks on the Same Subnet

- Set up four machines, as shown in the following diagram.

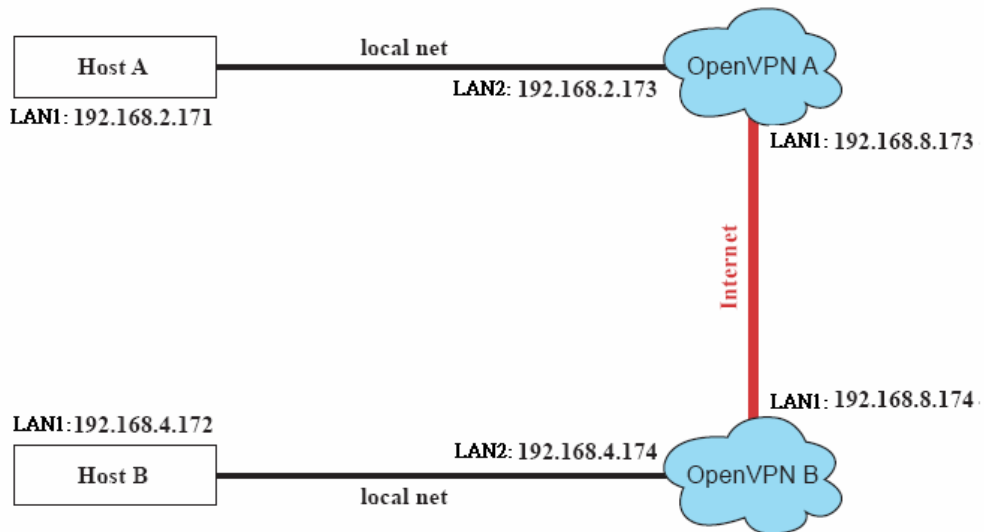


- The configuration procedure is almost the same as for the previous example. The only difference is that you will need to comment out the parameter **up** in `/etc/openvpn/tap0-br.conf` of OpenVPN A and `/etc/openvpn/tap0-br.conf` of OpenVPN B.

```
# point to the peer
remote 192.168.8.174
dev tap0
secret /etc/openvpn/secrouter.key
cipher DES-EDE3-CBC
auth MD5
tun-mtu 1500
tun-mtu-extra 64
ping 40
#up /etc/openvpn/tap0-br.sh
#comp-lzo
```

Routed IP

1. Set up four machines, as shown in the following diagram.



2. On machine OpenVPN A, modify the remote address in configuration file `/etc/openvpn/tun.conf`.

```
# point to the peer
remote 192.168.8.174
dev tun
secret /etc/openvpn/secrouter.key
cipher DES-EDE3-CBC
auth MD5
tun-mtu 1500
tun-mtu-extra 64
ping 40
ifconfig 192.168.2.173 192.168.4.174
up /etc/openvpn/tun.sh
-----
```

3. Next, modify the routing table in script file `/etc/openvpn/tun.sh`.

```
#-----Start-----
#!/bin/sh
# value after "-net" is the subnet behind the remote peer
route add -net 192.168.2.0 netmask 255.255.255.0 gw $5
#-----end-----
```

4. On machine OpenVPN B, modify the remote address in configuration file `/etc/openvpn/tun.conf`.

```
# point to the peer
remote 192.168.8.173
dev tun
secret /etc/openvpn/secrouter.key
cipher DES-EDE3-CBC
auth MD5
tun-mtu 1500
tun-mtu-extra 64
ping 40
ifconfig 192.168.4.174 192.168.2.173
up /etc/openvpn/tun.sh
```

And then modify the routing table in script file `/etc/openvpn/tun.sh`.

```
#-----Start-----
#!/bin/sh
# value after "-net" is the subnet behind the remote peer
route add -net 192.168.2.0 netmask 255.255.255.0 gw $5
#-----end-----
```

The first argument of parameter **ifconfig** is the local internal interface and the second argument is the internal interface at the remote peer.

\$5 is the argument that the OpenVPN program passes to the script file. Its value is the second argument of **ifconfig** in the configuration file.

5. Check the routing table after you run the OpenVPN programs, by typing the command **# route**.

Destination	Gateway	Genmsk	Flags	Metric	Ref	Use	Iface
192.168.4.174	*	255.255.255.255	UH	0	0	0	tun0
192.168.4.0	192.168.4.174	255.255.255.0	UG	0	0	0	tun0
192.168.2.0	*	255.255.255.0	U	0	0	0	eth1
192.168.8.0	*	255.255.255.0	U	0	0	0	eth0

The following topics are covered in this chapter:

- ❑ **RTC (Real Time Clock)**
- ❑ **UART**
- ❑ **Digital I/O**
 - Special Note
 - Examples
- ❑ **WDT (Watch Dog Timer)**
 - Introduction
 - How the WDT Works
 - The user API
 - Special Note
 - Examples

RTC (Real Time Clock)

The device node is located at `/dev/rtc`. The V2616-LX supports standard Linux simple RTC control. You must include `<linux/rtc.h>`.

1. Function: RTC_RD_TIME

```
int ioctl(fd, RTC_RD_TIME, struct rtc_time *time);
```

Description: read time information from the RTC. It will return the value on argument 3.

2. Function: RTC_SET_TIME

```
int ioctl(fd, RTC_SET_TIME, struct rtc_time *time);
```

Description: set RTC time. Argument 3 will be passed to RTC.

UART

The normal tty device nodes are `/dev/ttyM0` and `/dev/ttyM1`. The V2616-LX supports standard Linux termios control with RS-232/422/485 serial ports.

Digital I/O

Digital Output channels can be set to high or low. The channels are controlled by the function call `set_dout_state()`. Use the digital input channels to detect the state change of the digital input signal. The DI channels can also be used to detect whether or not the state of a digital signal changes during a fixed period of time. This can be done with the function call `set_din_event()`.

Return error code definitions:

```
#define DIO_ERROR_PORT -1 // no such port
#define DIO_ERROR_MODE -2 // no such mode or state
#define DIO_ERROR_CONTROL -3 // open or ioctl fail
#define DIO_ERROR_DURATION -4 // The value of duration is not 0 or not in the range,
40 <= duration <= 3600000 milliseconds (1 hour)
#define DIO_ERROR_DURATION_20MS -5 // The value of duration must be a multiple of 20
ms
#define DIO_OK 0
```

DIN and DOUT definitions:

```
#define DIO_HIGH 1
#define DIO_LOW 0
```

Moxa functions for DI/DO

Function	<code>int set_dout_state(int doport, int state)</code>
Description	Set the DOUT port to high or low state.
Input	<doport> The DOUT port you want to set. Port starts from 0 to 3 <state> Set high or low state; DIO_HIGH (1) for high, DIO_LOW (0) for low.
Output	None
Return	refer to the error code

Function	<code>int get_din_state(int diport, int *state)</code>
Description	Get the DIN port state
Input	<diport> The DIN port to get the state of. Port numbering is from 0 to 3 <state> Save the current state
Output	<state> DIO_HIGH (1) for high, DIO_LOW (0) for low

Return	Refer to the error code
--------	-------------------------

Function	int get_dout_state(int doport, int *state)
Description	Get the DOUT port state
Input	<doport> The DOUT port to get the state of. <state> Save the current state.
Output	<state> DIO_HIGH (1) for high, DIO_LOW (0) for low
Return	Refer to the error code

Function	int set_din_event(int diport, void (*func)(int diport), int mode, long int duration)
Description	Set the DIN event when the state is changed from high to low or from low to high
Input	<diport> The port that will be used to detect the DIN event. Port numbering is from 0 to 3. This value depends on your device. <(*func)(int diport)> Not NULL: Returns the call back function. When the event occurs, the call back function will be invoked. NULL: Clear this event <mode> DIN_EVENT_HIGH_TO_LOW (1): From high to low DIN_EVENT_LOW_TO_HIGH (0): From low to high DIN_EVENT_CLEAR (-1): Clear this event <duration> 0: Detect the din event DIN_EVENT_HIGH_TO_LOW or DIN_EVENT_LOW_TO_HIGH without duration Not 0: Detect the din event DIN_EVENT_HIGH_TO_LOW or DIN_EVENT_LOW_TO_HIGH with duration. Note: The value of "duration" must be a multiple of 20 milliseconds. The range of "duration" is 0, or 40 <= duration <= 3600000 milliseconds. The error of the measurement is 24 ms. For example, if the DIN duration is 200 ms, this event will be generated when the DIN pin stays in the same state for a time between 176 ms and 200 ms.
Output	None
Return	Refer to the error code

Function	int get_din_event(int diport, int *mode, long int *duration)
Description	To retrieve the DIN event configuration, including mode (DIN_EVENT_HIGH_TO_LOW or DIN_EVENT_LOW_TO_HIGH), and the value of "duration."
Input	<diport> Which DIN port you want to retrieve <mode> Save the set event. <duration> The duration the DIN port is kept in high or low state. - return to the current duration value of diport
Output	<mode> DIN_EVENT_HIGH_TO_LOW (1): From high to low DIN_EVENT_LOW_TO_HIGH(0): From low to high DIN_EVENT_CLEAR(-1): Clear this event <duration> The value of duration should be 0 or 40 <= duration <= 3600000 milliseconds.
Return	Refer to the error code

Special Note

1. You need to build the moxalib in advance for DI/DO. The moxalib is included in the folder `\example\moxalib` on the CD.
2. Make sure to link the library `libmoxalib` for DI/DO programming, and include the header file `moxadevice.h`. Only one program at a time can use the DI/DO library.
3. Due to hardware limitations, you need to modify `MIN_DURATION` as 60 for V2616-LX computers.

Examples

Example files `tdio.c` and `Makefile` are located in the folder `\example\tdio\` on the CD.

WDT (Watch Dog Timer)

Introduction

The WDT works like a watchdog function, and can be enabled or disabled. When the WDT function is enabled and the application does not acknowledge it, the system will reboot. The acknowledgement time can be set to any number between 50 milliseconds and 60 seconds.

How the WDT Works

You will need to write your own application to enable the WDT function. Refer to the following APIs for help on writing the application.

The user API

Function	<code>int swtd_open(void)</code>
Description	Open the file handle to control the software watchdog.
Input	None
Output	None
Return	On success, return a file handle. Otherwise, return < 0 value.

Function	<code>int swtd_enable(int fd, unsigned long time)</code>
Description	Enable software watchdog. And you must do <code>swtd_ack()</code> after this procedure
Input	<fd> the file handle, from the <code>swtd_open()</code> return value <time> The time you wish to ack software watchdog periodically. Note: You must ack the software watchdog before timeout. Otherwise, the system will reboot automatically. The minimal time is 50 msec, the maximum time is 60 seconds. The time unit is msec.
Output	None
Return	On success, 0 is returned. Otherwise, an error number is return

Function	<code>int swtd_disable(int fd)</code>
Description	Disable the application to ack software watchdog. And the kernel will ack it automatically.
Input	<fd> the file handle from <code>swtd_open()</code> return value.
Output	None
Return	On success, 0 is returned. Otherwise, an error number is return

Function	<code>int swtd_get(int fd, int *mode, unsigned long *time)</code>
----------	---

Description	Get current setting values.
Input	<fd> the file handle from swtd_open() return value. <*mode> return the status 1(enable) or 0(disable) of userspace watchdog <*time> return the current time period.
Output	None
Return	On success, 0 is returned. Otherwise, an error number is return

Function	int swtd_ack(int fd)
Description	Acknowledge software watchdog. When software watchdog is enabled, application should execute swtd_ack() periodically within user predefined time.
Input	<fd> the file handle from swtd_open() return value.
Output	None
Return	On success, 0 is returned. Otherwise, an error number is return

Function	int swtd_close(int fd)
Description	Close the file handle.
Input	<fd> the file handle from swtd_open() return value.
Output	None
Return	On success, 0 is returned. Otherwise, an error number is return

Special Note

When you “kill the application with -9” or “kill without option” or “Ctrl+c” the kernel will change to auto ack the software watchdog.

When your application enables the software watchdog and does not ack, your application may have a logical error, or your application has generated a core dump. The kernel will not change to auto ack. This can cause your system to reboot again and again.

Examples

The example file **watchdog.c** and **Makefile** are put in the folder `\example\swatchdog\` on the CD.

RAID 0/1 Function Configuration

The V2616-LX ready-to-run embedded computer is a RAID management platform designed to serve as a front-end for data acquisition and industrial control applications. This chapter describes how to configure the volume supported by the Linux operating system.

The following topics are covered in this chapter:

❑ **dm-raid**

- Creating RAID from the BIOS
- Mounting the RAID Volume
- Replacing a Failed Disk

❑ **Software RAID—mdadm**

- Creating Software RAID Volume
- Checking the Software RAID Status
- Replacing a Failed Disk

dm-raid

This embedded computer platform uses an Intel 82801 SATA RAID controller. The purpose of this guide is to enable use of a RAID set created by the on-board BIOS RAID controller.

```
#lspci
...
00:1f.2 RAID bus controller: Intel Corporation Mobile 82801 SATA RAID Controller
(rev 03)
...
```



ATTENTION

There are three ways to create RAID:

1. Software-RAID: The RAID is created by software.
2. Hardware-RAID: A special controller is used to build RAID. Hardware RAID is generally faster, and does not place a load on the CPU, and hardware RAID can be used with any OS
3. FakeRAID: Since RAID hardware is very expensive, multi-channel controllers are sometimes used with special BIOS features to perform RAID. This is a form of software RAID using special drivers, and it is not necessarily faster than true software RAID. Read [FakeRaidHowto](#) for details.

The RAID software included with current versions of Linux (and Ubuntu) is based on the 'mdadm' driver and works very well.

Creating RAID from the BIOS

1. To enter the Intel® Matrix Storage Manager option ROM user interface, press the <Ctrl> and <i> keys simultaneously when prompted during the Power-On Self Test (POST).

```
Intel(R) Matrix Storage Manager option ROM v5.0.0.1032 ICHx
Copyright(C) 2003-05 Intel Corporation. All Rights Reserved.

RAID Volumes:
None defined.

Physical Disks:
Port Drive Model Serial # Size Type/Status(Vol ID)
0 Maxtor 6Y060M0 Y2MGJ4FE 57.3GB Non-RAID Disk
1 Maxtor 6Y080M0 Y2RIZ18E 76.3GB Non-RAID Disk
2 Maxtor 6Y200M0 Y60MQ3RE 189.9GB Non-RAID Disk

Press <Ctrl>+<I> to enter Configuration Utility..
```

2. Select first option, **Create RAID Volume** and then press the <Enter> key.

```
Intel(R) Matrix Storage Manager option ROM v7.0.0.9198 ICH8M-E
Copyright(C) 2003-06 Intel Corporation. All Rights Reserved.

1. Create RAID Volume
2. Delete RAID Volume
3. Reset Disks to Non-RAID
4. Recovery Volume Options
5. Exit

[ DISK VOLUME INFORMATION ]

RAID Volumes:
None defined.

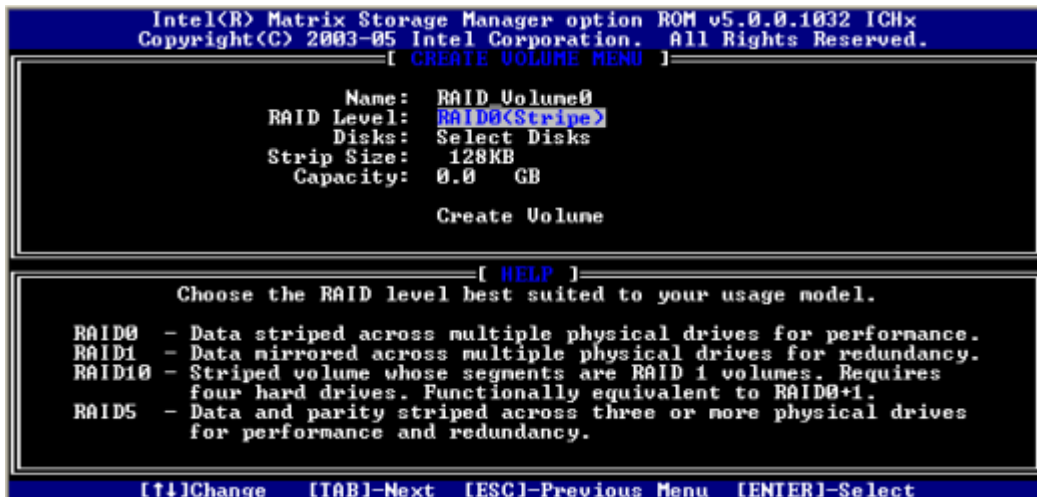
Physical Disks:
Port Drive Model Serial # Size Type/Status(Vol ID)
0 ST3120023AS 3KA0H0KF 111.8GB Non-RAID Disk
1 ST3160023AS 3JS0NDYQ 149.1GB Non-RAID Disk
3 ST360015AS 3KC01D1X 55.9GB Non-RAID Disk

[↑↓]-Select [ESC]-Exit [ENTER]-Select Menu
```

3. Type in a volume name and press the <Enter> key, or press the <Enter> key to accept the default name.



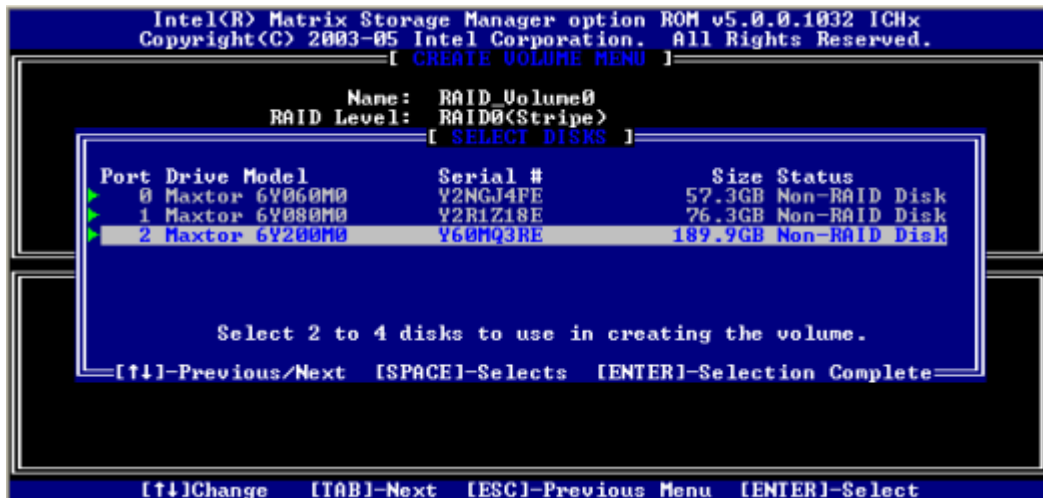
4. Select the RAID level by using the <1> or <1> keys to scroll through the available values, then press the <Enter> key.



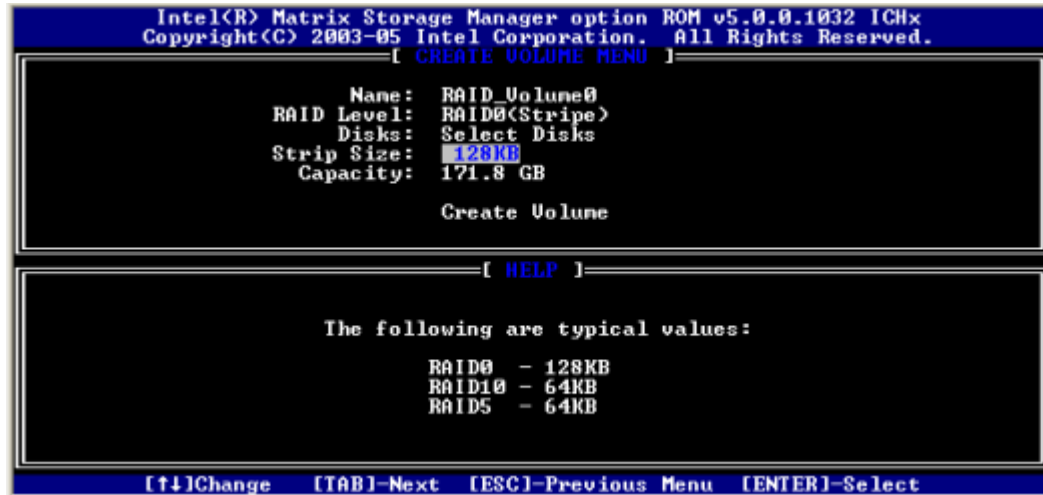
5. Press the <Enter> key to select the physical disks. A dialog similar to the following will appear:



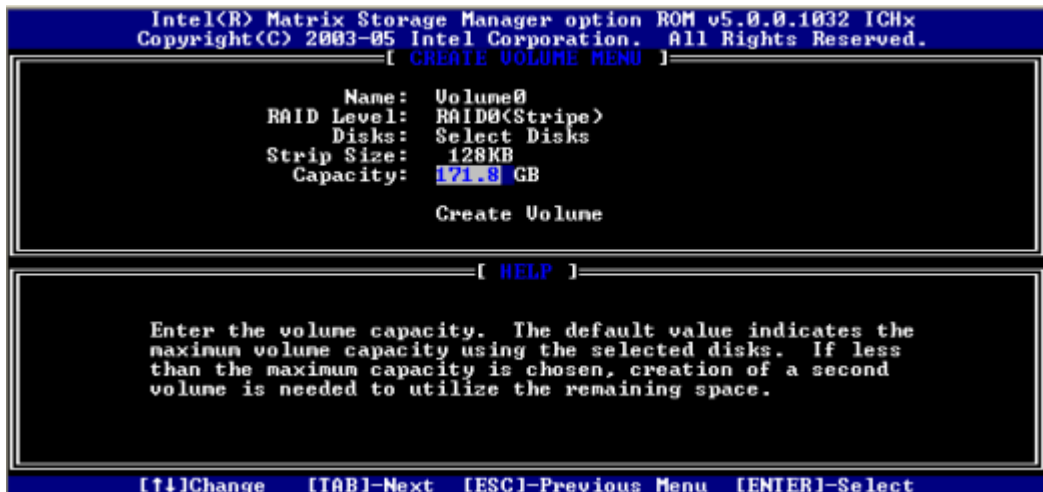
6. Select the appropriate number of hard drives by using the <↑> or <↓> keys to scroll through the list of available hard drives. Press the <Space> key to select a drive. When you have finished selecting hard drives, press the <Enter> key.



7. Unless you have selected RAID 1, select the strip size by using the <↑> or <↓> keys to scroll through the available values, and then press the <Enter> key.



8. Select the volume capacity and then press the <Enter> key. Note: The default value indicates the maximum volume capacity using the selected disks. If less than the maximum volume capacity is chosen, creation of a second volume is needed to utilize the remaining space (i.e., a matrix RAID configuration).



- At the Create Volume prompt, press the <Enter> key to create the volume. The following prompt will appear

```

Intel(R) Matrix Storage Manager option ROM v5.0.0.1032 ICHx
Copyright(C) 2003-05 Intel Corporation. All Rights Reserved.
[ CREATE VOLUME MENU ]

Name: RAID_Volume0
RAID Level: RAID0(Stripe)
Disks: Select Disks
Strip Size: 128KB
Capacity: 171.8 GB

WARNING: ALL DATA ON SELECTED DISKS WILL BE LOST.
Are you sure you want to create this volume? (Y/N):

Press "ENTER" to Create the specified volume.

[↑↓]Change [TAB]Next [ESC]-Previous Menu [ENTER]-Select

```

- Press the <Y> key to confirm volume creation.
- To exit the option ROM user interface, select option 5. Exit and press the <Enter> key. Press the <Y> key again to confirm exit.

Note: To change any of the information before the volume creation has been confirmed, you must exit the Create Volume process and restart it. Press the <Esc> key to exit the Create Volume process.

Mounting the RAID Volume

- Testing dmraid

To verify that dmraid will work with your configuration, check the contents of the /dev/mapper directory. /dev/dm-0 is a link to /dev/mapper/isw_fihjejccc_Volume0. You can partition or format one of these device files.

```

root@Moxa:~# ls -l /dev/mapper/
total 0
crw----- 1 root root 10, 59 Aug 5 10:10 control
lrwxrwxrwx 1 root root 7 Aug 5 10:10 isw_fihjejccc_Volume0 -> ../dm-0
root@Moxa:~#

```



ATTENTION

If there is just a "control" file, then dmraid was either not loaded, or dmraid will not work with your configuration.

- Create a partition with fdisk,

```

root@Moxa:~# fdisk /dev/dm-0

```

and then after the RAID is created, activate it.

```

root@Moxa:~# dmraid -ay

```

- Format the RAID.

```

root@Moxa:~# mkfs.ext4 /dev/dm-0

```

3. Mount the raid device.

```
root@Moxa:~# mount /dev/dm-0 /mnt/raid
```

4. If you need to mount it automatically, you can add the configure in /etc/fstab. Reboot and it should be mounted at /mnt/raid.

```
/dev/dm-0 /mnt/raid ext4 defaults 0 2
```

Replacing a Failed Disk

If the array is running in mirror mode and one of the disks fails, you can replace the failed disk with a new one. Run "dmraid -s" to check if the initial status is OK.

```
root@Moxa:~# dmraid -s
*** Group superset isw_ddjejjhgi
--> Active Subset
name   : isw_ddjejjhgi_Volume0
size   : 14680320
stride : 128
type    : mirror
status  : ok
subsets: 0
devs    : 2
spares  : 0
```

Run "dmraid -r" and check if the mirror is running and the disk drives are attached.

```
root@Moxa:~# root@Moxa:~# dmraid -r
/dev/sdc: isw, "isw_ddjejjhgi", GROUP, ok, 976773166 sectors, data@ 0
/dev/sdb: isw, "isw_ddjejjhgi", GROUP, ok, 31277054 sectors, data@ 0
```

Remove the failed hard disk, and run "dmraid -s" again to check the status.

```
root@Moxa:~# dmraid -s
ERROR: isw: wrong number of devices in RAID set "isw_ddjejjhgi_Volume0" [1/2] on /dev/sdc
*** Group superset isw_ddjejjhgi
--> *Inconsistent* Active Subset
name   : isw_ddjejjhgi_Volume0
size   : 14680320
stride : 128
type    : mirror
status  : inconsistent
subsets: 0
devs    : 1
spares  : 0
root@Moxa:~#
```

The RAID status is inconsistent. You need to unmount the RAID volume and stop the raid.

```
root@Moxa:~# umount /mnt/raid0
root@Moxa:~# dmraid -an
```


Now install the new drive and run "dmesg" to check if the new drive has been attached.

```
root@Moxa: ~# dmesg
...
[ 1906.505084] sd 4:0:0:0: [sdb] 976773168 512-byte logical blocks: (500 GB/465 GiB)
[ 1906.505131] sd 4:0:0:0: [sdb] Write Protect is off
[ 1906.505133] sd 4:0:0:0: [sdb] Mode Sense: 00 3a 00 00
[ 1906.505153] sd 4:0:0:0: [sdb] Write cache: enabled, read cache: enabled, doesn't support DPO or
FUA
[ 1906.505261] sdb: sdb1
[ 1906.520526] sd 4:0:0:0: [sdb] Attached SCSI disk
```

When the new drive is attached, rebuild the RAID volume by running **dmraid -R RAID-set [device-path]**.

```
root@Moxa: ~# dmraid -R isw_ddjejjhgi_Volume0 /dev/sdb
```

Next, use **dmraid -ay** to activate the RAID configurations and then mount it again.

```
root@Moxa: ~# dmraid -ay
root@Moxa: ~# mount /dev/dm-1 /mnt/raid
```

Software RAID—mdadm

mdadm is a Linux utility used to manage software RAID devices. The name is derived from the "md" (multiple device) device nodes it "adm"inisters or manages; it replaces the utility mdctl. The original name was "Mirror Disk," but was changed as the functionality increased. Note that this section describes the RAID settings by the Linux operating system, instead of the settings by BIOS.

Creating Software RAID Volume

The V2616-LX has 2 SATA hardisk slots and can manage linear, raid0, and raid1 volumes on these two SATA hardisks.

1. Create a partition with fdisk.

```
root@Moxa:~# fdisk /dev/sdb1
root@Moxa:~# fdisk /dev/sdc1
```

2. Create the RAID volume.

The Following mdadm options are used to create the raid volume.

```
-C: create
-v: verbose
-l: RAID level, options are: linear, raid0, 0, stripe, raid1, 1, mirror, raid4, 4, raid5, 5, raid6, 6, raid10, 10, multipath,
mp, faulty. Obviously some of these are synonymous.
-n: the number of disks
```

- a. Create a linear mode software RAID.

```
root@Moxa:~# mdadm -Cv -llinear -n2 /dev/md0 /dev/sd{b,c}1
```

- b. Create a striping mode software RAID 0.

```
root@Moxa:~# mdadm -Cv -l0 -n2 /dev/md0 /dev/sd{b,c}1
```

- c. Create a mirror mode software RAID 1.

```
root@Moxa:~# mdadm -Cv -l1 -n2 /dev/md0 /dev/sd{b,c}1
```

3. Format the RAID.

```
root@Moxa:~# mkfs.ext4 /dev/md0
```

4. Mount the raid device manually.

```
root@Moxa:~# mount /dev/md0 /mnt/raid
```

5. Start the raid volume automatically at next boot up.

If you need to start the array automatically, edit `/etc/mdadm/mdadm.conf`.

```
root@Moxa:~# mount -o remount,rw /
root@Moxa:~# mdadm --detail --scan >> /etc/mdadm/mdadm.conf
```

Edit `/etc/mdadm/mdadm.conf`.

```
DEVICE /dev/sdb1 /dev/sdc1
CREATE owner=root group=disk mode=0660 auto=yes
HOMEHOST <system>
MAILADDR your_email@xxx.com
ARRAY /dev/md0 metadata=1.2 name=Moxa:0
UUID=45ae9dbe:f30741ec:b22eff98:2dad12d
```

Add the following configuration in `/etc/fstab`.

```
/dev/md0 /mnt/raid ext4 defaults 0 2
```

Unmount the root file system and reboot. The array should be started and mounted at `/mnt/raid`.

```
root@Moxa:~# umount /
```

Checking the Software RAID Status

The software raid status can be checked by reading `/proc/mdstat`.

```
root@Moxa:~# cat /proc/mdstat
Personalities : [linear]
md0 : active linear sdc1[1] sdb1[0]
      23436724 blocks super 1.2 0k rounding
unused devices: <none>
```

If the array is not running, there is no active linear drive.

```
root@Moxa:~# cat /proc/mdstat
Personalities : [linear]
unused devices: <none>
```

Replacing a Failed Disk

If the array is running in mirror mode and one of the disks fails, you should replace the failed disk with a new one. In this case, `sdb1[0](F)` means that the `sdb` disk has failed.

```
md1 : active raid1 sdc1[1] sdb1[0](F)
17920384 blocks [2/1] [_U]
```

Use the following command to remove the failed disk from raid.

```
root@Moxa: ~# mdadm -r /dev/md0 /dev/sdb1
mdadm: hot removed /dev/sdb1 from /dev/md0
```

Next, replace the failed drive with the new one and add it to the array.

```
root@Moxa: ~# mdadm -a /dev/md0 /dev/sdb1
```

Run the following command to check if the array is recovering automatically.

```
root@Moxa: ~# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 sdb1[0] sdc1[1]
      7806522 blocks super 1.2 [2/1] [_U]
      [= >.....] recovery = 10.6% (831488/7806522) finish=0.9min
      speed=118784K/sec

unused devices: <none>
```

System Recovery

The V2616-LX ready-to-run embedded computers are an embedded Linux platform. This chapter describes the recovery process in the event of system instability.

The following topics are covered in this chapter:

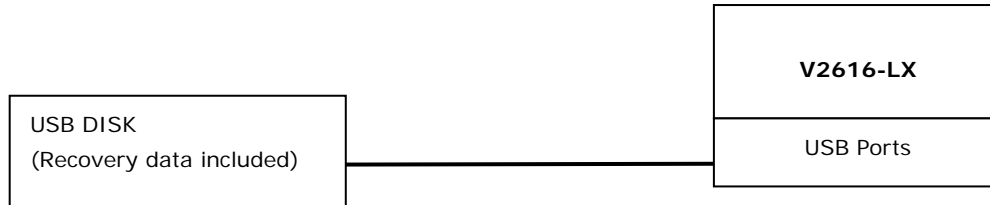
- ❑ **Recovery Environment**
- ❑ **Recovery Procedure**
- ❑ **Saving the System to the USB Drive**

Recovery Environment

The environment includes a V2616-LX embedded computer and a bootable USB disk with the recovery programs and system image file.

Hardware

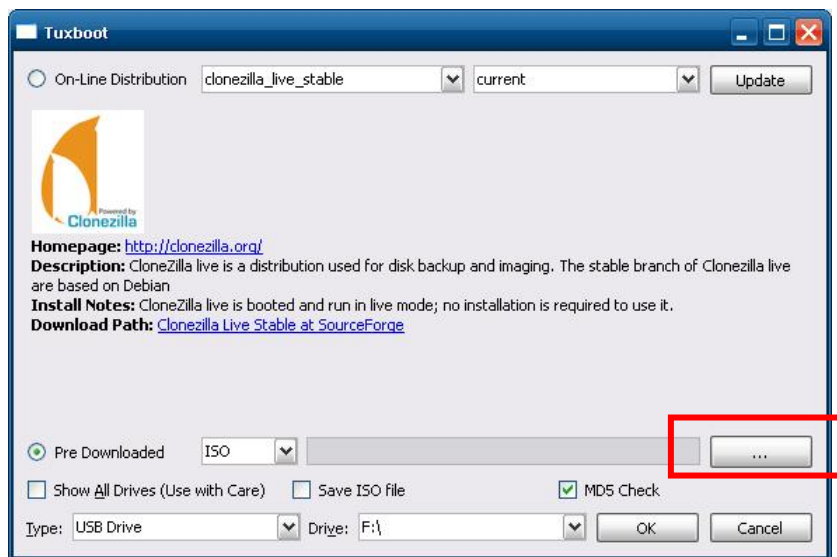
The hardware used includes a PC, a V2616-LX computer and a USB disk with the recovery programs. **(Note: The USB disk should be at least 2GB.)**



Recovery Procedure

Step 1: Prepare your USB drive

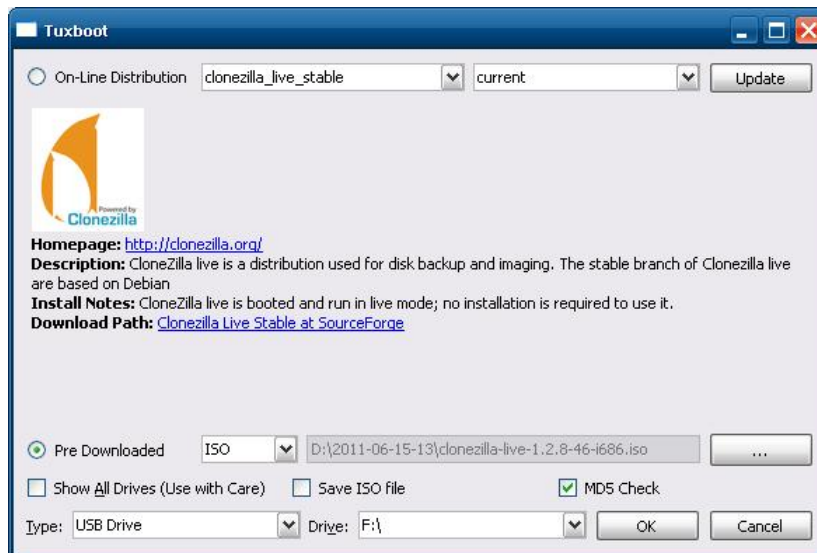
1. Execute **tuxboot-windows-23.exe** from the **utility_tools/CloneZilla** folder on the Software CD, select **Pre Download**, and then click "..."



2. Select the ISO file in the directory.



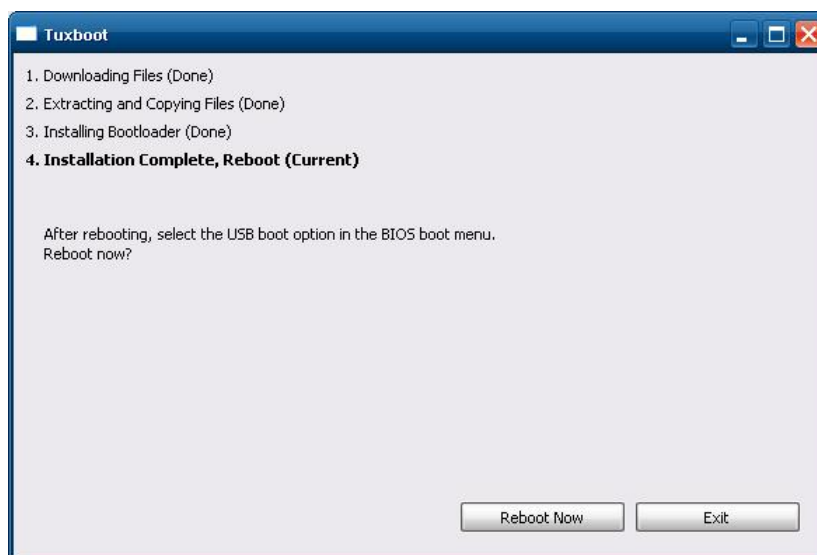
3. Select **USB Drive** type, select a **Drive**, and then click **OK** to continue.



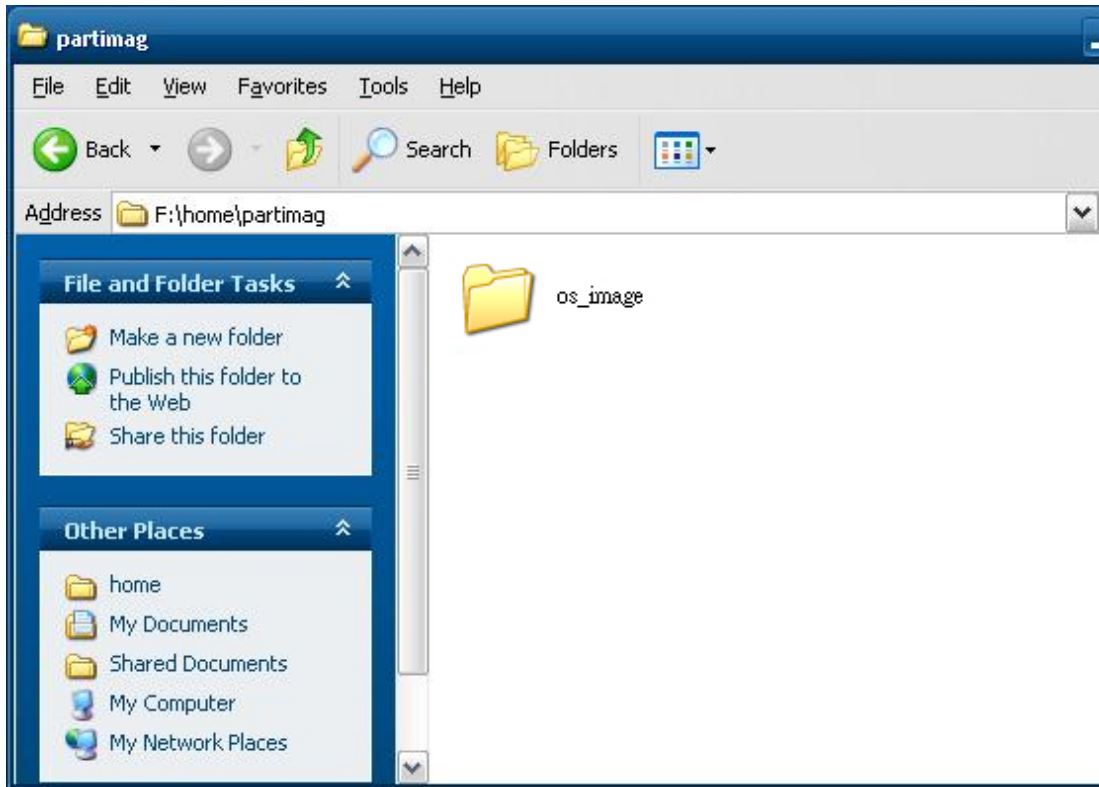
4. The boot files will be copied to your USB drive.



5. When finished, click **Exit** to stop the program.



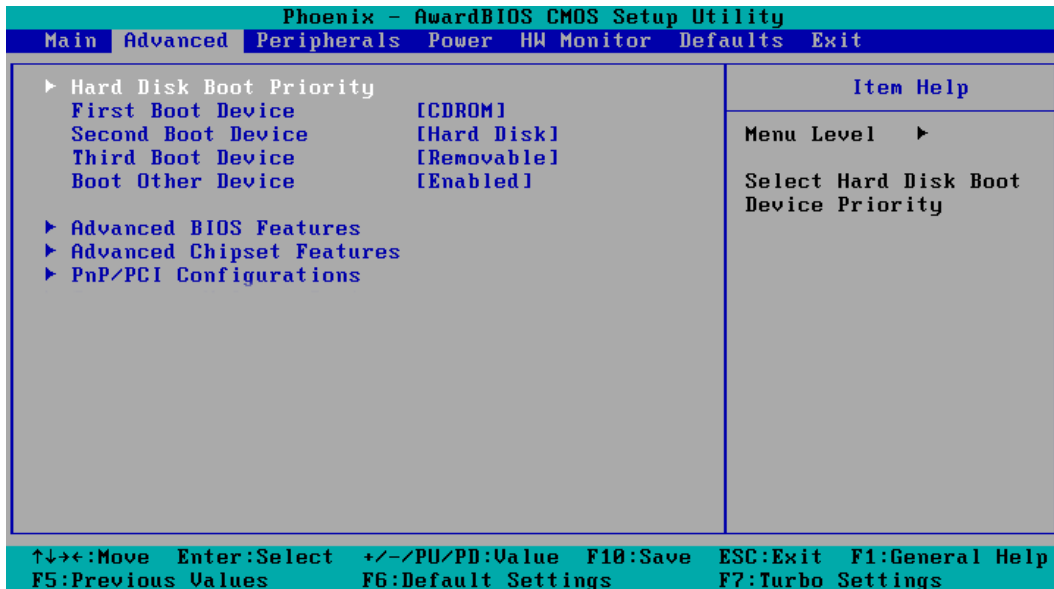
6. Manually copy the **os_image** directory from the **/recovery** folder on the Software CD to **\home\partimag** on the USB drive.



Step 2: Change the BIOS Settings

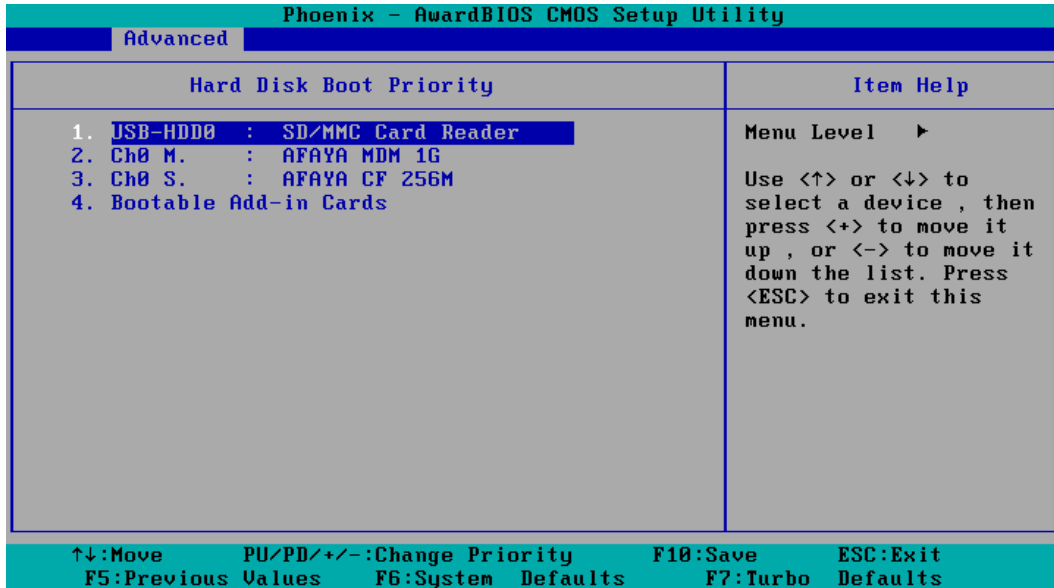
You will need to change the BIOS settings to boot from the USB disk.

1. Turn on the computer and press **DEL** to enter the BIOS setup menu. Select **Hard Disk Boot Priority** and then press **Enter**.



2. Select USB disk and then press "+" to move it to the first boot device position and then make sure your newly installed Compact Flash card is the second boot device.

Warning: An incorrect boot priority will lead to recovery failure.



3. Press **F10** and then press **Enter** to save and exit bios setup.

Step 3: Restore the system from USB drive

Connect the USB disk to any of the V2616-LX's USB ports and then reboot the computer. The system will boot from the USB disk and the Pre-installation Environment and the recovery utility will appear.

1. Select **clonezilla live restore disk**.



2. Wait for the USB drive boot process to finish.

```
[ 5.153522] sd 0:0:0:0: [sda] Attached SCSI disk
[ 5.163726] sd 0:0:1:0: [sdb] Attached SCSI disk
[ 5.287941] sd 0:0:0:0: Attached scsi generic sg0 type 0
[ 5.310750] sd 0:0:1:0: Attached scsi generic sg1 type 0
[ 5.334915] sr 1:0:0:0: Attached scsi generic sg2 type 5
Begin: Loading essential drivers ... [ 5.690577] Atheros(R) L2 Ethernet Driver - version 2.2.3
[ 5.692430] Copyright (c) 2007 Atheros Corporation.
[ 5.776770] Broadcom NetXtreme II 5771x 10Gigabit Ethernet Driver bnx2x 1.62.00-6 (2011/01/30)
[ 5.914014] Btrfs loaded
[ 5.955475] device-mapper: uevent: version 1.0.3
[ 5.961407] device-mapper: ioctl: 4.19.1-ioctl (2011-01-07) initialised: dm-devel@redhat.com
done.
Begin: Running /scripts/init-premount ... done.
Begin: Mounting root file system ... [ 6.178946] Uniform Multi-Platform E-IDE driver
[ 6.186189] ide_generic: please use "probe_mask=0x3f" module parameter for probing all legacy ISA
IDE ports
[ 6.913744] FAT: utf8 is not a recommended IO charset for FAT filesystems, filesystem will be cas
e sensitive!
[ 7.047997] aufs: module is from the staging directory, the quality is unknown, you have been war
ned.
[ 7.072516] aufs 2.1-standalone.tree-38-rcN-20110228
Begin: Running /scripts/live-premount ... done.
[ 7.213433] loop: module loaded
[ 7.509770] squashfs: version 4.0 (2009/01/31) Phillip Lougher
Begin: Running /scripts/live-realpremount ... done.
Begin: Mounting "/live/image/live/filesystem.squashfs" on "//filesystem.squashfs" via "/dev/loop0"
.. done.
done.
Begin: Running /scripts/live-bottom
... Begin: Configuring fstab ... done.
Begin: Preconfiguring networking ... done.
Begin: Loading preseed file ... done.
Begin: Running /scripts/init-bottom ... done.
INIT: version 2.88 booting
Using makefile-style concurrent boot in runlevel S.
live-config: hostname user-setup sudo locales tzdata keyboard-configuration sysvinit sysv-rc initram
fs-tools util-linux login openssh-server_
```

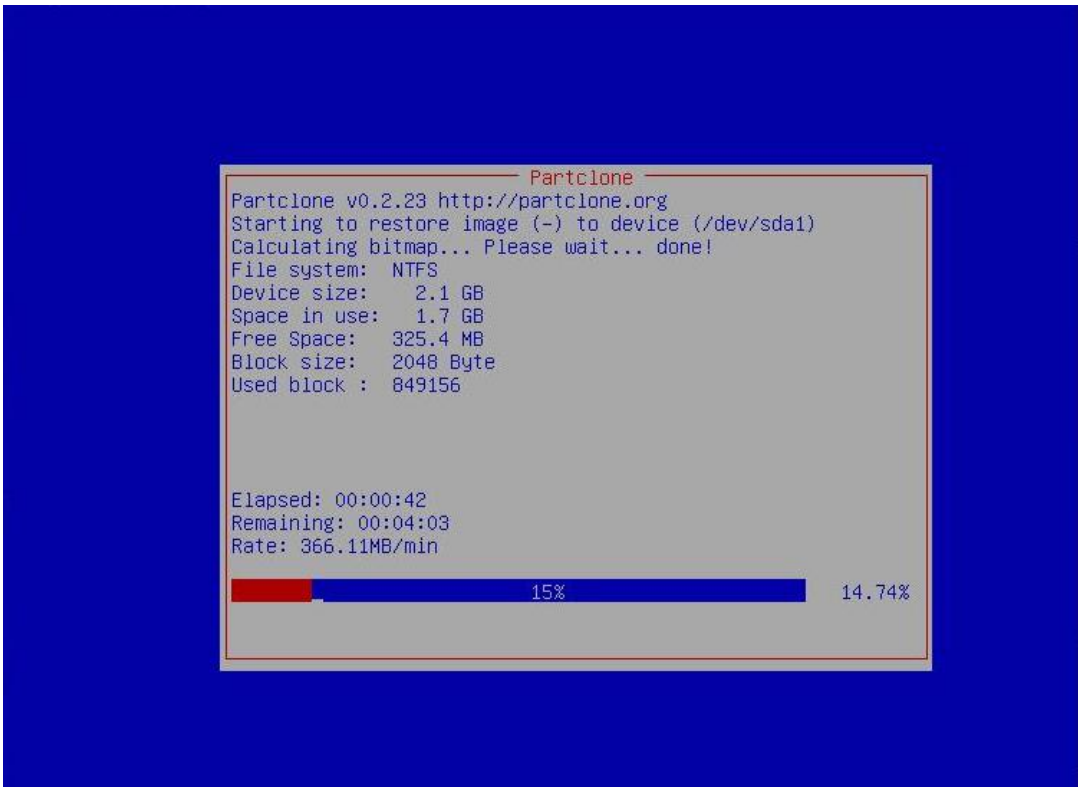
3. Enter **y** to continue the restore process.

```
The jobs in /etc/ocs/ocs-live.d/ are finished. Start "ocs-live-restore" now.
Setting the TERM as linux
*****
Clonezilla image dir: /home/partimag
*****
Shutting down the Logical Volume Manager
  No volume groups found
  No volume groups found
Finished Shutting down the Logical Volume Manager
*****
Activating the partition info in /proc... done!
*****
The following step is to restore an image to the hard disk/partition(s) on this machine: "/home/part
imag/xpe_savedisk" -> "sda sda1"
WARNING!!! WARNING!!! WARNING!!!
WARNING! THE EXISTING DATA IN THIS HARDDISK/PARTITION(S) WILL BE OVERWRITTEN! ALL EXISTING DATA WILL
BE LOST:
*****
Machine: VirtualBox
sda (2.1GB_VBOX_HARDDISK_ata-VBOX_HARDDISK_VB1c64a0a3-c9f7523d)
*****
Are you sure you want to continue? ?
[y/n] y
```

- 4. Enter **y** to confirm again.

```
The jobs in /etc/ocs/ocs-live.d/ are finished. Start "ocs-live-restore" now.
Setting the TERM as linux
*****
Clonezilla image dir: /home/partimag
*****
Shutting down the Logical Volume Manager
  No volume groups found
  No volume groups found
Finished Shutting down the Logical Volume Manager
*****
Activating the partition info in /proc... done!
*****
The following step is to restore an image to the hard disk/partition(s) on this machine: "/home/part
imag/xpe_savedisk" -> "sda sda1"
WARNING!!! WARNING!!! WARNING!!!
WARNING! THE EXISTING DATA IN THIS HARDDISK/PARTITION(S) WILL BE OVERWRITTEN! ALL EXISTING DATA WILL
BE LOST:
*****
Machine: VirtualBox
sda (2.1GB_VBOX_HARDDISK__ata-VBOX_HARDDISK_VB1c64a0a3-c9f7523d)
*****
Are you sure you want to continue? ?
[y/n] y
OK, let's do it!!
This program is not started by clonezilla server.
The following step is to restore an image to the hard disk/partition(s) on this machine: "/home/part
imag/xpe_savedisk" -> "sda (sda1)"
WARNING!!! WARNING!!! WARNING!!!
WARNING! THE EXISTING DATA IN THIS HARDDISK/PARTITION(S) WILL BE OVERWRITTEN! ALL EXISTING DATA WILL
BE LOST:
*****
Machine: VirtualBox
sda (2.1GB_VBOX_HARDDISK__ata-VBOX_HARDDISK_VB1c64a0a3-c9f7523d)
*****
Let me ask you again, Are you sure you want to continue? ?
[y/n] _
```

- 5. Wait for the process to finish.



6. Select **(0) Poweroff** to power off the computer.

```
Restoring the first 446 bytes of MBR data, i.e. executable code area, for sda... done!
*****
Now resize the partition for sda1
ntfsresize -f /dev/sda1
ntfsresize v2.0.0 (libntfs 10:0:0)
Device name      : /dev/sda1
NTFS volume version: 3.1
Cluster size     : 2048 bytes
Current volume size: 2064511488 bytes (2065 MB)
Current device size: 2064513024 bytes (2065 MB)
New volume size  : 2064511488 bytes (2065 MB)
Nothing to do: NTFS volume size is already OK.
*****
The grub directory is NOT found. Maybe it does not exist (so other boot manager exists) or the file
system is not supported in the kernel. Skip running grub-install.
*****
Found NTFS boot partition among the restored partition(s): /dev/sda1
Head and sector no. of /dev/sda from EDD: 64, 63.
The start sector of NTFS partition /dev/sda1: 63
Adjust filesystem geometry for the NTFS partition: /dev/sda1
Running: partclone.ntfsfixboot -w -h 64 -t 63 -s 63 /dev/sda1
ntfsfixboot version 0.9
done!
*****
*****
*****
This program is not started by Clonezilla server, so skip notifying it the job is done.
Finished!
Now syncing - flush filesystem buffers..

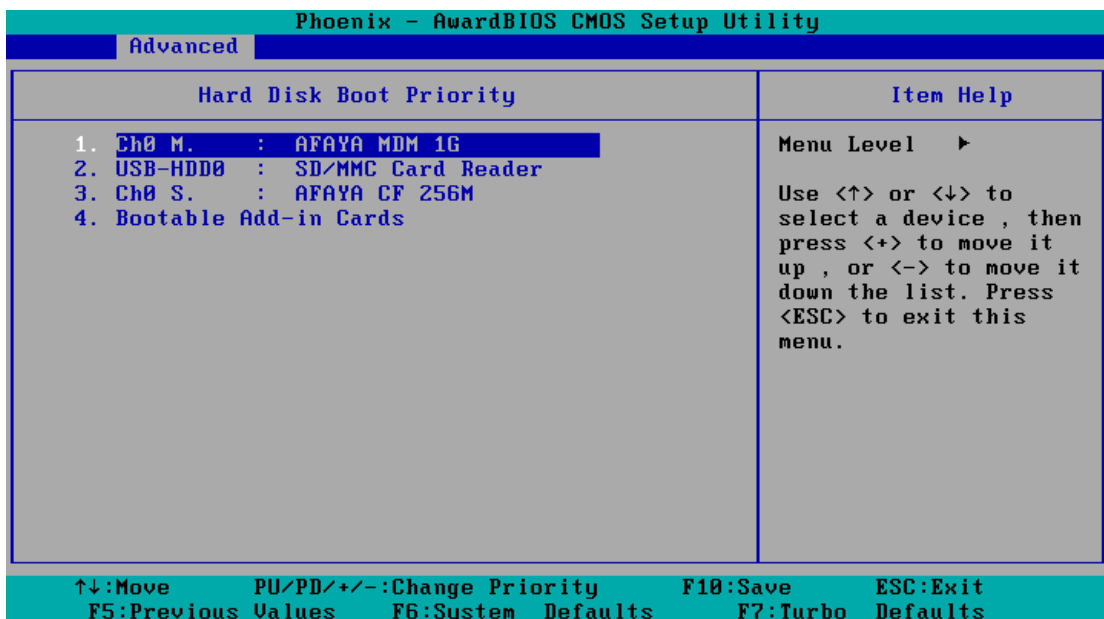
"ocs-live-restore" is finished.
Now you can choose to:
(0) Poweroff
(1) Reboot
(2) Enter command line prompt
(3) Start over
[2]
```

7. Remove the USB drive after the computer has been powered off.

Step 4: Change the BIOS Settings to Boot from the Original Disk

Now you will need to change the boot priority so that it can boot from the original disk. As the system reboots, press **DEL** to enter the BIOS setup menu.

1. Select **Hard Disk Boot Priority** and then press **Enter**. Make sure the hard disk has first boot priority.



2. Press **F10** and then press **Enter** to save and exit BIOS settings.

Step 5: Reboot the Computer

You need to wait about 10 to 15 minutes for the system to restart, since the system configuration files will be initiated while booting up for the first time. **Do not turn off the computer or shut down the computer** while the system is restarting; otherwise, the IIS service will be terminated. When the operating system has successfully launched, you will need to restart your computer so that the new settings can be activated.

Saving the System to the USB Drive

You may also save the current system to the USB drive for system recovery in case the system crashes. Before saving the system to the USB drive, we suggest you remove all files under `\home\partimag\` on the USB drive. In addition, change the BIOS settings to make the USB drive the first boot priority.

When the system has been launched, take the following steps.

1. Select **clonezilla live save disk**.



2. Wait for the USB drive boot process to finish.

```
[ 5.141941] sd 0:0:1:0: [sdb] Attached SCSI disk
[ 5.257277] sd 0:0:0:0: Attached scsi generic sg0 type 0
[ 5.269691] sd 0:0:1:0: Attached scsi generic sg1 type 0
[ 5.280668] sr 1:0:0:0: Attached scsi generic sg2 type 5
Begin: Loading essential drivers ... [ 5.772551] Atheros(R) LZ Ethernet Driver - version 2.2.3
[ 5.774561] Copyright (c) 2007 Atheros Corporation.
[ 5.863196] Broadcom NetXtreme II 5771x 10Gigabit Ethernet Driver bnx2x 1.62.00-6 (2011/01/30)
[ 6.005932] Btrfs loaded
[ 6.054095] device-mapper: uevent: version 1.0.3
[ 6.059737] device-mapper: ioctl: 4.19.1-ioctl (2011-01-07) initialised: dm-devel@redhat.com
done.
Begin: Running /scripts/init-premount ... done.
Begin: Mounting root file system ... [ 6.289382] Uniform Multi-Platform E-IDE driver
[ 6.301889] ide_generic: please use "probe_mask=0x3f" module parameter for probing all legacy ISA
IDE ports
[ 6.801141] NTFS driver 2.1.30 [Flags: R/W MODULE1.
[ 6.914295] NTFS volume version 3.1.
Begin: Running /scripts/live-premount ... done.
[ 7.331989] FAT: utf8 is not a recommended IO charset for FAT filesystems, filesystem will be cas
e sensitive!
[ 7.453369] aufs: module is from the staging directory, the quality is unknown, you have been war
ned.
[ 7.479098] aufs 2.1-standalone.tree-38-rcN-20110228
[ 7.610228] loop: module loaded
[ 7.905144] squashfs: version 4.0 (2009/01/31) Phillip Lougher
Begin: Running /scripts/live-realpremount ... done.
Begin: Mounting "/live/image/live/filesystem.squashfs" on "/filesystem.squashfs" via "/dev/loop0" .
.. done.
done.
Begin: Running /scripts/live-bottom
... Begin: Configuring fstab ... done.
Begin: Preconfiguring networking ... done.
Begin: Loading preseed file ... done.
Begin: Running /scripts/init-bottom ... done.
INIT: version 2.88 booting
Using makefile-style concurrent boot in runlevel S.
```

3. Enter **y** to continue.

```
Setting the TERM as linux
*****
Clonezilla image dir: /home/partimag
*****
Shutting down the Logical Volume Manager
. No volume groups found
. No volume groups found
Finished Shutting down the Logical Volume Manager
Selected device [sda] found!
The selected devices: sda
*****
Activating the partition info in /proc... done!
Selected device [sda] found!
The selected devices: sda
Searching for data partition(s)...
Excluding busy partition or disk...
Unmouted partitions (including extended or swap): sda1
Collecting info.. done!
Searching for swap partition(s)...
Excluding busy partition or disk...
Unmouted partitions (including extended or swap): sda1
Collecting info.. done!
The data partition to be saved: sda1
The swap partition to be saved:
Activating the partition info in /proc... done!
Selected device [sda1] found!
The selected devices: sda1
Getting /dev/sda1 info...
*****
The following step is to save the hard disk/partition(s) on this machine as an image:
*****
Machine: VirtualBox
sda (2103MB VBox_HARDDISK__ata-VBOX_HARDDISK_VB1c64a0a3-c9f7523d)
sda1 (2065MB ntfs(In_VBOX_HARDDISK_)_ata-VBOX_HARDDISK_VB1c64a0a3-c9f7523d)
*****
-> "/home/partimag/xpe_savedisk".
Are you sure you want to continue? ? (y/n) y
```

4. Wait for the process to finish.

```

/dev/sdb1: read failed after 0 of 2048 at 0: Input/output error
  No volume groups found
  No volume groups found
Finished Shutting down the Logical Volume Manager
Checking the integrity of partition table in the disk /dev/sda...
Reading the partition table for /dev/sda...RETVL=0
*****
*****
done!
Saving the MBR data for sda...
1+0 records in
1+0 records out
512 bytes (512 B) copied, 0.00347646 s, 147 kB/s
*****
*****
Starting saving /dev/sda1 as /home/partimag/xpe_savedisk/sda1.XXX...
/dev/sda1 filesystem: ntfs.
*****
Checking NTFS integrity in /dev/sda1... done!
Checking the disk space...
Use ntfsclone with gzip to save the image.
Image file will be split with size limit 1000000 MB.
*****
If this action fails or hangs, check:
* Is the disk full ?
*****
ntfsclone v2.0.0 (libntfs 10:0:0)
NTFS volume version: 3.1
Cluster size      : 2048 bytes
Current volume size: 2064510976 bytes (2065 MB)
Current device size: 2064513024 bytes (2065 MB)
Scanning volume ...
100.00 percent completed
Accounting clusters ...
Space in use      : 1770 MB (85.7%)
Saving NTFS to image ...
_ 0.64 percent completed

```

5. Select **(0) Poweroff** so that the computer will power off when the process is finished.

```

Restoring the first 446 bytes of MBR data, i.e. executable code area, for sda... done!
*****
Now resize the partition for sda1
ntfsresize -f /dev/sda1
ntfsresize v2.0.0 (libntfs 10:0:0)
Device name      : /dev/sda1
NTFS volume version: 3.1
Cluster size     : 2048 bytes
Current volume size: 2064511488 bytes (2065 MB)
Current device size: 2064513024 bytes (2065 MB)
New volume size  : 2064511488 bytes (2065 MB)
Nothing to do: NTFS volume size is already OK.
*****
The grub directory is NOT found. Maybe it does not exist (so other boot manager exists) or the file
system is not supported in the kernel. Skip running grub-install.
*****
Found NTFS boot partition among the restored partition(s): /dev/sda1
Head and sector no. of /dev/sda from EDD: 64, 63.
The start sector of NTFS partition /dev/sda1: 63
Adjust filesystem geometry for the NTFS partition: /dev/sda1
Running: partclone.ntfsfixboot -w -h 64 -t 63 -s 63 /dev/sda1
ntfsfixboot version 0.9
done!
*****
*****
This program is not started by Clonezilla server, so skip notifying it the job is done.
Finished!
Now syncing - flush filesystem buffers...

"ocs-live-restore" is finished.
Now you can choose to:
(0) Poweroff
(1) Reboot
(2) Enter command line prompt
(3) Start over
[2]

```

A

Software Components

acpi	1.5-2	displays information on ACPI devices
acpi-support-base	0.137-5	scripts for handling base ACPI events such as the power button
acpid	1:2.0.7-1	Advanced Configuration and Power Interface event daemon
adduser	3.112+nmu2	add and remove users and groups
alacarte	0.13.2-1	easy GNOME menu editing tool
alsa-base	1.0.23+dfsg-2	ALSA driver configuration files
alsa-utils	1.0.23-3	Utilities for configuring and using ALSA
apache2	2.2.16-6+squeeze1	Apache HTTP Server metapackage
apache2-mpm-prefork	2.2.16-6+squeeze1	Apache HTTP Server - traditional non-threaded model
apache2-utils	2.2.16-6+squeeze1	utility programs for web servers
apache2.2-bin	2.2.16-6+squeeze1	Apache HTTP Server common binary files
apache2.2-common	2.2.16-6+squeeze1	Apache HTTP Server common files
app-install-data	2010.11.17	Application Installer Data Files
apt	0.8.10.3+squeeze1	Advanced front-end for dpkg
apt-utils	0.8.10.3+squeeze1	APT utility programs
apt-xapian-index	0.41	maintenance and search tools for a Xapian index of Debian packages
aptitude	0.6.3-3.2	terminal-based package manager (terminal interface only)
aspell	0.60.6-4	GNU Aspell spell-checker
aspell-en	6.0-0-6	English dictionary for GNU Aspell
at	3.1.12-1	Delayed job execution and batch processing
at-spi	1.30.1-3	Assistive Technology Service Provider Interface
autoconf	2.67-2	automatic configure script builder
autoconf2.13	2.13-60	automatic configure script builder (obsolete version)
automake	1:1.11.1-1	A tool for generating GNU Standards-compliant Makefiles
automake1.4	1:1.4-p6-13.1	A tool for generating GNU Standards-compliant Makefiles
autotools-dev	20100122.1	Update infrastructure for config.{guess,sub} files
base-files	6.0squeeze2	Debian base system miscellaneous files
base-passwd	3.5.22	Debian base system master password and group files
bash	4.1-3	The GNU Bourne Again SHell
bash-completion	1:1.2-3	programmable completion for the bash shell
bc	1.06.95-2	The GNU bc arbitrary precision calculator language
bind9-host	1:9.7.3.dfsg-1~squeeze3	Version of 'host' bundled with BIND 9.X
binutils	2.20.1-16	The GNU assembler, linker and binary utilities
brasero	2.30.3-2	CD/DVD burning application for GNOME
brasero-common	2.30.3-2	Common files for the Brasero CD burning application and library

bridge-utils	1.4-5	Utilities for configuring the Linux Ethernet bridge
bsdmainutils	8.0.13	collection of more utilities from FreeBSD
bsdutils	1:2.17.2-9	Basic utilities from 4.4BSD-Lite
busybox	1:1.17.1-8	Tiny utilities for small and embedded systems
bzip2	1.0.5-6	high-quality block-sorting file compressor - utilities
ca-certificates	20090814+nmu2	Common CA certificates
caplets-data	1:2.30.1-2	configuration applets for GNOME - data files
cdrdao	1:1.2.3-0.1	records CDs in Disk-At-Once (DAO) mode
console-setup	1.68+squeeze2	console font and keymap setup program
console-terminus	4.30-2	Fixed-width fonts for fast reading on the Linux console
consolekit	0.4.1-4	framework for defining and tracking users, sessions and seats
coreutils	8.5-1	GNU core utilities
cpio	2.11-4	GNU cpio -- a program to manage archives of files
cpp	4:4.4.5-1	The GNU C preprocessor (cpp)
cpp-4.3	4.3.5-4	The GNU C preprocessor
cpp-4.4	4.4.5-8	The GNU C preprocessor
cpufrequtils	007-1	utilities to deal with the cpufreq Linux kernel feature
cron	3.0pl1-116	process scheduling daemon
dash	0.5.5.1-7.4	POSIX-compliant shell
dbus	1.2.24-4+squeeze1	simple interprocess messaging system
dbus-x11	1.2.24-4+squeeze1	simple interprocess messaging system (X11 deps)
debconf	1.5.36.1	Debian configuration management system
debconf-i18n	1.5.36.1	full internationalization support for debconf
debian-archive-keyring	2010.08.28	GnuPG archive keys of the Debian archive
debian-faq	4.0.4+nmu1	The Debian FAQ
debianutils	3.4	Miscellaneous utilities specific to Debian
defoma	0.11.11	Debian Font Manager -- automatic font configuration framework
deskbar-applet	2.32.0-1	universal search and navigation bar for GNOME
desktop-base	6.0.5squeeze1	common files for the Debian Desktop
desktop-file-utils	0.15-2	Utilities for .desktop files
dictionaries-common	1.5.17	Common utilities for spelling dictionary tools
diffutils	1:3.0-1	File comparison utilities
discover	2.1.2-5	hardware identification system
discover-data	2.2010.10.18	Data lists for Discover hardware detection system
dmidecode	2.9-1.2	Dump Desktop Management Interface data
dmraid	1.0.0.rc16-4.1	Device-Mapper Software RAID support tool
dmsetup	2:1.02.48-5	The Linux Kernel Device Mapper userspace library
dmz-cursor-theme	0.4.3	Style neutral, scalable cursor theme
dnsutils	1:9.7.3.dfsg-1~squeeze3	Clients provided with BIND
docbook-xml	4.5-7	standard XML documentation system for software and systems
dosfstools	3.0.9-1	utilities for making and checking MS-DOS FAT filesystems
dpkg	1.15.8.11	Debian package management system
dvd+rw-tools	7.1-6	DVD+-RW/R tools
e2fslibs	1.41.12-4stable1	ext2/ext3/ext4 file system libraries
e2fsprogs	1.41.12-4stable1	ext2/ext3/ext4 file system utilities
eject	2.1.5+deb1+cvs20081104-7.1	ejects CDs and operates CD-Changeurs under Linux
esound-common	0.2.41-8	Enlightened Sound Daemon - Common files

ethtool	1:2.6.34-3	display or change Ethernet device settings
evolution-data-server	2.30.3-2	evolution database backend server
evolution-data-server-common	2.30.3-2	architecture independent files for Evolution Data Server
exim4-base	4.72-6+squeeze2	support files for all Exim MTA (v4) packages
exim4-config	4.72-6+squeeze2	configuration for the Exim MTA (v4)
exim4-daemon-light	4.72-6+squeeze2	lightweight Exim MTA (v4) daemon
exuberant-ctags	1:5.8-3squeeze1	build tag file indexes of source code definitions
fancontrol	1:3.1.2-6	utilities to read temperature/voltage/fan sensors
file	5.04-5	Determines file type using "magic" numbers
file-roller	2.30.2-2	an archive manager for GNOME
findutils	4.4.2-1+b1	utilities for finding files--find, xargs
fontconfig	2.8.0-2.1	generic font configuration library - support binaries
fontconfig-config	2.8.0-2.1	generic font configuration library - configuration
ftp	0.17-23	The FTP client
fuse-utils	2.8.4-1.1	Filesystem in USErspace (utilities)
g++	4:4.4.5-1	The GNU C++ compiler
g++-4.4	4.4.5-8	The GNU C++ compiler
gcc	4:4.4.5-1	The GNU C compiler
gcc-4.3	4.3.5-4	The GNU C compiler
gcc-4.3-base	4.3.5-4	The GNU Compiler Collection (base package)
gcc-4.4	4.4.5-8	The GNU C compiler
gcc-4.4-base	4.4.5-8	The GNU Compiler Collection (base package)
gconf2	2.28.1-6	GNOME configuration database system (support tools)
gconf2-common	2.28.1-6	GNOME configuration database system (common files)
gdb	7.0.1-2+b1	The GNU Debugger
gdbserver	7.0.1-2+b1	The GNU Debugger (remote server)
gdm3	2.30.5-6squeeze3	Next generation GNOME Display Manager
genisoimage	9:1.1.11-1	Creates ISO-9660 CD-ROM filesystem images
geoip-database	1.4.7~beta6+dfsg-1	IP lookup command line tools that use the GeoIP library (country database)
gettext-base	0.18.1.1-3	GNU Internationalization utilities for the base system
gksu	2.0.2-5	graphical frontend to su
gnome-about	2.30.2-2	The GNOME about box
gnome-applets	2.30.0-3	Various applets for the GNOME panel - binary files
gnome-applets-data	2.30.0-3	Various applets for the GNOME panel - data files
gnome-control-center	1:2.30.1-2	utilities to configure the GNOME desktop
gnome-desktop-data	2.30.2-2	Common files for GNOME desktop apps
gnome-dictionary	2.30.0-2	GNOME dictionary application
gnome-icon-theme	2.30.3-2	GNOME Desktop icon theme
gnome-keyring	2.30.3-5	GNOME keyring services (daemon and tools)
gnome-media	2.30.0-1	GNOME media utilities
gnome-media-common	2.30.0-1	GNOME media utilities - common files
gnome-menus	2.30.3-1	an implementation of the freedesktop menu specification for GNOME
gnome-mime-data	2.18.0-1	base MIME and Application database for GNOME.
gnome-netstatus-applet	2.28.1-1	Network status applet for GNOME
gnome-panel	2.30.2-2	launcher and docking facility for GNOME
gnome-panel-data	2.30.2-2	common files for the GNOME Panel
gnome-power-manager	2.32.0-2	power management tool for the GNOME desktop
gnome-screensaver	2.30.0-2squeeze1	GNOME screen saver and locker
gnome-session	2.30.2-3	The GNOME Session Manager - GNOME 2 session
gnome-session-bin	2.30.2-3	The GNOME Session Manager - Minimal runtime

gnome-session-common	2.30.2-3	Common files for the GNOME session manager
gnome-settings-daemon	2.30.2-2+squeeze1	daemon handling the GNOME session settings
gnome-system-monitor	2.28.1-1	Process viewer and system resource monitor for GNOME
gnome-terminal	2.30.2-1	The GNOME terminal emulator application
gnome-terminal-data	2.30.2-1	Data files for the GNOME terminal emulator
gnome-themes	2.30.2-1	official themes for the GNOME desktop
gnome-utils-common	2.30.0-2	data files for the GNOME utilities
gnupg	1.4.10-4	GNU privacy guard - a free PGP replacement
gpgv	1.4.10-4	GNU privacy guard - signature verification tool
grep	2.6.3-3	GNU grep, egrep and fgrep
groff-base	1.20.1-10	GNU troff text-formatting system (base system components)
gststreamer0.10-alsa	0.10.30-1	GStreamer plugin for ALSA
gststreamer0.10-plugins-base	0.10.30-1	GStreamer plugins from the "base" set
gststreamer0.10-plugins-good	0.10.24-1	GStreamer plugins from the "good" set
gststreamer0.10-plugins-ugly	0.10.15-1	GStreamer plugins from the "ugly" set
gststreamer0.10-x	0.10.30-1	GStreamer plugins for X11 and Pango
gtk2-engines	1:2.20.1-1	theme engines for GTK+ 2.x
gtk2-engines-pixbuf	2.20.1-2	Pixbuf-based theme for GTK+ 2.x
gvfs	1.6.4-3	userspace virtual filesystem - server
gvfs-backends	1.6.4-3	userspace virtual filesystem - backends
gzip	1.3.12-9	GNU compression utilities
hdparm	9.32-1	tune hard disk parameters for high performance
heirloom-mailx	12.4-2	feature-rich BSD mail(1)
hicolor-icon-theme	0.12-1	default fallback theme for FreeDesktop.org icon themes
host	1:9.7.3.dfsg-1~squeeze3	Transitional package
hostname	3.04	utility to set/show the host name or domain name
hunspell-en-us	20070829-4	English_american dictionary for hunspell
hwdata	0.230-1	hardware identification / configuration data
ifrename	30~pre9-5	Rename network interfaces based on various static criteria
ifupdown	0.6.10	high level tools to configure network interfaces
initramfs-tools	0.98.8	tools for generating an initramfs
initscripts	2.88dsf-13.1	scripts for initializing and shutting down the system
insserv	1.14.0-2	Tool to organize boot sequence using LSB init.d script dependencies
install-info	4.13a.dfsg.1-6	Manage installed documentation in info format
iproute	20100519-3	networking and traffic control tools
iptables	1.4.8-3	administration tools for packet filtering and NAT
iputils-ping	3:20100418-3	Tools to test the reachability of network hosts
isc-dhcp-client	4.1.1-P1-15+squeeze2	ISC DHCP client
isc-dhcp-common	4.1.1-P1-15+squeeze2	common files used by all the isc-dhcp* packages
iso-codes	3.23-1	ISO language, territory, currency, script codes and their translations
kbd	1.15.2-2	Linux console font and keytable utilities
keyboard-configuration	1.68+squeeze2	system-wide keyboard preferences
klibc-utils	1.5.20-1+squeeze1	small utilities built with klibc for early boot
liba52-0.7.4	0.7.4-14	library for decoding ATSC A/52 streams
libaa1	1.4p5-38	ascii art library

libacl1	2.2.49-4	Access control list shared library
libao-common	1.0.0-5	Cross Platform Audio Output Library (Common files)
libao4	1.0.0-5	Cross Platform Audio Output Library
libapache2-mod-php5	5.3.3-7+squeeze3	server-side, HTML-embedded scripting language (Apache 2 module)
libapr1	1.4.2-6+squeeze3	The Apache Portable Runtime Library
libaprutil1	1.3.9+dfsg-5	The Apache Portable Runtime Utility Library
libaprutil1-dbd-sqlite3	1.3.9+dfsg-5	The Apache Portable Runtime Utility Library - SQLite3 Driver
libaprutil1-ldap	1.3.9+dfsg-5	The Apache Portable Runtime Utility Library - LDAP Driver
libarchive1	2.8.4-1	Single library to read/write tar, cpio, pax, zip, iso9660, etc.
libart-2.0-2	2.3.21-1	Library of functions for 2D graphics - runtime files
libasound2	1.0.23-2.1	shared library for ALSA applications
libaspell15	0.60.6-4	GNU Aspell spell-checker runtime library
libasyncns0	0.3-1.1	Asynchronous name service query library
libatasmart4	0.17+git20100219-2	ATA S.M.A.R.T. reading and parsing library
libatk1.0-0	1.30.0-1	The ATK accessibility toolkit
libatk1.0-data	1.30.0-1	Common files for the ATK accessibility toolkit
libatspi1.0-0	1.30.1-3	C binding libraries of at-spi for GNOME Accessibility
libattr1	1:2.4.44-2	Extended attribute shared library
libaudiofile0	0.2.6-8	Open-source version of SGI's audiofile library
libaudit0	1.7.13-1+b2	Dynamic library for security auditing
libavahi-client3	0.6.27-2+squeeze1	Avahi client library
libavahi-common-data	0.6.27-2+squeeze1	Avahi common data files
libavahi-common3	0.6.27-2+squeeze1	Avahi common library
libavahi-glib1	0.6.27-2+squeeze1	Avahi glib integration library
libavc1394-0	0.5.3-1+b2	control IEEE 1394 audio/video devices
libbind9-60	1:9.7.3.dfsg-1~squeeze3	BIND9 Shared Library used by BIND
libblas3gf	1.2-8	Basic Linear Algebra Reference implementations, shared library
libblkid1	2.17.2-9	block device id library
libbluetooth3	4.66-3	Library to use the BlueZ Linux Bluetooth stack
libbonobo2-0	2.24.3-1	Bonobo CORBA interfaces library
libbonobo2-common	2.24.3-1	Bonobo CORBA interfaces library -- support files
libbonoboui2-0	2.24.3-1	The Bonobo UI library
libbonoboui2-common	2.24.3-1	The Bonobo UI library -- common files
libboost-iostreams1.42.0	1.42.0-4	Boost.Iostreams Library
libbrasero-media0	2.30.3-2	CD/DVD burning library for GNOME - runtime
libbsd0	0.2.0-1	utility functions from BSD systems - shared library
libburn4	0.8.0.pl00-2+squeeze1	library to provide CD/DVD writing functions
libbz2-1.0	1.0.5-6	high-quality block-sorting file compressor library - runtime
libc-bin	2.11.2-10	Embedded GNU C Library: Binaries
libc-dev-bin	2.11.2-10	Embedded GNU C Library: Development binaries
libc6	2.11.2-10	Embedded GNU C Library: Shared libraries
libc6-dev	2.11.2-10	Embedded GNU C Library: Development Libraries and Header Files
libc6-i386	2.11.2-10	Embedded GNU C Library: 32-bit shared libraries for AMD64
libcaca0	0.99.beta17-1	colour ASCII art library

libcairo-perl	1.070-1	Perl interface to the Cairo graphics library
libcairo2	1.8.10-6	The Cairo 2D vector graphics library
libcairo-mm-1.0-1	1.8.4-3	C++ wrappers for Cairo (shared libraries)
libcamel1.2-14	2.30.3-2	The Evolution MIME message handling library
libcanberra-gtk-module	0.24-1	translates Gtk+ widgets signals to event sounds
libcanberra-gtk0	0.24-1	Gtk+ helper for playing widget event sounds with libcanberra
libcanberra0	0.24-1	a simple abstract interface for playing event sounds
libcap2	1:2.19-3	support for getting/setting POSIX.1e capabilities
libcdio-cdda0	0.81-4	library to read and control digital audio CDs
libcdio-paranoia0	0.81-4	library to read digital audio CDs with error correction
libcdio10	0.81-4	library to read and control CD-ROM
libcdparanoia0	3.10.2+debian-9	audio extraction tool for sampling CDs (library)
libck-connector0	0.4.1-4	ConsoleKit libraries
libcomerr2	1.41.12-4stable1	common error description library
libcpufreq0	007-1	shared library to deal with the cpufreq Linux kernel feature
libcroco3	0.6.2-1	a generic Cascading Style Sheet (CSS) parsing and manipulation toolkit
libcups2	1.4.4-7	Common UNIX Printing System(tm) - Core library
libcwidget3	0.5.16-3	high-level terminal interface library for C++ (runtime files)
libdatrie1	0.2.4-1	Double-array trie library
libdb4.6	4.6.21-16	Berkeley v4.6 Database Libraries [runtime]
libdb4.7	4.7.25-9	Berkeley v4.7 Database Libraries [runtime]
libdb4.8	4.8.30-2	Berkeley v4.8 Database Libraries [runtime]
libdbus-1-3	1.2.24-4+squeeze1	simple interprocess messaging system
libdbus-glib-1-2	0.88-2.1	simple interprocess messaging system (GLib-based shared library)
libdevmapper1.02.1	2:1.02.48-5	The Linux Kernel Device Mapper userspace library
libdiscover2	2.1.2-5	hardware identification library
libdmraid1.0.0.rc16	1.0.0.rc16-4.1	Device-Mapper Software RAID support tool - shared library
libdns69	1:9.7.3.dfsg-1~squeeze3	DNS Shared Library used by BIND
libdrm-intel1	2.4.21-1~squeeze3	Userspace interface to intel-specific kernel DRM services -- runtime
libdrm-nouveau1	2.4.21-1~squeeze3	Userspace interface to nouveau-specific kernel DRM services -- runtime
libdrm-radeon1	2.4.21-1~squeeze3	Userspace interface to radeon-specific kernel DRM services -- runtime
libdrm2	2.4.21-1~squeeze3	Userspace interface to kernel DRM services -- runtime
libdv4	1.0.0-2.1	software library for DV format digital video (runtime lib)
libdvdnv4	4.1.3-7	DVD navigation library
libdv dread4	4.1.3-10	library for reading DVDs
libebook1.2-0	2.30.3-2	Utility library for evolution data servers
libebook1.2-9	2.30.3-2	Client library for evolution address books
libecal1.2-7	2.30.3-2	Client library for evolution calendars
libedata-book1.2-2	2.30.3-2	Backend library for evolution address books
libedata-cal1.2-7	2.30.3-2	Backend library for evolution calendars
libedataserver1.2-13	2.30.3-2	Utility library for evolution data servers
libedataserverui1.2-8	2.30.3-2	GUI utility library for evolution data servers
libedit2	2.11-20080614-2	BSD editline and history libraries

libeggdbus-1-0	0.6-1	D-Bus bindings for GObject
libegroupwise1.2-13	2.30.3-2	Client library for accessing groupwise POA through SOAP interface
libelf1	0.148-1	library to read and write ELF files
libenchant1c2a	1.6.0-1	a wrapper library for various spell checker engines
libept1	1.0.4	High-level library for managing Debian package information
libesd0	0.2.41-8	Enlightened Sound Daemon - Shared libraries
libevent-1.4-2	1.4.13-stable-1	An asynchronous event notification library
libexempi3	2.1.1-1	library to parse XMP metadata (Library)
libexif12	0.6.19-1	library to parse EXIF files
libexpat1	2.0.1-7	XML parsing C library - runtime library
libfam0	2.7.0-17	Client library to control the FAM daemon
libffi5	3.0.9-3	Foreign Function Interface library runtime
libfile-copy-recursive-perl	0.38-1	Perl extension for recursively copying files and directories
libflac8	1.2.1-2+b1	Free Lossless Audio Codec - runtime C library
libfont-afm-perl	1.20-1	Font::AFM - Interface to Adobe Font Metrics files
libfont-freetype-perl	0.03-1	Read font files and render glyphs from Perl using FreeType2
libfontconfig1	2.8.0-2.1	generic font configuration library - runtime
libfontenc1	1:1.0.5-2	X11 font encoding library
libfreetype6	2.4.2-2.1	FreeType 2 font engine, shared library files
libfs6	2:1.0.2-1	X11 Font Services library
libfuse2	2.8.4-1.1	Filesystem in USErspace library
libgail-common	2.20.1-2	GNOME Accessibility Implementation Library -- common modules
libgail18	2.20.1-2	GNOME Accessibility Implementation Library -- shared libraries
libgc1c2	1:6.8-1.2	conservative garbage collector for C and C++
libgcc1	1:4.4.5-8	GCC support library
libgconf2-4	2.28.1-6	GNOME configuration database system (shared libraries)
libgcr0	2.30.3-5	Library for Crypto UI related task - runtime
libgcrypt11	1.4.5-2	LGPL Crypto library - runtime library
libgdata-google1.2-1	2.30.3-2	Client library for accessing Google POA through SOAP interface
libgdata1.2-1	2.30.3-2	Client library for accessing Google POA through SOAP interface
libgdbm3	1.8.3-9	GNU dbm database routines (runtime version)
libgdict-1.0-6	2.30.0-2	GNOME Dictionary base library - runtime
libgdu0	2.30.1-2	GObject based Disk Utility Library
libgeoip1	1.4.7~beta6+dfsg-1	A non-DNS IP-to-country resolver library
libgfortran3	4.4.5-8	Runtime library for GNU Fortran applications
libgksu2-0	2.0.13~pre1-3	library providing su and sudo functionality
libgl1-mesa-dri	7.7.1-4	A free implementation of the OpenGL API -- DRI modules
libgl1-mesa-glx	7.7.1-4	A free implementation of the OpenGL API -- GLX runtime
libglade2-0	1:2.6.4-1	library to load .glade files at runtime
libglib-perl	2:1.223-1	interface to the GLib and GObject libraries
libglib2.0-0	2.24.2-1	The GLib library of C routines
libglib2.0-data	2.24.2-1	Common files for GLib library
libglibmm-2.4-1c2a	2.24.2-1	C++ wrapper for the GLib toolkit (shared libraries)

libglu1-mesa	7.7.1-4	The OpenGL utility library (GLU)
libgmime-2.4-2	2.4.14-1+nmu1	MIME message parser and creator library - runtime
libgmp3c2	2:4.3.2+dfsg-1	Multiprecision arithmetic library
libgnome-desktop-2-17	2.30.2-2	Utility library for loading .desktop files - runtime files
libgnome-keyring0	2.30.1-1	GNOME keyring services library
libgnome-media0	2.30.0-1	runtime libraries for the GNOME media utilities
libgnome-menu2	2.30.3-1	an implementation of the freedesktop menu specification for GNOME
libgnome-window-setting s1	1:2.30.1-2	Utility library for getting window manager settings
libgnome2-0	2.30.0-1	The GNOME library - runtime files
libgnome2-canvas-perl	1.002-2	Perl interface to the GNOME canvas library
libgnome2-common	2.30.0-1	The GNOME library - common files
libgnome2-perl	1.042-2	Perl interface to the GNOME libraries
libgnome2-vfs-perl	1.081-1	Perl interface to the 2.x series of the GNOME VFS library
libgnomecanvas2-0	2.30.1-1	A powerful object-oriented display - runtime files
libgnomecanvas2-comm on	2.30.1-1	A powerful object-oriented display - common files
libgnomekbd-common	2.30.2-2	GNOME library to manage keyboard configuration - common files
libgnomekbd4	2.30.2-2	GNOME library to manage keyboard configuration - shared library
libgnomeui-0	2.24.3-1	The GNOME libraries (User Interface) - runtime files
libgnomeui-common	2.24.3-1	The GNOME libraries (User Interface) - common files
libgnomevfs2-0	1:2.24.3-1	GNOME Virtual File System (runtime libraries)
libgnomevfs2-common	1:2.24.3-1	GNOME Virtual File System (common files)
libgnomevfs2-extra	1:2.24.3-1	GNOME Virtual File System (extra modules)
libgnutls26	2.8.6-1	the GNU TLS library - runtime library
libgomp1	4.4.5-8	GCC OpenMP (GOMP) support library
libgp11-0	2.30.3-5	Glib wrapper library for PKCS#11 - runtime
libgpg-error0	1.6-1	library for common error values and messages in GnuPG components
libgpgme11	1.2.0-1.2	GPGME - GnuPG Made Easy
libgphoto2-2	2.4.6-3	gphoto2 digital camera library
libgphoto2-port0	2.4.6-3	gphoto2 digital camera port library
libgpm2	1.20.4-3.3	General Purpose Mouse - shared library
libgsf-1-114	1.14.18-1	Structured File Library - runtime version
libgsf-1-common	1.14.18-1	Structured File Library - common files
libgssapi-krb5-2	1.8.3+dfsg-4squeeze1	MIT Kerberos runtime libraries - krb5 GSS-API Mechanism
libgssglue1	0.1-4	mechanism-switch gssapi library
libgssrpc4	1.8.3+dfsg-4squeeze1	MIT Kerberos runtime libraries - GSS enabled ONCRPC
libgstreamer-plugins-bas e0.10-0	0.10.30-1	GStreamer libraries from the "base" set
libgstreamer0.10-0	0.10.30-1	Core GStreamer libraries and elements
libgtk2-perl	2:1.222-1	Perl interface to the 2.x series of the Gimp Toolkit library
libgtk2.0-0	2.20.1-2	The GTK+ graphical user interface library
libgtk2.0-bin	2.20.1-2	The programs for the GTK+ graphical user interface library
libgtk2.0-common	2.20.1-2	Common files for the GTK+ graphical user interface library
libgtkmm-2.4-1c2a	1:2.20.3-1	C++ wrappers for GTK+ (shared libraries)
libgtop2-7	2.28.1-1	gtop system monitoring library (shared)

libgtop2-common	2.28.1-1	gtop system monitoring library (common)
libgucharmap7	1:2.30.3-1	Unicode browser widget library (shared library)
libgudev-1.0-0	164-3	GObject-based wrapper library for libudev
libgweather-common	2.30.3-1	GWeather common files
libgweather1	2.30.3-1	GWeather shared library
libhal-storage1	0.5.14-3	Hardware Abstraction Layer - shared library for storage devices
libhal1	0.5.14-3	Hardware Abstraction Layer - shared library
libhtml-format-perl	2.04-2	format HTML syntax trees into text, PostScript or RTF
libhtml-parser-perl	3.66-1	collection of modules that parse HTML text documents
libhtml-tagset-perl	3.20-2	Data tables pertaining to HTML
libhtml-tree-perl	3.23-2	Perl module to represent and create HTML syntax trees
libhunspell-1.2-0	1.2.11-1	spell checker and morphological analyzer (shared library)
libical0	0.44-3	iCalendar library implementation in C (runtime)
libice6	2:1.0.6-2	X11 Inter-Client Exchange library
libicu44	4.4.1-7	International Components for Unicode
libid3tag0	0.15.1b-10	ID3 tag reading library from the MAD project
libidl0	0.8.14-0.1	library for parsing CORBA IDL files
libidn11	1.15-2	GNU Libidn library, implementation of IETF IDN specifications
libiec61883-0	1.2.0-0.1	an partial implementation of IEC 61883
libimobiledevice1	1.0.2-1	Library for communicating with the iPhone and iPod Touch
libisc62	1:9.7.3.dfsg-1~squeeze3	ISC Shared Library used by BIND
libisccc60	1:9.7.3.dfsg-1~squeeze3	Command Channel Library used by BIND
libiscfg62	1:9.7.3.dfsg-1~squeeze3	Config File Handling Library used by BIND
libisofs6	0.6.32-2	library to create ISO9960 images
libiw30	30~pre9-5	Wireless tools - library
libjasper1	1.900.1-7+b1	The JasPer JPEG-2000 runtime library
libjpeg62	6b1-1	The Independent JPEG Group's JPEG runtime library (version 6.2)
libk5crypto3	1.8.3+dfsg-4squeeze1	MIT Kerberos runtime libraries - Crypto Library
libkadm5clnt-mit7	1.8.3+dfsg-4squeeze1	MIT Kerberos runtime libraries - Administration Clients
libkadm5srv-mit7	1.8.3+dfsg-4squeeze1	MIT Kerberos runtime libraries - KDC and Admin Server
libkdb5-4	1.8.3+dfsg-4squeeze1	MIT Kerberos runtime libraries - Kerberos database
libkeyutils1	1.4-1	Linux Key Management Utilities (library)
libklibc	1.5.20-1+squeeze1	minimal libc subset for use with initramfs
libkrb5-3	1.8.3+dfsg-4squeeze1	MIT Kerberos runtime libraries
libkrb5support0	1.8.3+dfsg-4squeeze1	MIT Kerberos runtime libraries - Support library
liblapack3gf	3.2.1-8	library of linear algebra routines 3 - shared version
libldap-2.4-2	2.4.23-7.2	OpenLDAP libraries
liblocale-gettext-perl	1.05-6	Using libc functions for internationalization in Perl
liblockfile1	1.08-4	NFS-safe locking library, includes dotlockfile program
libltdl7	2.2.6b-2	A system independent dlopen wrapper for GNU libtool
liblua5.1-0	5.1.4-5	Simple, extensible, embeddable programming language
liblwres60	1:9.7.3.dfsg-1~squeeze3	Lightweight Resolver Library used by BIND
liblzma2	5.0.0-2	XZ-format compression library
liblzo2-2	2.03-2	data compression library

libmad0	0.15.1b-5	MPEG audio decoder library
libmagic1	5.04-5	File type determination library using "magic" numbers
libmailtools-perl	2.06-1	Manipulate email in perl programs
libmetacity-private0	1:2.30.1-3	library for the Metacity window manager
libmpeg2-4	0.4.1-3	MPEG1 and MPEG2 video decoder library
libmpfr4	3.0.0-2	multiple precision floating-point computation
libnautilus-extension1	2.30.1-2squeeze1	libraries for nautilus components - runtime version
libncurses5	5.7+20100313-5	shared libraries for terminal handling
libncurses5-dev	5.7+20100313-5	developer's libraries and docs for ncurses
libncursesw5	5.7+20100313-5	shared libraries for terminal handling (wide character support)
libnet-dbus-perl	0.33.6-2	Extension for the Dbus bindings
libnet-telnet-perl	3.03-3	Script telnetable connections
libnewt0.52	0.52.11-1	Not Erik's Windowing Toolkit - text mode windowing with slang
libnfnlink0	1.0.0-1	Netfilter netlink library
libnfsidmap2	0.23-2	An nfs idmapping library
libnotify1	0.5.0-2	sends desktop notifications to a notification daemon
libnspr4-0d	4.8.6-1	NetScape Portable Runtime Library
libnss3-1d	3.12.8-1+squeeze1	Network Security Service libraries
libntfs-3g75	1:2010.3.6-1	ntfs-3g filesystem in userspace (FUSE) library
libntfs10	2.0.0-1+b1	library that provides common NTFS access functions
libogg0	1.2.0~dfsg-1	Ogg bitstream library
liboil0.3	0.3.17-2	Library of Optimized Inner Loops
libonig2	5.9.1-1	Oniguruma regular expressions library
liboobs-1-4	2.30.1-1	GObject based interface to system-tools-backends - shared library
libopencore-amrnb0	0.1.2-1	Adaptive Multi Rate speech codec - shared library
libopencore-amrwb0	0.1.2-1	Adaptive Multi-Rate - Wideband speech codec - shared library
liborbit2	1:2.14.18-0.1	libraries for ORBit2 - a CORBA ORB
liborc-0.4-0	1:0.4.6-2	Library of Optimized Inner Loops Runtime Compiler
libpam-ck-connector	0.4.1-4	ConsoleKit PAM module
libpam-gnome-keyring	2.30.3-5	PAM module to unlock the GNOME keyring upon login
libpam-modules	1.1.1-6.1	Pluggable Authentication Modules for PAM
libpam-runtime	1.1.1-6.1	Runtime support for the PAM library
libpam0g	1.1.1-6.1	Pluggable Authentication Modules library
libpanel-applet2-0	2.30.2-2	library for GNOME Panel applets
libpango-perl	1.221-2	Perl module to layout and render international text
libpango1.0-0	1.28.3-1+squeeze2	Layout and rendering of internationalized text
libpango1.0-common	1.28.3-1+squeeze2	Modules and configuration files for the Pango
libpangomm-1.4-1	2.26.2-1	C++ Wrapper for pango (shared libraries)
libparted0debian1	2.3-5	The GNU Parted disk partitioning shared library
libpcap0.8	1.1.1-2	system interface for user-level packet capture
libpci3	1:3.1.7-6	Linux PCI Utilities (shared library)
libpciaccess0	0.12.0-1	Generic PCI access library for X
libpcre3	8.02-1.1	Perl 5 Compatible Regular Expression Library - runtime files
libperl5.10	5.10.1-17squeeze2	shared Perl library
libpixmap-1-0	0.16.4-1	pixel-manipulation library for X and cairo
libpkcs11-helper1	1.07-1	library that simplifies the interaction with PKCS#11
libplist1	1.3-2	Library for handling Apple binary and XML property lists
libpng12-0	1.2.44-1+squeeze1	PNG library - runtime

libpolkit-agent-1-0	0.96-4	PolicyKit Authentication Agent API
libpolkit-backend-1-0	0.96-4	PolicyKit backend API
libpolkit-gobject-1-0	0.96-4	PolicyKit Authorization API
libpolkit-gtk-1-0	0.96-3	PolicyKit GTK+ API
libpopt0	1.16-1	lib for parsing cmdline parameters
libproxy0	0.3.1-2	automatic proxy configuration management library (shared)
libpth20	2.0.7-16	The GNU Portable Threads
libpulse-mainloop-glib0	0.9.21-3+squeeze1	PulseAudio client libraries (glib support)
libpulse0	0.9.21-3+squeeze1	PulseAudio client libraries
libpython2.6	2.6.6-8+b1	Shared Python runtime library (version 2.6)
libqdbm14	1.8.77-4	QDBM Database Libraries [runtime]
librarian0	0.8.1-5	Documentation meta-data library (library package)
libraw1394-11	2.0.5-2	library for direct access to IEEE 1394 bus (aka FireWire)
libreadline5	5.2-7	GNU readline and history libraries, run-time libraries
libreadline6	6.1-3	GNU readline and history libraries, run-time libraries
librpcsecgss3	0.19-2	allows secure rpc communication using the rpcsec_gss protocol
librpm1	4.8.1-6	RPM shared library
librpmio1	4.8.1-6	RPM IO shared library
librsvg2-2	2.26.3-1	SAX-based renderer library for SVG files (runtime)
librsvg2-common	2.26.3-1	SAX-based renderer library for SVG files (extra runtime)
libsasl2-2	2.1.23.dfsg1-7	Cyrus SASL - authentication abstraction library
libsasl2-modules	2.1.23.dfsg1-7	Cyrus SASL - pluggable authentication modules
libselenium1	2.0.96-1	SELinux runtime shared libraries
libsensors4	1:3.1.2-6	library to read temperature/voltage/fan sensors
libsepol1	2.0.41-1	SELinux library for manipulating binary security policies
libsgutils2-2	1.29-1	utilities for devices using the SCSI command set (shared libraries)
libshout3	2.2.2-5+b1	MP3/Ogg Vorbis broadcast streaming library
libsidplay1	1.36.59-5	SID (MOS 6581) emulation library
libsigc++-2.0-0c2a	2.2.4.2-1	type-safe Signal Framework for C++ - runtime
libslab0a	2.30.0-1	beautification app library file
libslang2	2.2.2-4	The S-Lang programming library - runtime version
libsm6	2:1.1.1-1	X11 Session Management library
libsmbclient	2:3.5.6~dfsg-3squeeze4	shared library for communication with SMB/CIFS servers
libsndfile1	1.0.21-3+squeeze1	Library for reading/writing audio files
libsnmp-base	5.4.3~dfsg-2	SNMP (Simple Network Management Protocol) MIBs and documentation
libsnmp15	5.4.3~dfsg-2	SNMP (Simple Network Management Protocol) library
libsoup-gnome2.4-1	2.30.2-1	an HTTP library implementation in C -- GNOME support library
libsoup2.4-1	2.30.2-1	an HTTP library implementation in C -- Shared library
libspeex1	1.2~rc1-1	The Speex codec runtime library
libsqlite3-0	3.7.3-1	SQLite 3 shared library
libss2	1.41.12-4stable1	command-line interface parsing library
libssl0.9.8	0.9.8o-4squeeze1	SSL shared libraries
libstartup-notification0	0.10-1	library for program launch feedback (shared library)
libstdc++6	4.4.5-8	The GNU Standard C++ Library v3
libstdc++6-4.4-dev	4.4.5-8	The GNU Standard C++ Library v3 (development files)
libtag1-vanilla	1.6.3-1	TagLib Audio Meta-Data Library (Vanilla flavour)
libtag1c2a	1.6.3-1	TagLib Audio Meta-Data Library

libtalloc2	2.0.1-1	hierarchical pool based memory allocator
libtasn1-3	2.7-1	Manage ASN.1 structures (runtime)
libtdb1	1.2.1-2+b1	Trivial Database - shared library
libtext-charwidth-perl	0.04-6	get display widths of characters on the terminal
libtext-iconv-perl	1.7-2	converts between character sets in Perl
libtext-wrapi18n-perl	0.06-7	internationalized substitute of Text::Wrap
libthai-data	0.1.14-2	Data files for Thai language support library
libthai0	0.1.14-2	Thai language support library
libtheora0	1.1.1+dfsg.1-3	The Theora Video Compression Codec
libtie-ixhash-perl	1.21-2	ordered associative arrays for Perl
libtiff4	3.9.4-5+squeeze3	Tag Image File Format (TIFF) library
libtimedate-perl	1.2000-1	collection of modules to manipulate date/time information
libtokyocabinet8	1.4.37-6	Tokyo Cabinet Database Libraries [runtime]
libtotem-plparser17	2.30.3-1	Totem Playlist Parser library - runtime files
libtracker-client-0.8-0	0.8.17-1	metadata database, indexer and search tool - library
libtwolame0	0.3.12-1	MPEG Audio Layer 2 encoding library
libudev0	164-3	libudev shared library
libunique-1.0-0	1.1.6-1.1	Library for writing single instance applications - shared libraries
libupower-glib1	0.9.5-5	abstraction for power management - shared library
liburi-perl	1.54-2	module to manipulate and access URI strings
libusb-0.1-4	2:0.1.12-16	userspace USB programming library
libusb-1.0-0	2:1.0.8-2	userspace USB programming library
libusbmuxd1	1.0.4-1	USB multiplexor daemon for iPhone and iPod Touch devices - library
libuuid-perl	0.02-4	Perl extension for using UUID interfaces as defined in e2fsprogs
libuuid1	2.17.2-9	Universally Unique ID library
libv4l-0	0.8.0-1	Collection of video4linux support libraries
libvisual-0.4-0	0.4.0-3	Audio visualization framework
libvisual-0.4-plugins	0.4.0.dfsg.1-2	Audio visualization framework plugins
libvorbis0a	1.3.1-1	The Vorbis General Audio Compression Codec (Decoder library)
libvorbisenc2	1.3.1-1	The Vorbis General Audio Compression Codec (Encoder library)
libvorbisfile3	1.3.1-1	The Vorbis General Audio Compression Codec (High Level API)
libvte-common	1:0.24.3-2	Terminal emulator widget for GTK+ 2.0 - common files
libvte9	1:0.24.3-2	Terminal emulator widget for GTK+ 2.0 - runtime files
libwavpack1	4.60.1-1	an audio codec (lossy and lossless) - library
libwbclient0	2:3.5.6~dfsg-3squeeze4	Samba winbind client library
libwebkit-1.0-2	1.2.7-0+squeeze1	Web content engine library for Gtk+
libwebkit-1.0-common	1.2.7-0+squeeze1	Web content engine library for Gtk+ - data files
libwnck-common	2.30.4-2	Window Navigator Construction Kit - common files
libwnck22	2.30.4-2	Window Navigator Construction Kit - runtime files
libwrap0	7.6.q-19	Wietse Venema's TCP wrappers library
libwww-perl	5.836-1	Perl HTTP/WWW client/server library
libx11-6	2:1.3.3-4	X11 client-side library
libx11-data	2:1.3.3-4	X11 client-side library
libx11-xcb1	2:1.3.3-4	Xlib/XCB interface library
libx86-1	1.1+ds1-6	x86 real-mode library
libxapian22	1.2.3-2	Search engine library

libxau6	1:1.0.6-1	X11 authorisation library
libxaw7	2:1.0.7-1	X11 Athena Widget library
libxcb-atom1	0.3.6-1	utility libraries for X C Binding -- atom
libxcb-aux0	0.3.6-1	utility libraries for X C Binding -- aux
libxcb-dri2-0	1.6-1	X C Binding, dri2 extension
libxcb-event1	0.3.6-1	utility libraries for X C Binding -- event
libxcb-render-util0	0.3.6-1	utility libraries for X C Binding -- render-util
libxcb-render0	1.6-1	X C Binding, render extension
libxcb1	1.6-1	X C Binding
libxcomposite1	1:0.4.2-1	X11 Composite extension library
libxcursor1	1:1.1.10-2	X cursor management library
libxdamage1	1:1.1.3-1	X11 damaged region extension library
libxdmcp6	1:1.0.3-2	X11 Display Manager Control Protocol library
libxext6	2:1.1.2-1	X11 miscellaneous extension library
libxfixes3	1:4.0.5-1	X11 miscellaneous 'fixes' extension library
libxfont1	1:1.4.1-2	X11 font rasterisation library
libxft2	2.1.14-2	FreeType-based font drawing library for X
libxi6	2:1.3-6	X11 Input extension library
libxinerama1	2:1.1-3	X11 Xinerama extension library
libxkbfile1	1:1.0.6-2	X11 keyboard file manipulation library
libxklavier16	5.0-2	X Keyboard Extension high-level API
libxml-parser-perl	2.36-1.1+b1	Perl module for parsing XML files
libxml-twig-perl	1:3.34-1	Perl module for processing huge XML documents in tree mode
libxml-xpathengine-perl	0.12-2	re-usable XPath engine for DOM-like trees
libxml2	2.7.8.dfsg-2+squeeze1	GNOME XML library
libxmu6	2:1.0.5-2	X11 miscellaneous utility library
libxmuu1	2:1.0.5-2	X11 miscellaneous micro-utility library
libxpm4	1:3.5.8-1	X11 pixmap library
libxrandr2	2:1.3.0-3	X11 RandR extension library
libxrender1	1:0.9.6-1	X Rendering Extension client library
libxres1	2:1.0.4-1	X11 Resource extension library
libxslt1.1	1.1.26-6	XSLT 1.0 processing library - runtime library
libxss1	1:1.2.0-2	X11 Screen Saver extension library
libxt6	1:1.0.7-1	X11 toolkit intrinsics library
libxtst6	2:1.1.0-3	X11 Testing -- Record extension library
libxv1	2:1.0.5-1	X11 Video extension library
libxvmc1	2:1.0.5-1	X11 Video extension library
libxxf86dga1	2:1.1.1-2	X11 Direct Graphics Access extension library
libxxf86vm1	1:1.1.0-2	X11 XFree86 video mode extension library
linux-base	2.6.32-35	Linux image base package
linux-headers-2.6.32-5-amd64	2.6.32-35	Header files for Linux 2.6.32-5-amd64
linux-headers-2.6.32-5-common	2.6.32-35	Common header files for Linux 2.6.32-5
linux-image-2.6-amd64	2.6.32+29	Linux 2.6 for 64-bit PCs (meta-package)
linux-image-2.6.32-5-amd64	2.6.32-35	Linux 2.6.32 for 64-bit PCs
linux-kbuild-2.6.32	2.6.32-1	Kbuild infrastructure for Linux 2.6.32
linux-libc-dev	2.6.32-35	Linux support headers for userspace development
linux-sound-base	1.0.23+dfsg-2	base package for ALSA and OSS sound systems
lm-sensors	1:3.1.2-6	utilities to read temperature/voltage/fan sensors
locales	2.11.2-10	Embedded GNU C Library: National Language (locale)

		data [support]
lockfile-progs	0.1.15	Programs for locking and unlocking files and mailboxes
login	1:4.1.4.2+svn3283-2+squeeze1	system login tools
logrotate	3.7.8-6	Log rotation utility
lrzsz	0.12.21-5	Tools for zmodem/xmodem/ymodem file transfer
lsb-base	3.2-23.2squeeze1	Linux Standard Base 3.2 init script functionality
lsb-release	3.2-23.2squeeze1	Linux Standard Base version reporting utility
lsof	4.81.dfsg.1-1	List open files
m4	1.4.14-3	a macro processing language
make	3.81-8	An utility for Directing compilation.
man-db	2.5.7-8	on-line manual pager
mawk	1.3.3-15	a pattern scanning and text processing language
mdadm	3.1.4-1+8efb9d1	tool to administer Linux MD arrays (software RAID)
menu	2.1.44	generates programs menu for all menu-aware applications
menu-xdg	0.5	freedesktop.org menu compliant window manager scripts
metacity	1:2.30.1-3	lightweight GTK+ window manager
metacity-common	1:2.30.1-3	shared files for the Metacity window manager
mime-support	3.48-1	MIME files 'mime.types' & 'mailcap', and support programs
minicom	2.4-3	friendly menu driven serial communication program
mlocate	0.22.2-1	quickly find files on the filesystem based on their name
modconf	0.3.11	Device Driver Configuration
module-init-tools	3.12-1	tools for managing Linux kernel modules
mount	2.17.2-9	Tools for mounting and manipulating filesystems
mttools	4.0.12-1	Tools for manipulating MSDOS files
mutt	1.5.20-9+squeeze1	text-based mailreader supporting MIME, GPG, PGP and threading
nautilus	2.30.1-2squeeze1	file manager and graphical shell for GNOME
nautilus-data	2.30.1-2squeeze1	data files for nautilus
ncurses-base	5.7+20100313-5	basic terminal type definitions
ncurses-bin	5.7+20100313-5	terminal-related programs and man pages
ncurses-term	5.7+20100313-5	additional terminal type definitions
net-tools	1.60-23	The NET-3 networking toolkit
netbase	4.45	Basic TCP/IP networking system
netcat-traditional	1.10-38	TCP/IP swiss army knife
nfs-common	1:1.2.2-4	NFS support files common to client and server
notification-daemon	0.5.0-2	daemon to displays passive pop-up notifications
ntfs-3g	1:2010.3.6-1	read-write NTFS driver for FUSE
ntfsprogs	2.0.0-1+b1	tools for doing neat things in NTFS partitions from Linux
ntpdate	1:4.2.6.p2+dfsg-1+b1	client for setting system time from NTP servers
openbsd-inetd	0.20080125-6	The OpenBSD Internet Superserver
openssh-blacklist	0.4.1	list of default blacklisted OpenSSH RSA and DSA keys
openssh-blacklist-extra	0.4.1	list of non-default blacklisted OpenSSH RSA and DSA keys
openssh-client	1:5.5p1-6	secure shell (SSH) client, for secure access to remote machines
openssh-server	1:5.5p1-6	secure shell (SSH) server, for secure access from remote machines
openssl	0.9.8o-4squeeze1	Secure Socket Layer (SSL) binary and related cryptographic tools

openssl-blacklist	0.5-2	list of blacklisted OpenSSL RSA keys
openvpn	2.1.3-2	virtual private network daemon
openvpn-blacklist	0.4	list of blacklisted OpenVPN RSA shared keys
p7zip-full	9.04~dfsg.1-1	7z and 7za file archivers with high compression ratio
passwd	1:4.1.4.2+svn3283-2+squeeze1	change and administer password and group data
pciutils	1:3.1.7-6	Linux PCI Utilities
perl	5.10.1-17squeeze2	Larry Wall's Practical Extraction and Report Language
perl-base	5.10.1-17squeeze2	minimal Perl system
perl-modules	5.10.1-17squeeze2	Core Perl modules
php5	5.3.3-7+squeeze3	server-side, HTML-embedded scripting language (metapackage)
php5-cli	5.3.3-7+squeeze3	command-line interpreter for the php5 scripting language
php5-common	5.3.3-7+squeeze3	Common files for packages built from the php5 source
php5-suhosin	0.9.32.1-1	advanced protection module for php5
pm-utils	1.3.0-3	utilities and scripts for power management
pmount	0.9.23-1	mount removable devices as normal user
policykit-1	0.96-4	framework for managing administrative policies and privileges
policykit-1-gnome	0.96-3	GNOME authentication agent for PolicyKit-1
portmap	6.0.0-2	RPC port mapper
powermgmt-base	1.31	Common utils and configs for power management
ppp	2.4.5-4	Point-to-Point Protocol (PPP) - daemon
pppconfig	2.3.18+nmu2	A text menu based utility for configuring ppp
pppoe	3.8-3	PPP over Ethernet driver
pppoeconf	1.19	configures PPPoE/ADSL connections
procps	1:3.2.8-9	/proc file system utilities
proftpd-basic	1.3.3a-6squeeze1	Versatile, virtual-hosting FTP daemon - binaries
psmisc	22.11-1	utilities that use the proc file system
python	2.6.6-3+squeeze6	interactive high-level object-oriented language (default version)
python-apt	0.7.100.1+squeeze1	Python interface to libapt-pkg
python-apt-common	0.7.100.1+squeeze1	Python interface to libapt-pkg (locales)
python-cairo	1.8.8-1+b1	Python bindings for the Cairo vector graphics library
python-central	0.6.16+nmu1	register and build utility for Python packages
python-chardet	2.0.1-1	universal character encoding detector
python-dbus	0.83.1-1	simple interprocess messaging system (Python interface)
python-debian	0.1.18	Python modules to work with Debian-related data formats
python-gconf	2.28.1-1	Python bindings for the GConf configuration database system
python-glade2	2.17.0-4	GTK+ bindings: Glade support
python-gmenu	2.30.3-1	an implementation of the freedesktop menu specification for GNOME
python-gnome2	2.28.1-1	Python bindings for the GNOME desktop environment
python-gnomeapplet	2.30.0-4	Python bindings for the GNOME panel applet library
python-gnomedesktop	2.30.0-4	Python bindings for the GNOME desktop library
python-gnomekeyring	2.30.0-4	Python bindings for the GNOME keyring library
python-gnupginterface	0.3.2-9.1	Python interface to GnuPG (GPG)
python-gobject	2.21.4+is.2.21.3-1	Python bindings for the GObject library
python-gtk2	2.17.0-4	Python bindings for the GTK+ widget set

python-minimal	2.6.6-3+squeeze6	minimal subset of the Python language (default version)
python-numpy	1:1.4.1-5	Numerical Python adds a fast array facility to the Python language
python-pyorbit	2.24.0-6	A Python language binding for the ORBit2 CORBA implementation
python-software-properties	0.60.debian-3	manage the repositories that you install software from
python-support	1.0.10	automated rebuilding support for Python modules
python-wnck	2.30.0-4	Python bindings for the WNCK library
python-xapian	1.2.3-3	Xapian search engine interface for Python
python2.6	2.6.6-8+b1	An interactive high-level object-oriented language (version 2.6)
python2.6-minimal	2.6.6-8+b1	A minimal subset of the Python language (version 2.6)
python3.1	3.1.3-1	An interactive high-level object-oriented language (version 3.1)
python3.1-minimal	3.1.3-1	A minimal subset of the Python language (version 3.1)
radeontool	1.6.1-1	utility to control ATI Radeon backlight functions on laptops
rarian-compat	0.8.1-5	Documentation meta-data library (compatibility tools)
readline-common	6.1-3	GNU readline and history libraries, common files
rpm-common	4.8.1-6	common files for RPM
rpm2cpio	4.8.1-6	tool to convert RPM package to CPIO archive
rsyslog	4.6.4-2	enhanced multi-threaded syslogd
sed	4.2.1-7	The GNU sed stream editor
sensible-utils	0.0.4	Utilities for sensible alternative selection
sgml-base	1.26+nmu1	SGML infrastructure and SGML catalog file support
sgml-data	2.0.4	common SGML and XML data
shared-mime-info	0.71-4	FreeDesktop.org shared MIME database and spec
snmp	5.4.3~dfsg-2	SNMP (Simple Network Management Protocol) applications
snmpd	5.4.3~dfsg-2	SNMP (Simple Network Management Protocol) agents
software-properties-gtk	0.60.debian-3	manage the repositories that you install software from
ssh	1:5.5p1-6	secure shell client and server (metapackage)
ssl-cert	1.0.28	simple debconf wrapper for OpenSSL
sudo	1.7.4p4-2.squeeze.2	Provide limited super user privileges to specific users
synaptic	0.70~pre1+b1	Graphical package manager
system-tools-backends	2.10.1-2	System Tools to manage computer configuration -- scripts
sysv-rc	2.88dsf-13.1	System-V-like runlevel change mechanism
sysvinit	2.88dsf-13.1	System-V-like init utilities
sysvinit-utils	2.88dsf-13.1	System-V-like utilities
tar	1.23-3	GNU version of the tar archiving utility
tasksel	2.88	Tool for selecting tasks for installation on Debian systems
tasksel-data	2.88	Official tasks used for installation of Debian systems
tcpd	7.6.q-19	Wietse Venema's TCP wrapper utilities
tcpdump	4.1.1-1	A powerful tool for network monitoring and data acquisition
telnet	0.17-36	The telnet client
telnetd	0.17-36	The telnet server
tftpd	0.17-18	Trivial file transfer protocol server
time	1.7-23.1	The GNU time program for measuring cpu resource usage

traceroute	1:2.0.15-1	Traces the route taken by packets over an IPv4/IPv6 network
ttf-dejavu-core	2.31-1	Vera font family derivate with additional characters
tzdata	2011d-0squeeze1	time zone and daylight-saving time data
ucf	3.0025+nmu1	Update Configuration File: preserve user changes to config files.
udev	164-3	/dev/ and hotplug management daemon
udisks	1.0.1+git20100614-3	abstraction for enumerating block devices
unattended-upgrades	0.62.2	automatic installation of security upgrades
update-inetd	4.38+nmu1	inetd configuration file updater
upower	0.9.5-5	abstraction for power management
usbmount	0.0.21	automatically mount and unmount USB mass storage devices
usbmuxd	1.0.4-1	USB multiplexor daemon for iPhone and iPod Touch devices
usbutils	0.87-5	Linux USB utilities
util-linux	2.17.2-9	Miscellaneous system utilities
vbtool	1.1-2	run real-mode video BIOS code to alter hardware state
vim	2:7.2.445+hg~cb94c42c0e1a-1	Vi IMproved - enhanced vi editor
vim-common	2:7.2.445+hg~cb94c42c0e1a-1	Vi IMproved - Common files
vim-runtime	2:7.2.445+hg~cb94c42c0e1a-1	Vi IMproved - Runtime files
vim-tiny	2:7.2.445+hg~cb94c42c0e1a-1	Vi IMproved - enhanced vi editor - compact version
w3m	0.5.2-9	WWW browsable pager with excellent tables/frames support
watchdog	5.9-1	A software watchdog
wget	1.12-2.1	retrieves files from the web
whiptail	0.52.11-1	Displays user-friendly dialog boxes from shell scripts
whois	5.0.10	an intelligent whois client
x-ttcidfont-conf	32	TrueType and CID fonts configuration for X
x11-apps	7.5+5	X applications
x11-common	1:7.5+8	X Window System (X.Org) infrastructure
x11-session-utils	7.5+1	X session utilities
x11-utils	7.5+4	X11 utilities
x11-xfs-utils	7.4+1	X font server utilities
x11-xkb-utils	7.5+5	X11 XKB utilities
x11-xserver-utils	7.5+3	X server utilities
xauth	1:1.0.4-1	X authentication utility
xbase-clients	1:7.5+8	miscellaneous X clients - metapackage
xfonts-base	1:1.0.1	standard fonts for X
xfonts-encodings	1:1.0.3-1	Encodings for X.Org fonts
xfonts-utils	1:7.5+2	X Window System font utility programs
xinit	1.2.0-2	X server initialisation tool
xkb-data	1.8-2	X Keyboard Extension (XKB) configuration data
xml-core	0.13	XML infrastructure and XML catalog file support
xserver-common	2:1.7.7-13	common files used by various X servers
xserver-xephyr	2:1.7.7-13	nested X server
xserver-xorg	1:7.5+8	the X.Org X server
xserver-xorg-core	2:1.7.7-13	Xorg X server - core server
xserver-xorg-input-all	1:7.5+8	the X.Org X server -- input driver metapackage

xserver-xorg-input-evdev	1:2.3.2-6	X.Org X server -- evdev input driver
xserver-xorg-input-synaptics	1.2.2-2	Synaptics TouchPad driver for X.Org server
xserver-xorg-input-wacom	0.10.5+20100416-1	X.Org X server -- Wacom input driver
xserver-xorg-video-all	1:7.5+8	the X.Org X server -- output driver metapackage
xserver-xorg-video-apm	1:1.2.2-2	X.Org X server -- APM display driver
xserver-xorg-video-ark	1:0.7.2-2	X.Org X server -- ark display driver
xserver-xorg-video-ati	1:6.13.1-2+squeeze1	X.Org X server -- AMD/ATI display driver wrapper
xserver-xorg-video-chips	1:1.2.3-1	X.Org X server -- Chips display driver
xserver-xorg-video-cirrus	1:1.3.2-2+squeeze1	X.Org X server -- Cirrus display driver
xserver-xorg-video-fbdev	1:0.4.2-2	X.Org X server -- fbdev display driver
xserver-xorg-video-i128	1:1.3.3-2	X.Org X server -- i128 display driver
xserver-xorg-video-intel	2:2.13.0-6	X.Org X server -- Intel i8xx, i9xx display driver
xserver-xorg-video-mach64	6.8.2-3	X.Org X server -- ATI Mach64 display driver
xserver-xorg-video-mga	1:1.4.11.dfsg-4+squeeze1	X.Org X server -- MGA display driver
xserver-xorg-video-neomagic	1:1.2.4-3	X.Org X server -- Neomagic display driver
xserver-xorg-video-nouveau	1:0.0.15+git20100329+7858345-5	X.Org X server -- Nouveau display driver (experimental)
xserver-xorg-video-nv	1:2.1.17-3	X.Org X server -- NV display driver
xserver-xorg-video-openchrome	1:0.2.904+svn842-2	X.Org X server -- VIA display driver
xserver-xorg-video-r128	6.8.1-3	X.Org X server -- ATI r128 display driver
xserver-xorg-video-radeon	1:6.13.1-2+squeeze1	X.Org X server -- AMD/ATI Radeon display driver
xserver-xorg-video- rendition	1:4.2.3-3	X.Org X server -- Rendition display driver
xserver-xorg-video-s3	1:0.6.3-2	X.Org X server -- legacy S3 display driver
xserver-xorg-video-s3virge	1:1.10.4-2	X.Org X server -- S3 ViRGE display driver
xserver-xorg-video-savage	1:2.3.1-2	X.Org X server -- Savage display driver
xserver-xorg-video-siliconmotion	1:1.7.3-2	X.Org X server -- SiliconMotion display driver
xserver-xorg-video-sis	1:0.10.3-1	X.Org X server -- SiS display driver
xserver-xorg-video-sisusb	1:0.9.3-2	X.Org X server -- SiS USB display driver
xserver-xorg-video-tdfx	1:1.4.3-2	X.Org X server -- tdfx display driver
xserver-xorg-video-trident	1:1.3.3-2	X.Org X server -- Trident display driver
xserver-xorg-video-tseng	1:1.2.3-2+squeeze1	X.Org X server -- Tseng display driver
xserver-xorg-video-vesa	1:2.3.0-3	X.Org X server -- VESA display driver
xserver-xorg-video-vmware	1:11.0.1-2	X.Org X server -- VMware display driver
xserver-xorg-video-vooodoo	1:1.2.3-2	X.Org X server -- Voodoo display driver

xz-utils	5.0.0-2	XZ-format compression utilities
yelp	2.30.1+webkit-1	Help browser for GNOME
zenity	2.30.0-1	Display graphical dialog boxes from shell scripts
zlib1g	1:1.2.3.4.dfsg-3	compression library - runtime