

V2201 Series Linux Software User's Manual

Edition 1.2, March 2017

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MOXA[®]

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V2201 Series Linux Software User's Manual

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Introduction

Thank you for purchasing the Moxa V2201 Series of x86 ready-to-run embedded computers. This manual introduces the software configuration and management of the V2201-LX, which runs the Linux operating system. For hardware installation, connector interfaces, setup, and upgrading the BIOS, please refer to *V2201 Series 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 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**

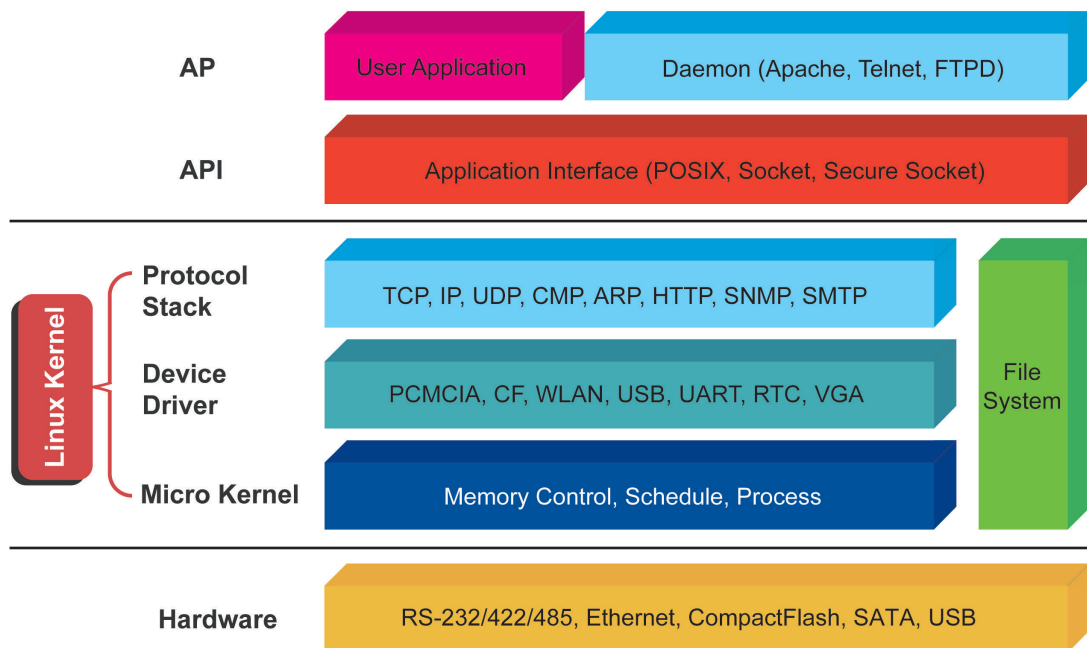
Overview

The Moxa V2201 series ultra-compact x86 embedded computer is based on the Intel® Atom™ E3800 series processor, features the most reliable I/O design to maximize connectivity, and supports a wireless module, making it suitable for a diverse range of communication applications. The computer’s meticulous thermal design ensures reliable system operation in temperatures ranging from -40 to 85°C (-40 to 70°C with a special-purpose Moxa wireless module installed).

The V2201 series supports “Moxa Hardware Monitor” for device I/O status monitoring and alerts, system temperature monitoring and alerts, and system power management. Monitoring system status closely makes it easier to recover from errors and provides the most reliable platform for your applications.

Software Specifications

The Linux operating system pre-installed on the V2201 embedded computer is the **Debian Jessie 8.1** distribution. The Debian project is a worldwide group of volunteers who endeavor to produce an operating system distribution that 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

For information and documentation on the Debian GNU/Linux and free software concept, refer to the following links:

<http://www.debian.org/>

<http://www.gnu.org/>



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 V2201 Linux models are pre-installed with the Debian Jessie 8.1 Linux distribution. For a list of the software components, see "Appendix A."

Software Configuration

In this chapter, we explain how to operate a V2201-LX computer directly from your desktop. There are three ways to connect to the V2201-LX computer: through an HDMI monitor or by using an SSH console from a Windows or Linux machine. This chapter describes basic Linux operating system configurations. The advanced network management and configuration will be described in the next chapter “**Managing Communications.**”

The following topics are covered in this chapter:

- ❑ **Starting from an HDMI 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**
- ❑ **Cron—Daemon for Executing Scheduled Commands**
- ❑ **Inserting a USB Storage Device into the Computer**
- ❑ **Checking the Linux Version**
- ❑ **APT—Installing and Removing Packages**

Starting from an HDMI Console

Connect the display monitor to the V2201-LX HDMI connector, and then power it up by connecting it to the power adaptor. It takes about 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 **moxa**.

Login: moxa

Password: moxa

```
Moxa login: moxa
Password:

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

For further information check:
http://www.moxa.com/

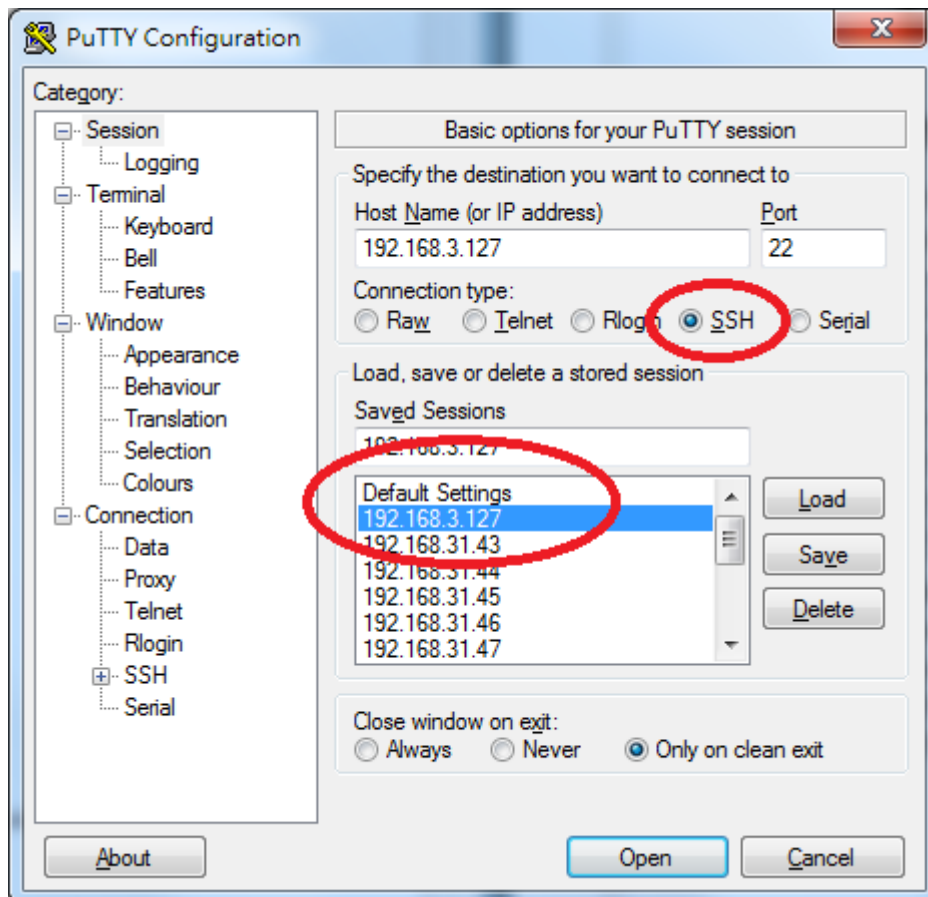
moxa@moxa:~$
```

Connecting from an SSH Console

The V2201-LX computer supports an SSH Console to offer users with better security over the network 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 V2201-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 V2201-LX's console utility via SSH.

```
# ssh moxa@192.168.3.127
```

Select **yes** to open the connection.

```
[moxa@Moxa:~$]# ssh moxa@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 V2201-LX has two time settings. One is the system time, and the other is provided by an RTC (Real Time Clock) built into the V2201-LX's hardware.

Setting the Time Manually

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

Use the following command to set the system time.

```
moxa@moxa:~# 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.

```
root@moxa:~# hwclock
```

```
root@moxa:/home/moxa# date ; hwclock
Mon Jun 30 11:39:04 CST 2014
Mon 30 Jun 2014 11:39:05 AM CST -0.860107 seconds
root@moxa:/home/moxa#
root@moxa:/home/moxa# ntpdate time.stdtime.gov.tw
21 Aug 15:28:10 ntpdate[5876]: step time server 118.163.81.61 offset 36042533.994253
sec
root@moxa:/home/moxa#
root@moxa:/home/moxa# hwclock -w
root@moxa:/home/moxa# date ; hwclock
Fri Aug 21 15:28:18 CST 2015
Fri 21 Aug 2015 03:28:19 PM CST -0.078792 seconds
root@moxa:/home/moxa#
```

NTP Client

The V2201-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.

```
root@moxa:~# date ; hwclock
Wed Dec 16 16:36:12 CST 2009
Wed 16 Dec 2009 03:38:13 AM CST -0.016751 seconds
root@moxa:~#
root@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
root@moxa:~#
root@moxa:~# hwclock -w
root@moxa:~# date ; hwclock
```

```
Wed Dec 16 03:51:07 CST 2009
Wed 16 Dec 2009 03:51:07 AM CST    -0.016771 seconds
root@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

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

```
moxa@Moxa:~# chmod 755 fixtime
```

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

```
moxa@Moxa:~# vi /etc/inittab
```

Add the following line to the bottom of the file:

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

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

```
moxa@Moxa:~# init q
```

Enabling and Disabling Daemons

Only the following daemons are enabled in the V2201 by default:

sftpd SFTP Server / Client daemon

sshd Secure Shell Server daemon

```
You may manage what services to run in the background by the command insserv. Below
example shows how to add the apache daemon in current runlevel.moxa@Moxa:~$ sudo
insserv -d apache2
```

Apache will not activate in the current boot session, but will be running in the background from the next boot session. To disable the apache daemon, use the following command:

```
moxa@Moxa:~$ sudo insserv -r apache2
```

Linux daemons can be started or stopped in the current boot session by using of the scripts in `/etc/init.d`. To start the apache daemon, use:

```
moxa@Moxa:~$ sudo /etc/init.d/apache2 start
```

To stop the apache daemon, use:

```
moxa@Moxa:~$ sudo /etc/init.d/apache2 stop
```

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 in that minute. 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, if you want to launch a program at 8:00 every day.

```
#minute hour date month week 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 mode of `fixtime.sh`
moxa@Moxa:~# **chmod 755 fixtime.sh**
3. Modify `/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** 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.

```
root@Moxa:~# mount
sysfs on /sys type sysfs (rw,nosuid,nodev,noexec,relatime)
proc on /proc type proc (rw,nosuid,nodev,noexec,relatime)
udev on /dev type devtmpfs (rw,relatime,size=10240k,nr_inodes=492181,mode=755)
devpts on /dev/pts type devpts
(rw,nosuid,noexec,relatime,gid=5,mode=620,ptmxmode=000)
tmpfs on /run type tmpfs (rw,nosuid,relatime,size=790820k,mode=755)
/dev/sda1 on / type ext4 (rw,noatime,errors=remount-ro,data=ordered)
securityfs on /sys/kernel/security type securityfs (rw,nosuid,nodev,noexec,relatime)
tmpfs on /dev/shm type tmpfs (rw,nosuid,nodev)
tmpfs on /run/lock type tmpfs (rw,nosuid,nodev,noexec,relatime,size=5120k)
tmpfs on /sys/fs/cgroup type tmpfs (ro,nosuid,nodev,noexec,mode=755)
cgroup on /sys/fs/cgroup/systemd type cgroup
(rw,nosuid,nodev,noexec,relatime,xattr,release_agent=/lib/systemd/systemd-cgroups-agent,name=systemd)
pstore on /sys/fs/pstore type pstore (rw,nosuid,nodev,noexec,relatime)
cgroup on /sys/fs/cgroup/cpuset type cgroup (rw,nosuid,nodev,noexec,relatime,cpuset)
cgroup on /sys/fs/cgroup/cpu,cpuacct type cgroup
(rw,nosuid,nodev,noexec,relatime,cpu,cpuacct)
cgroup on /sys/fs/cgroup/devices type cgroup
(rw,nosuid,nodev,noexec,relatime,devices)
cgroup on /sys/fs/cgroup/freezer type cgroup
(rw,nosuid,nodev,noexec,relatime,freezer)
cgroup on /sys/fs/cgroup/net_cls,net_prio type cgroup
(rw,nosuid,nodev,noexec,relatime,net_cls,net_prio)
cgroup on /sys/fs/cgroup/blkio type cgroup (rw,nosuid,nodev,noexec,relatime,blkio)
cgroup on /sys/fs/cgroup/perf_event type cgroup
(rw,nosuid,nodev,noexec,relatime,perf_event)
tmpfs on /etc/machine-id type tmpfs (ro,relatime,size=790820k,mode=755)
systemd-1 on /proc/sys/fs/binfmt_misc type autofs
(rw,relatime,fd=21,pgrp=1,timeout=300,minproto=5,maxproto=5,direct)
hugetlbfs on /dev/hugepages type hugetlbfs (rw,relatime)
mqueue on /dev/mqueue type mqueue (rw,relatime)
debugfs on /sys/kernel/debug type debugfs (rw,relatime)
binfmt_misc on /proc/sys/fs/binfmt_misc type binfmt_misc (rw,relatime)
/dev/sdb1 on /media/usb0 type vfat
(rw,nodev,noexec,noatime,nodiratime,sync,umask=0022,codepage=437,ioccharset=utf8,shortname=mixed,errors=remount-ro)
/dev/sdc1 on /media/usb1 type vfat
(rw,nodev,noexec,noatime,nodiratime,sync,umask=0022,codepage=437,ioccharset=utf8,shortname=mixed,errors=remount-ro)
```



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:

```
root@Moxa:~# uname -a
Linux Moxa 3.16.0-4-amd64 #1 SMP Debian 3.16.7-ckt9-2 (2015-04-13) x86_64 GNU/Linux
root@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`.

1. Next, configure the `/etc/apt/sources.list` using **vi** editor.

```
root@Moxa:~# vi /etc/apt/sources.list
deb http://ftp.us.debian.org/debian/ jessie main contrib non-free
deb-src http://ftp.us.debian.org/debian/ jessie main contrib non-free

deb http://ftp.us.debian.org/debian/ jessie-updates main contrib non-free
deb-src http://ftp.us.debian.org/debian/ jessie-updates main contrib non-free

deb http://security.debian.org/ jessie/updates main contrib non-free
deb-src http://security.debian.org/ jessie/updates main contrib non-free

deb http://ftp.debian.org/debian jessie-backports main contrib non-free
deb-src http://ftp.debian.org/debian jessie-backports main contrib non-free
```

2. Update the source list after you configure it.

```
root@Moxa:~# apt-get update
root@Moxa:~#
```

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

```
root@Moxa:~# apt-get install vim
root@Moxa:~#
```

4. Use one of the following commands to remove a package:

- (a) For a simple package removal:

```
root@Moxa:~# apt-get remove vim
root@Moxa:~#
```

- (b) For a complete package removal:

```
root@Moxa:~# apt-get remove vim --purge
root@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**.

```
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda1       7.3G  1.2G  6.0G  17% /
udev            10M   4.0K   10M   1% /dev
tmpfs           773M   8.6M  764M   2% /run
tmpfs           1.9G    0   1.9G   0% /dev/shm
tmpfs           5.0M    0   5.0M   0% /run/lock
tmpfs           1.9G    0   1.9G   0% /sys/fs/cgroup
```

**ATTENTION**

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

```
root@Moxa:~# apt-get clean
root@Moxa:~#
```


Managing Communications

The V2201-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”
- ❑ **Serial Port Operation Mode**
- ❑ **DNS Client**
 - /etc/hostname
 - /etc/resolv.conf
 - /etc/nsswitch.conf
- ❑ **Configuring Ethernet Bonding**
- ❑ **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**
- ❑ **OpenVPN**
 - Ethernet Bridging for Private Networks on Different Subnets
 - Ethernet Bridging for Private Networks on the Same Subnet
 - Routed IP
 - Cellular Module
- **Wi-Fi Module**

Detecting Network Interfaces

Debian Linux systems use **udev** to detect new network interfaces, including Ethernet interfaces and wireless interfaces. One of the rules is **/lib/udev/rules.d/75-persistent-net-generator.rules** for creating a persistent network interface naming order. The content in **/etc/udev/rules.d/70-persistent-net.rules** 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 V2201 computer has two 10/100 or 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@moxa:~# cd /etc/network
```

2. Type **vi interfaces** to edit the network configuration file with **vi** editor. You can configure the V2201's Ethernet ports for static or dynamic (DHCP) IP addresses.

```
moxa@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@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@moxa:~# ifconfig eth0 192.168.1.1
moxa@moxa:~#

```

Serial Port Operation Mode

The V2201-LX computer has 2 serial ports named COM1 and COM2. The ports support RS-232, RS-422, 2-wire RS-485, and 4-wire RS-485 operation modes with baudrate settings up to 115200 bps.

By default, the serial interface is set to RS-232. You can use the **setinterface** command to change the serial port operation mode, as indicated below:

```
setinterface device-node [interface-no]
```

device-node	/dev/ttyS0 to /dev/ttyS1
interface-no	0 set to RS232 interface
	1 set to RS485-2WIRES interface
	2 set to RS422 interface
	3 set to RS485-4WIRES interface

For example, use the following commands to set **/dev/ttyS0** to RS-422:

```

root@moxa:/home/moxa# setinterface /dev/ttyS0 2
root@moxa:/home/moxa# setinterface /dev/ttyS0

```

```
Now setting is RS422 interface.
```

DNS Client

The V2201-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. Edit `/etc/hostname`:

```
moxa@Moxa:~# sudo vi /etc/hostname
Moxa
```

2. Re-configure the hostname.

```
root@Moxa:~# /etc/init.d/hostname.sh start
```

3. Check the new hostname.

```
root@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

```
root@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
```

Configuring Ethernet Bonding

The Linux bonding driver provides a method for aggregating multiple network interfaces into a single logical "bonded" interface. To use the bonding feature, load the bonding driver. Then use `ifenslave` to add the Ethernet interface into the `bond0` interface. The following script bonds `eth1` and `eth2` together; you can place the script in `/etc/init.d/bonding.sh`.

```
#!/bin/bash

#### BEGIN INIT INFO
# Provides:      bonding
# Short-Description: Start the bonding service, bond eth1 and eth2.
# Required-Start:  $all
# Required-Stop:  $all
# Should-Start:
# Should-Stop:
# Default-Start:  2 3 4 5
# Default-Stop:   0 1 6
### END INIT INFO

NAME=bonding
PATH=/bin:/usr/bin:/sbin:/usr/sbin

case "$1" in
start)
# to set ethX interfaces as slave the bond0 must have an ip
if [ "$2" == "" ]; then
$0
exit 1
fi
echo "Starting bonding service: $NAME."
modprobe bonding mode=1 miimon=100 # load bonding module

ifdown eth2 # putting down eth2
ifdown eth1 # putting down eth1

ifconfig bond0 hw ether 00:90:E8:00:00:60 # change mac address
ifconfig bond0 $2 netmask 255.255.255.0 up # set ip address

ifenslave bond0 eth2 # set eth2 in slave for bond0
ifenslave bond0 eth1 # set eth1 in slave for bond0
```

```

;;

stop)
    echo "Stopping bonding service: $NAME"
    ifenslave -d bond0 eth2      # release eth2 from bond0
    ifenslave -d bond0 eth1      # release eth1 from bond0

    ifconfig bond0 down          # putting down bond0
    modprobe -r bonding          # unload bonding module

    ifup eth2
    ifup eth1
;;

restart)
    $0 stop
    $0 start $2
;;

*)
    echo "Usage: /etc/init.d/$NAME {start|stop|restart} [ip address]"
    exit 1
;;
esac

exit 0

```

You can use `insserv` to add this to run level.

```
moxa@Moxa:~# sudo insserv -v -d bonding.sh
```

To remove it from run level, use the following command:

```
moxa@Moxa:~# sudo insserv -r bonding.sh
```

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/apache2-default`

Save your CGI page to the following directory:

`/var/www/apache2-default/cgi-bin/`

Before you modify the homepage, use a browser (such as Microsoft Internet Explorer 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. Type `# vi /etc/apache2/sites-enabled/000-default` to edit the configuration file. Comment out the following lines:

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

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

2. Re-start the apache server.

```
root@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** directory 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 V2201-LX's **/media/usb0** directory.
3. Type `# vi /etc/apache2/sites-available/default` and `# vi /etc/apache2/sites-available/default-ssl` to edit the configuration file.

```
root@Moxa:/etc# sudo vi /etc/apache2/sites-available/default
root@Moxa:/etc# sudo vi /etc/apache2/sites-available/default-s
```

4. 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>
...
<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>

```

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

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

```
#!/apache2 restart
```

6. Start your browser and connect to the V2201-LX by typing the current LAN1 IP address in the browser's address box.
7. Re-start the apache server.

```
root@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 V2201-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.

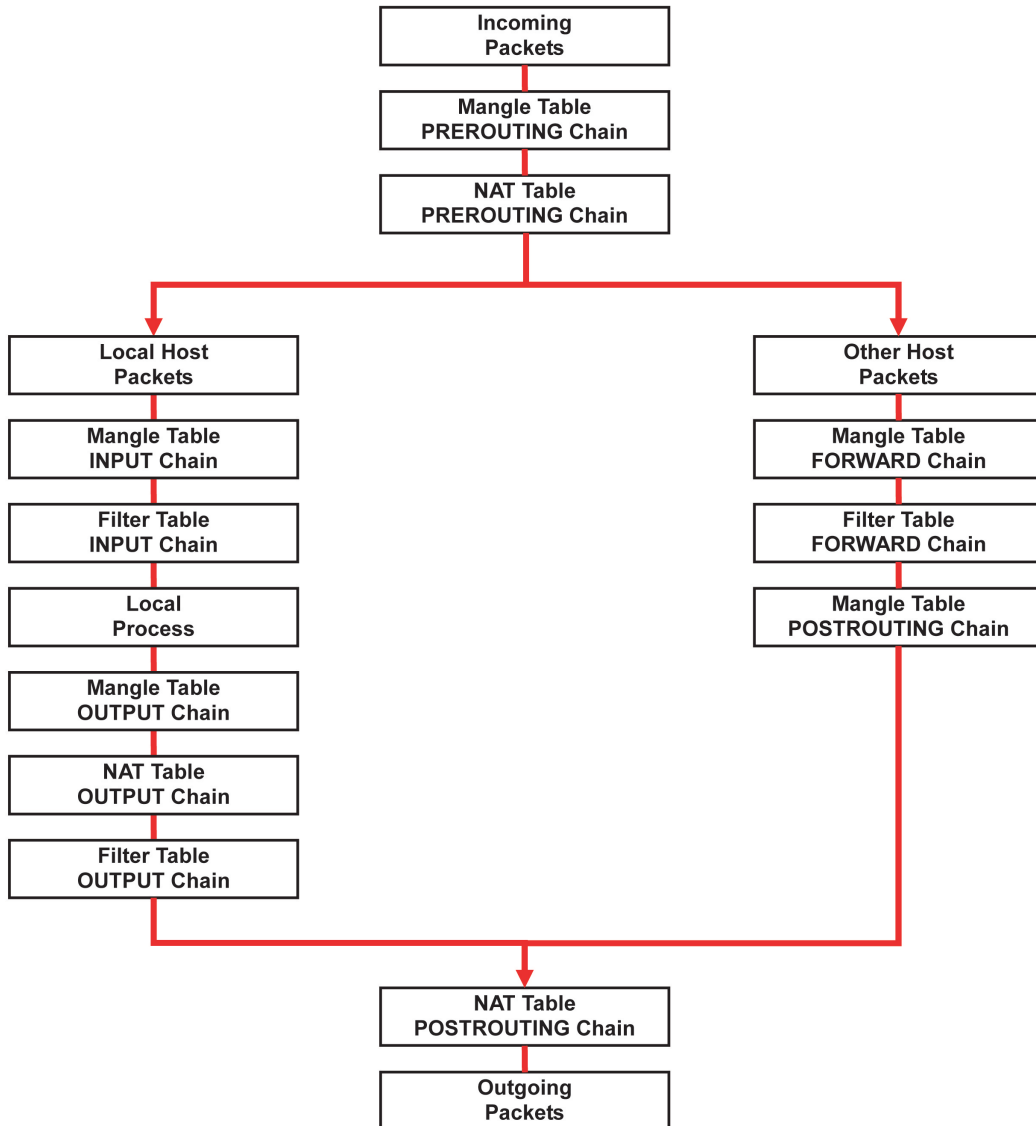
Mangle Table—includes two chains

- **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 V2201-LX supports the following sub-modules. Use the module that matches your application.

arptable_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
iptable_filter.ko	iptable_mangle.ko	iptable_nat.ko	iptable_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 V2201-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 V2201-LX.

OUTPUT: For locally-generated packets.

FORWARD: For packets routed out through the V2201-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 V2201-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 V2201-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 V2201-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.



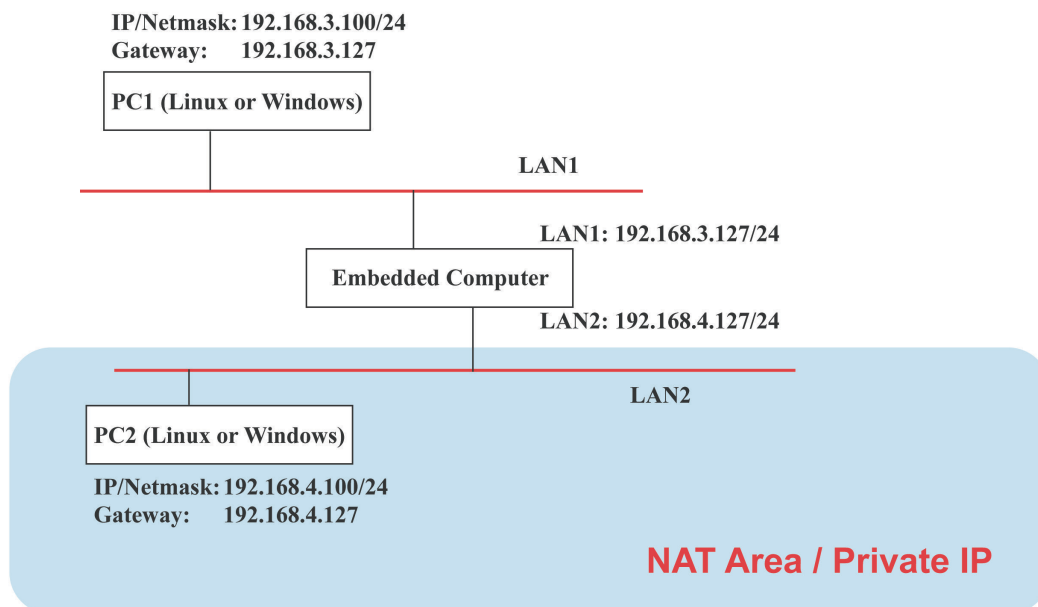
ATTENTION

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 V2201-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_contrack 2> /dev/null
modprobe ip_contrack_ftp 2> /dev/null
modprobe ip_contrack_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 V2201-LX Ethernet port. Since PPP is a peer-to-peer system, the V2201-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 "default route 192.1.1.17" are optional.

```
#pppd connect 'chat -v "" ATDT5551212 CONNECT "" \ ogin: username word: password'
/dev/ttyS0 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/ttyUSBx 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)

Login: username; Password: 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/tty 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/ttyUSBx 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:

```
root@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/ttyUSBx 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/ttyS0 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-ttyUSBx.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.

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

PPPoE

Use the following procedure to configure PPPoE:

1. Connect the V2201-LX's LAN port to an ADSL modem with a cross-over cable, HUB, or switch.
2. Log in to the V2201-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
```

```
root@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
root@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 V2201-LX without worrying about the amount of disk space that will be available. The V2201-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

The V2201-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:

```
***** SNMP QUERY STARTED *****
[root@jaredRH90 root]# snmpwalk -v 1 -c public 192.168.30.128|more
RFC1213-MIB::sysDescr.0 = STRING: "Linux Moxa 2.6.30-bpo.2-686 #1 SMP Fri Dec 11
18:12:58 UTC 2009 i686"
RFC1213-MIB::sysObjectID.0 = OID: RFC1155-SMI::enterprises.8691.12.2420
DISMAN-EVENT-MIB::sysUpTimeInstance = Timeticks: (126176) 0:21:01.76
RFC1213-MIB::sysContact.0 = STRING: "\"Jared\""
RFC1213-MIB::sysName.0 = STRING: "Moxa"
RFC1213-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: (4) 0:00:00.04
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: RFC1213-MIB::ip
SNMPv2-MIB::sysORID.7 = OID: UDP-MIB::udpMIB
SNMPv2-MIB::sysORID.8 = OID: SNMP-VIEW-BASED-ACM-MIB::vacmBasicGroup
...
```



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

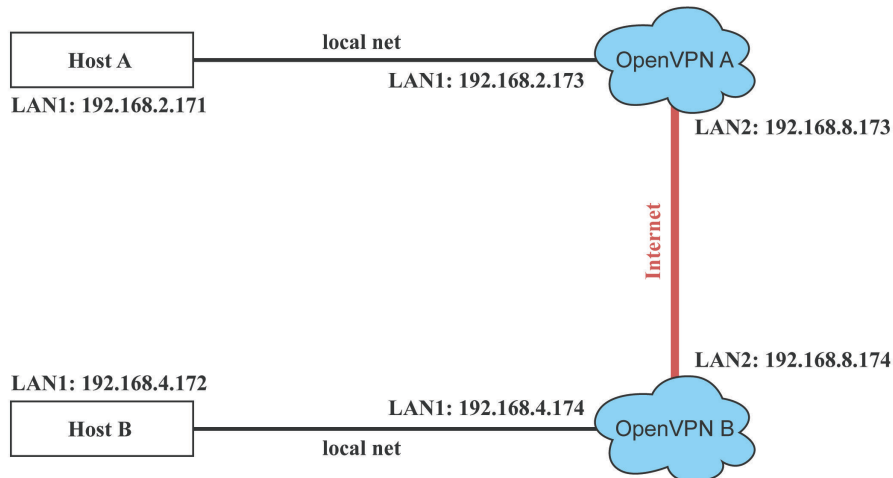
OpenVPN provides two types of tunnels for users to implement VPNS: **Routed IP Tunnels** and **Bridged Ethernet Tunnels**.

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
```

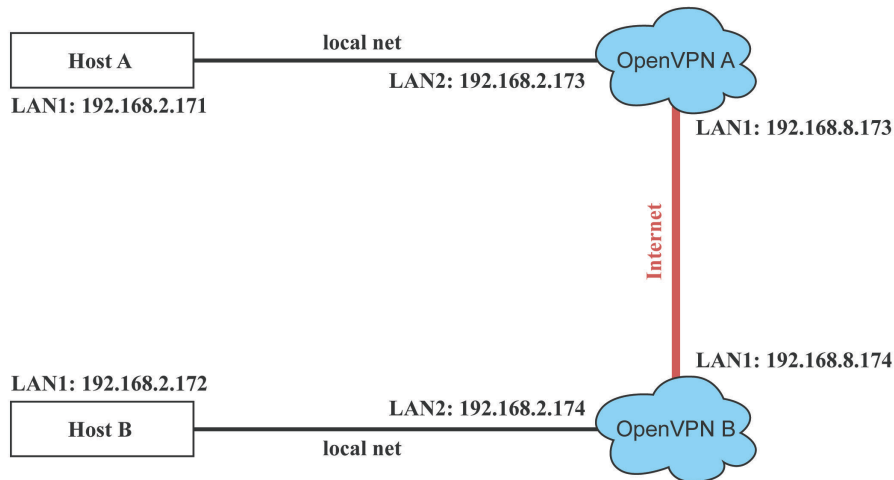
A successful ping indicates that you have created a VPN system that only allows authorized users from one internal network to access users at the remote site. For this system, all data is transmitted by UDP packets on port 5000 between OpenVPN peers.

- To shut down OpenVPN programs, type the command:

```
# killall -TERM openvpn
```


Ethernet Bridging for Private Networks on the Same Subnet

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

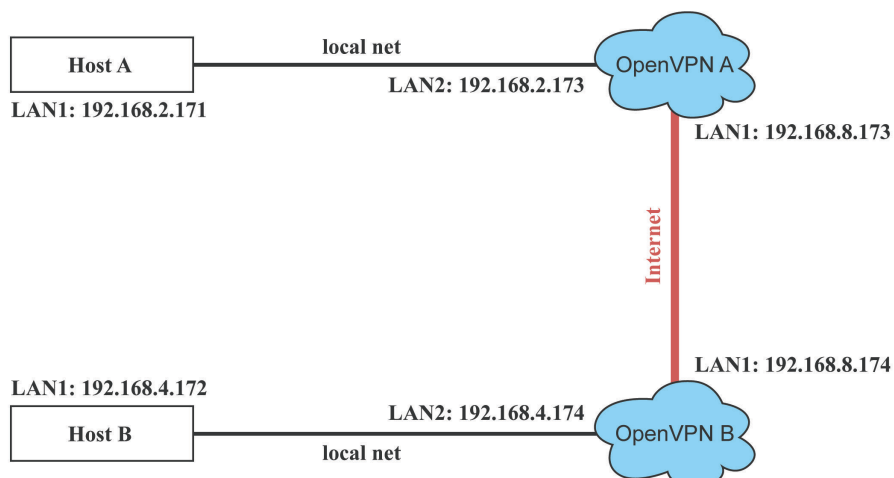


2. The configuration procedure is almost the same as for the previous example. The only difference is that you will need to comment out the parameter **up** in `/etc/openvpn/tap0-br.conf` of OpenVPN A and `/etc/openvpn/tap0-br.conf` of OpenVPN B.

```
# 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

**ATTENTION**

For more information about wpa_supplicant.conf, go to the following websites:

http://www.daemon-systems.org/man/wpa_supplicant.conf.5.html

http://linux.die.net/man/5/wpa_supplicant.conf

Cellular Module

Read below on to find out how to understand cellular signal strength from signal indicators, how to dial up on V2201, and several advanced setting in cellular module.

The MC7304, MC7354 and MC9090 cellular modules can be used with the V2201 series. Specifications can be found in the product's datasheet. You may use the V2201 cellular connection utility **cell_mgmt** to establish a cellular connection.

**IMPORTANT!**

Check the version of the cellular management utility using the `cell_mgmt version` command to ensure that it is **v1.7.4 or higher** and upgrade to the latest version available on Moxa's website. The carrier switch function on the cellular module might not work if the correct version of cellular management utility is not installed.

Cellular Signal Strength

Value	RSSI dbm	Condition
20 to 30	-73 to -53	Excellent
10 to 19	-93 to -74	Good
2 to 9	-109 to -94	Marginal
Else	Else	No signal

Cellular Dial-Up mode

For the 2 modules provided, it is suggested to dial up from QMI interface with QMI commands instead of using AT commands from the AT ports.

Dial Up mode	QMI /dev/cdc-wdm0
AT Port	/dev/ttyUSB2
GPS port	/dev/ttyUSB0

cell_mgmt Usage

Manual page

"cell_mgmt" is a utility to handle cellular module-related behavior.

```
moxa@Moxa:~$ sudo cell_mgmt help
[sudo] password for moxa:
Usage:
./cell_mgmt [OPTIONS]

OPTIONS
start [APN=[APN],Username=[user],Password=[pass],PIN=[pin_code]]
Start network.

example:
```

```

cell_mgmt start
cell_mgmt start APN=internet
cell_mgmt start APN=internet PIN=0000
cell_mgmt start APN=internet Username=moxa Password=pass PIN=0000

stop
    Stop network.

restart
    Restart network.

reset
    Reset cellular.

power_on
    Power ON.

power_off
    Power OFF.

gps_on
    GPS ON.

gps_off
    GPS OFF.

status
    Query network connection status.

signal
    Get signal strength.

at ['AT_COMMAND']
    Input AT Command.
    Must use SINGLE QUOTATION to enclose AT Command.

    example:
        cell_mgmt at 'AT+CSQ'

sim_status
    Query sim card status.

set_pin [PIN]
    Set PIN code to configuration file and verify.

pin_protection [PIN|PIN2] [enable|disable] [current_PIN]
    Set PIN protection in the UIM.

    example:
        cell_mgmt pin_protection PIN enable 0000

version
    Cellular management version.

interface [num]
    Set the interface wwan[num] for cell_mgmt.

```

Automatic dial up

It will set DNS and default gateway automatically.

Please clean up your computer's default gateway first, if you want to use cellular interface's gateway.

**cell_mgmt start APN=[APN] Username=[user] Password=[pass]
PIN=[pin_code]**

```

moxa@Moxa:/home/moxa# cell_mgmt start APN="internet"
warning : file /etc/qmi-network.conf does not exist.
Loading profile...
    APN: internet
Starting network with 'qmicli -d /dev/cdc-wdm1 --wds-start-network=internet

```

```
--client-no-release-cid --device-open-net=net-802-3|net-no-qos-header'...
Saving state... (CID: 8)
Saving state... (PDH: 1205656072)
Network started successfully
There is no PIN code
```

APN, Username, Password, PIN will be written in config file: /etc/qmi-network.conf when use "cell_mgmt start". Next time you can use "cell_mgmt start" without OPTIONS if OPTIONS are the same as last time set.

cell_mgmt stop

Stop network.

```
moxa@Moxa:/home/moxa# cell_mgmt stop
Loading profile...
  APN: internet
Loading previous state...
  Previous CID: 8
  Previous PDH: 1205656072
Stopping network with 'qmicli -d /dev/cdc-wdm1 --wds-stop-network=1205656072
--client-cid=8'...
Network stopped successfully
Clearing state...
```

cell_mgmt restart

Restart network.

```
moxa@Moxa:/home/moxa# cell_mgmt restart
Loading profile...
  APN: internet
Loading previous state...
  Previous CID: 8
  Previous PDH: 1205716376
Stopping network with 'qmicli -d /dev/cdc-wdm1 --wds-stop-network=1205716376
--client-cid=8'...
Network stopped successfully
Clearing state...
Loading profile...
  APN: internet
Starting network with 'qmicli -d /dev/cdc-wdm1 --wds-start-network=internet
--client-no-release-cid --device-open-net=net-802-3|net-no-qos-header'...
Saving state... (CID: 8)
Saving state... (PDH: 1205652720)
Network started successfully
There is no PIN code
```

Cellular module

cell_mgmt reset

Reset cellular module.

```
moxa@Moxa:/home/moxa# cell_mgmt restart
Loading profile...
  APN: internet
Loading previous state...
  Previous CID: 8
  Previous PDH: 1205716376
Stopping network with 'qmicli -d /dev/cdc-wdm1 --wds-stop-network=1205716376
```

```
--client-cid=8'...
Network stopped successfully
Clearing state...
Loading profile...
    APN: internet
Starting network with 'qmicli -d /dev/cdc-wdm1 --wds-start-network=internet
--client-no-release-cid --device-open-net=net-802-3|net-no-gps-header'...
Saving state... (CID: 8)
Saving state... (PDH: 1205652720)
Network started successfully
There is no PIN code
```

cell_mgmt power_on

Turn on cellular module power.

```
moxa@moxa:/home/moxa# cell_mgmt power_on
```

cell_mgmt power_off

Turn off cellular module power.

```
moxa@moxa:/home/moxa# cell_mgmt power_off
```

cell_mgmt gps_on

Turn on gps power.

```
moxa@moxa:/home/moxa# cell_mgmt gps_on
GPS function is *ENABLE*
```

cell_mgmt gps_off

Turn off gps power.

```
moxa@moxa:/home/moxa# cell_mgmt gps_off
GPS function is *DISABLE*
```

cell_mgmt status

Query network connection status.

```
moxa@moxa:/home/moxa# cell_mgmt status
Status: disconnected
```

cell_mgmt signal

Get signal strength.

```
moxa@moxa:/home/moxa# cell_mgmt signal
-86 dbm
```

cell_mgmt at ['AT_COMMAND']

Input AT Command.

Must use SINGLE QUOTATION to enclose AT Command.

for example input the at command AT+GMR

```
moxa@moxa:/home/moxa# cell_mgmt at 'AT+GMR'
please wait...

--- AT COMMAND: AT+GMR ---

OK
```

```
SWI9X15C_05.05.16.02 r21040 carmd-fwbuild1 2014/03/17 23:49:48
```

```
OK
```

Sim card

cell_mgmt sim_status

Query sim card status.

sim card had been locked or failed.

```
moxa@moxa:/home/moxa# cell_mgmt sim_status
[/dev/cdc-wdm1] UIM state retrieved:
      State: 'locked-or-failed'
```

sim card initialization-completed.

```
moxa@moxa:/home/moxa# cell_mgmt sim_status
[/dev/cdc-wdm1] UIM state retrieved:
      State: 'initialization-completed'
```

cell_mgmt set_pin [PIN]

Set PIN code to configuration file and verify.

```
moxa@moxa:/home/moxa# cell_mgmt set_pin 0000
old PIN=, new PIN=0000
[/dev/cdc-wdm1] PIN verified successfully
```

cell_mgmt pin_protection [PIN|PIN2] [enable|disable] [current_PIN]

Set PIN protection in the UIM.

enable PIN protection

```
moxa@moxa:/home/moxa# cell_mgmt pin_protection PIN enable 0000
[/dev/cdc-wdm1] PIN protection updated
```

disable PIN protection

```
moxa@moxa:/home/moxa# cell_mgmt pin_protection PIN disable 0000
[/dev/cdc-wdm1] PIN protection updated
```

Set interface

cell_mgmt interface [num]

Set the interface wwan[num] for cell_mgmt.

Check the interface current using.

```
moxa@moxa:/home/moxa# cell_mgmt interface
[0] wwan0 <Current>
[1] wwan1
```

Set interface to wwan[num]

```
moxa@moxa:/home/moxa# cell_mgmt interface 1
set interface=1
moxa@moxa:/home/moxa# cell_mgmt interface
```

```
[0] wwan0
[1] wwan1 <Current>
```

cellular management

cell_mgmt version

Cellular management version.

```
moxa@Moxa:/home/moxa# cell_mgmt version
cell_mgmt
version:1.7.0
```

Wi-Fi Module

In this section we show you how to connect to an 802.11 access point. The connection program we will use is **wpa_supplicant**.

There are two ways to use **wpa_supplicant**. You can use **wifi_mgmt**, which is offered by Moxa or use the use **wpa_supplicant** command.

Install wifi_mgmt

Upload the v2200-wifimgmt_1.0.0_amd64.deb file to target machine and use dpkg installer to install the package.

```
Moxa:/home# dpkg -i v2200-wifimgmt_1.0.0_amd64.deb
```

wifi_mgmt Usage

Manual page

wifi_mgmt help

wifi_mgmt is a utility for handling wifi module-related behavior.

```
moxa@Moxa:~$ sudo wifi_mgmt help
[sudo] password for moxa:
Usage:
  /sbin/wifi_mgmt [OPTIONS]

OPTIONS
  start Type=[type] SSID=[ssid] Password=[password]
      Insert an AP information to the managed AP list and then connect to the
  AP.

  [type]      open/wep/wpa/wpa2
  [ssid]      access point's SSID
  [password]  access point's password

  example:
      wifi_mgmt start Type=wpa SSID=moxa_ap Password=moxa
      wifi_mgmt start Type=open SSID=moxa_ap
  start [num]
      Connect to AP by the managed AP list number.
  start
      Connect to the last time AP that was used.
  scan -d
```



```

        Scan all the access points information and show the detail message.
scan
        Scan all the access points information.
signal
        Show the AP's signal.
list
        Show the managed AP list.
insert Type=[type] SSID=[ssid] Password=[password]
        Insert a new AP information to the managed AP list.

        [type]          open/wep/wpa/wpa2
        [ssid]          access point's SSID
        [password]     access point's password

example:
        wifi_mgmt insert Type=wpa SSID=moxa_ap Password=moxa
select [num]
        Select an AP num to connect which is in the managed AP list.
stop
        Stop network.
status
        Query network connection status.
interface [num]
        Switch to another wlan[num] interface.

        [num]          interface number
example:
        wifi_mgmt interface 0
interface
        Get the current setting interface.
reconnect
        Reconnect to the access point.
restart
        Stop wpa_supplicant then start it again.
version
        Wifi management version.

```

Connect to an AP

There are three ways to connect to an AP. The DNS and default gateway will be configured automatically. If you want to use the wireless interface's gateway, be sure to clean up your computer's default gateway first.

wifi_mgmt start Type=[type] SSID=[ssid] Password=[password]

Insert the AP information in the managed AP list and then connect to an AP.

```

root@Moxa:~# wifi_mgmt start Type=wpa SSID=moxa_ap Password=moxa
wpa_state=COMPLETED
*** Get DHCP IP address from AP ***
*** Get DHCP IP from AP! ***

```

wifi_mgmt start [num]

Connect to the AP using the managed AP list number. If you have inserted AP information before, some AP information will still be in the managed AP list. Check the managed AP list with the wifi_mgmt list command.

```

root@Moxa:~# wifi_mgmt list
network id / ssid / bssid / flags

```

```
0 MOXA_AP1 any [LAST USED]
1 MOXA_AP2 any [DISABLED]
2 MOXA_AP3 any [DISABLED]
```

Choose an AP number to start.

```
root@Moxa:~# wifi_mgmt start 1
wpa_state=COMPLETED
*** Get DHCP IP address from AP ***
*** Get DHCP IP from AP! ***
```

wifi_mgmt start

Connect to the previous AP that was used.

```
root@Moxa:~# wifi_mgmt list
network id / ssid / bssid / flags
0 MOXA_AP1 any [LAST USED]
1 MOXA_AP2 any [DISABLED]
2 MOXA_AP3 any [DISABLED]
```

Use the command `wifi_mgmt` to connect to the AP "MOXA_AP1" that was used the previous time.

```
root@Moxa:~# wifi_mgmt start
wpa_state=COMPLETED
*** Get DHCP IP address from AP ***
*** Get DHCP IP from AP! ***
```

Stop or restart network

wifi_mgmt stop

```
root@Moxa:~# wifi_mgmt stop
wpa_supplicant is closed!!
```

wifi_mgmt restart

```
root@Moxa:~# wifi_mgmt restart
wpa_supplicant is closed!!
wpa_state=COMPLETED
*** Get DHCP IP address from AP ***
*** Get DHCP IP from AP! ***
```

Insert an AP or choose another AP to connect.

If you want to use another AP to connect, use the `wifi_mgmt select` command to switch to another AP.

```
root@Moxa:~# wifi_mgmt insert Type=wpa2 SSID=MOXA_AP3 Password=moxa
root@Moxa:~# wifi_mgmt list
network id / ssid / bssid / flags
0 MOXA_AP1 any [CURRENT]
1 MOXA_AP2 any [DISABLED]
2 MOXA_AP3 any [DISABLED]
```

If you want to use another AP to connect, use the `wifi_mgmt select` command to switch to another AP.

```
root@Moxa:~# wifi_mgmt list
network id / ssid / bssid / flags
0 MOXA_AP1 any [DISABLED]
1 MOXA_AP2 any [CURRENT]
2 MOXA_AP3 any [DISABLED]
```

```

root@Moxa:~# wifi_mgmt select 2
wpa_state=COMPLETED
*** Get DHCP IP address from AP ***
*** Get DHCP IP from AP! ***

```

Other functions

wifi_mgmt scan

Scan all of the access point information.

```

root@Moxa:~# wifi_mgmt scan
bssid / frequency / signal level / flags / ssid
b0:b2:dc:dd:c9:e4      2462   -57   [WPA-PSK-TKIP] [ESS]   WES_AP
fc:f5:28:cb:8c:23     2412   -57   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-NB
fe:f0:28:cb:8c:23     2412   -59   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-Mobile
fc:f5:28:cb:39:08     2437   -79   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-NB
fe:f0:28:cb:39:08     2437   -81   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-Mobile
fc:f5:28:cb:5d:a8     2462   -83   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-NB
2c:54:cf:fd:5a:cf     2437   -83   [WPA-PSK-TKIP] [ESS]   5566fans
fe:f0:28:cb:5d:a8     2462   -87   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-Mobile
fe:f0:28:cb:5d:78     2462   -89   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-Mobile
fe:f0:28:cb:39:11     2437   -89   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-Mobile
fc:f5:28:cb:39:11     2437   -91   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-NB
fe:f0:28:cb:39:0b     2412   -91   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-Mobile
02:1a:11:f1:dc:a1     2462   -91   [WPA2-PSK-CCMP] [ESS]   M9 Davidoff
fc:f5:28:cb:5d:78     2462   -93   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-NB
fe:f0:28:cb:5d:b7     2462   -93   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-Mobile
fc:f5:28:cb:39:0b     2412   -93   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-NB
fc:f5:28:cb:5d:b7     2462   -95   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-NB
fc:f5:28:cb:5d:93     2462   -97   [WPA2-EAP-CCMP-preauth] [ESS]   MHQ-NB

```

wifi_mgmt scan -d

Scan all of the access point information and show a detailed message.

```

root@Moxa:~# wifi_mgmt scan -d
wlan0   Scan completed :
Cell 01 - Address: FC:F5:28:CB:8C:23
        Channel:1
        Frequency:2.412 GHz (Channel 1)
        Quality=51/70  Signal level=-59 dBm
        Encryption key:on
        ESSID:"MHQ-NB"
           9 Mb/s; 12 Mb/s; 18 Mb/s
        Mode:Master
           Group Cipher : CCMP
           Pairwise Ciphers (1) : CCMP
           Authentication Suites (1) : 802.1x
           Preauthentication Supported
Cell 02 - Address: FE:F0:28:CB:5D:A8
        Channel:11
        Frequency:2.462 GHz (Channel 11)
        Quality=25/70  Signal level=-85 dBm
        Encryption key:on
        ESSID:"MHQ-Mobile"
           9 Mb/s; 12 Mb/s; 18 Mb/s

```

```

Mode:Master
Group Cipher : CCMP
Pairwise Ciphers (1) : CCMP
Authentication Suites (1) : 802.1x
Preauthentication Supported
More.. ..

```

wifi_mgmtsignal

Show the AP's signal.

```

root@Moxa:~# wifi_mgmt signal
level=-59 dBm

```

wifi_mgmt delete

```

root@Moxa:~# wifi_mgmt list
network id / ssid / bssid / flags
0 MOXA_AP1 any [CURRENT]
1 MOXA_AP1 any [DISABLED]
2 MOXA_AP3 any [DISABLED]
root@Moxa:~# wifi_mgmt delete 2
***** WARNING *****
Are you sure that you want to delete network id 2 (y/n)y
network id / ssid / bssid / flags
0 MOXA_AP1 any
1 MOXA_AP2 any [DISABLED]

```

wifi_mgmt status

```

root@Moxa:~# wifi_mgmt status
bssid=b0:b2:dc:dd:c9:e4
ssid=MOXA_AP1
id=0
mode=station
pairwise_cipher=TKIP
group_cipher=TKIP
key_mgmt=WPA-PSK
wpa_state=COMPLETED
ip_address=192.168.1.36
address=00:0e:8e:4c:13:5e

```

wifi_mgmt interface [num]

If there is more than one wifi interface, you can change the interface.

```

root@Moxa:~# wifi_mgmt interface
There is(are) 2 interface(s):
wlan0 [Current]
wlan1
root@Moxa:~# wifi_mgmt interface 1
Now is setting the interface as wlan1.

```

wifi_mgmt reconnect

```

root@Moxa:~# wifi_mgmt reconnect
wpa_state=SCANNING
wpa_state=SCANNING
wpa_state=COMPLETED
*** Get DHCP IP address from AP ***
*** Get DHCP IP from AP! ***

```

wifi_mgmt version

```
root@Moxa:~# wifi_mgmt version
wifi_mgmt version 1.0 Build 15050223
```

Configuring the Wireless LAN by wpa_supplicant.conf**WARNING**

You might encounter **compatibility issues** if you configure Wi-Fi settings using **wifi_mgmt** instead of using **wpa_supplicant.conf**. Because **wifi_mgmt** edits **wpa_supplicant.conf** dynamically, use **wifi_mgmt** instead of editing **wpa_supplicant.conf** by yourself.

Moxa strongly advises against using the WEP and WPA encryption standards. Both are now officially deprecated by the Wi-Fi Alliance, and are considered insecure. To guarantee proper Wi-Fi encryption and security, please use WPA2 with the AES encryption algorithm.

You can configure the Wi-Fi connection using a configuration file or the **wpa_supplicant** command.

The following example is for OPEN/WEP/WPA/WPA2 AP.

```
ctrl_interface=/var/run/wpa_supplicant
ctrl_interface_group=wheel

update_config=1

### Open system ###
#network={
#    ssid="Open"
#    key_mgmt=NONE
#}
#####

##### WEP #####
#network={
#    ssid="WEP-ssid"
#    bssid=XX:XX:XX:XX:XX:XX
#    key_mgmt=NONE
#    wep_key0=KEY
#}
#####

##### WPA/WPA2 PSK #####
#network={
#    ssid="WPA-ssid"
#    proto=WPA WPA2 RSN
#    key_mgmt=WPA-PSK
#    pairwise=TKIP CCMP
#    group=TKIP CCMP
#    psk="KEY"
#}
#####
```

The basic command to connect for WPA-supPLICANT is:

```
root@Moxa:~# wpa_supplicant -i <interface> -c <configuration file> -B
```

The **-B** option should be included because it forces the supplicant to run in the background.

1. Connect with the following command after editing **wpa_supplicant.conf**:

```
root@Moxa:~# wpa_supplicant -i wlan0 -c /etc/wpa_supplicant.conf -B
```

2. Use **iwconfig** to check the connection status. The response you receive should be similar to the following:

```
wlan0 IEEE 802.11abgn ESSID:"MOXA_AP"  
Mode:Managed Frequency:2.462 GHz Access Point: 00:1F:1F:8C:0F:64  
Bit Rate=36 Mb/s Tx-Power=27 dBm  
Retry min limit:7 RTS thr:off Fragment thr:off  
Encryption key:1234-5678-90 Security mode:open  
Power Management:off  
Link Quality=37/70 Signal level=-73 dBm  
Rx invalid nwid:0 Rx invalid crypt:0 Rx invalid frag:0  
Tx excessive retries:0 Invalid misc:0 Missed beacon:0
```

**ATTENTION**

For more information about wpa_supplicant.conf, go to the following websites:

http://www.daemon-systems.org/man/wpa_supplicant.conf.5.html

http://linux.die.net/man/5/wpa_supplicant.conf

The following topics are covered in this chapter:

- ❑ **Device API**
- ❑ **Getting the Product Serial Number**
- ❑ **RTC (Real-Time Clock)**
- ❑ **UART**
- ❑ **Digital I/O**
 - Special Note
 - Examples
- ❑ **WDT (Watch Dog Timer)**
 - Introduction
 - Watchdog Usage
 - How the WDT Works
 - Watchdog Device IOCTL Commands
 - Examples

Device API

The V2201 supports control devices with the **ioctl** system API. The interface is shown below:

```
int ioctl(int d, int request,...);
Input:
  <d> open device node return file handle
  <request> argument in or out
```

Refer to desktop Linux's man page for detailed documentation:

```
#man ioctl
```

Getting the Product Serial Number

Use **dmidecode** command to read the product information.

```
moxa@moxa:~$ sudo dmidecode -s "baseboard-manufacturer"
Moxa
```

Refer to the following keywords to get other product information.

```
bios-vendor
bios-version
bios-release-date
system-manufacturer
system-product-name
system-version
system-serial-number
system-uuid
baseboard-manufacturer
baseboard-product-name
baseboard-version
baseboard-serial-number
baseboard-asset-tag
chassis-manufacturer
chassis-type
chassis-version
chassis-serial-number
chassis-asset-tag
processor-family
processor-manufacturer
processor-version
processor-frequency
```


RTC (Real-Time Clock)

The device node is located at `/dev/rtc`. The V2201 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/ttyS0` to `/dev/ttyS1`. The V2201 supports standard Linux termios control with RS-232/422/485 serial ports.

```
Usage:      setinterface <device node> <interface-no>
Device:     The uart device node
Operation:  0      set to RS232 interface
            1      set to RS485-2WIRES interface
            2      set to RS422 interface
            3      set to RS485-4WIRES interface
```

Example:

To set the MUE interface, use:

```
# setinterface /dev/ttyS0 2
```

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	int set_dout_state(int doport, int state)
Description	Set the DOUT port to high or low state.
Input	<doport> The DOUT port you want to set. Port starts from 0 to 1 <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	int get_din_state(int diport, int *state)
Description	Get the DIN port state
Input	<diport> The DIN port to get the state of. Port numbering is from 0 to 5 <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 5. 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	<code>int get_din_event(int diport, int *mode, long int *duration)</code>
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\` 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 V2201 computers.

Examples

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

Watchdog Usage

Users can set the ack time from a minimum of 1 sec to a maximum of 1 day. The default timer is 60 seconds and NO WAY OUT is enabled by default; there is no way of disabling the watchdog once it has been started, so if the watchdog daemon crashes, the system will reboot after the timeout has passed. If the NO WAY OUT is disabled, the user can stop the timer.

Example of setting the default timer

Edit the `/etc/modprobe.d/watchdog.conf` file to set the default timer. The following commands set the default timer to 60 seconds:

```
moxa@Moxa:~$ vi /etc/modprobe.d/watchdog.conf
options moxa_v2100_wdt timer_margin=60
moxa@Moxa:~$
```

Enable or disable NO WAY OUT

Edit the `/etc/modprobe.d/watchdog.conf` file to enable or disable NO WAY OUT.

Enable NO WAY OUT:

```
moxa@Moxa:~$ vi /etc/modprobe.d/watchdog.conf
options moxa_v2100_wdt nowayout=1
moxa@Moxa:~$
```

Disable NO WAY OUT:

```
moxa@Moxa:~$ vi /etc/modprobe.d/watchdog.conf
options moxa_v2100_wdt nowayout=0
moxa@Moxa:~$
```

Magic close

If NO WAY OUT is disabled, you can stop the timer using magic close. Use the following commands to do this:

```
root@Moxa:~$ echo V > /dev/watchdog
root@Moxa:~$
```

How the WDT Works

The Debian project supports a watchdog daemon. The watchdog daemon checks if your system is still working. If programs are no longer executing, it will perform a hard reset of the system. The standard watchdog driver and package have been installed in the V2201. If you need to run the watchdog once the system boots up, you can use **insserv** to enable the watchdog function.

```
moxa@Moxa:~$ sudo insserv -v -d watchdog
[sudo] password for moxa:
insserv: enable service ../init.d/watchdog -> /etc/init.d/./rc0.d/K01watchdog
insserv: enable service ../init.d/watchdog -> /etc/init.d/./rc1.d/K01watchdog
insserv: enable service ../init.d/watchdog -> /etc/init.d/./rc2.d/S23watchdog
insserv: enable service ../init.d/watchdog -> /etc/init.d/./rc3.d/S23watchdog
insserv: enable service ../init.d/watchdog -> /etc/init.d/./rc4.d/S23watchdog
insserv: enable service ../init.d/watchdog -> /etc/init.d/./rc5.d/S23watchdog
insserv: enable service ../init.d/watchdog -> /etc/init.d/./rc6.d/K01watchdog
insserv: creating .depend.boot
insserv: creating .depend.start
insserv: creating .depend.stop
moxa@Moxa:~$
```

Check the run level:

```
moxa@Moxa:~$ ls -l /etc/rc?.d/*watchdog*
lrwxrwxrwx 1 root root 18 Nov  8 15:48 /etc/rc0.d/K01watchdog -> ../init.d/watchdog
lrwxrwxrwx 1 root root 18 Nov  8 15:48 /etc/rc1.d/K01watchdog -> ../init.d/watchdog
lrwxrwxrwx 1 root root 18 Nov  8 15:48 /etc/rc2.d/S23watchdog -> ../init.d/watchdog
lrwxrwxrwx 1 root root 18 Nov  8 15:48 /etc/rc3.d/S23watchdog -> ../init.d/watchdog
lrwxrwxrwx 1 root root 18 Nov  8 15:48 /etc/rc4.d/S23watchdog -> ../init.d/watchdog
lrwxrwxrwx 1 root root 18 Nov  8 15:48 /etc/rc5.d/S23watchdog -> ../init.d/watchdog
lrwxrwxrwx 1 root root 18 Nov  8 15:48 /etc/rc6.d/K01watchdog -> ../init.d/watchdog
moxa@Moxa:~$
```

The watchdog configuration file is located in `/etc/watchdog.conf`. Currently, we configure the watchdog daemon to acknowledge the watchdog device in 60 seconds. The real-time parameter is to lock it into memory so that it is never swapped out to prevent the delay of watchdog acknowledge. You can configure this file to enable the watchdog as needed by your application.

```
...
watchdog-device = /dev/watchdog
...
interval          = 60
realtime          = yes
priority          = -10
...
```

Use the following command to remove it from run-level:

```
moxa@moxa:~# sudo inserv -r watchdog
```

Confirm that the watchdog is removed for the run level as follows:

```
moxa@moxa:~# ls -l /etc/rc?.d/*watchdog*
ls: cannot access /etc/rc?.d/*watchdog*: No such file or directory
moxa@moxa:~#
```

Watchdog Device IOCTL Commands

IOCTL	WDIIOC_GETSUPPORT
Description	Returns the support of the card itself
Input	None
Output	(struct watchdog_info *) arg
Return	On success, returns 0. Otherwise, returns a value < 0.

IOCTL	WDIIOC_GETSTATUS
Description	Returns the status of the card
Input	None
Output	(int *)arg
Return	On success, returns 0. Otherwise, returns a value < 0.

IOCTL	WDIIOC_GETBOOTSTATUS
Description	Returns the status of the card that was reported at bootup.
Input	None
Output	(int *)arg)
Return	On success, returns 0. Otherwise, returns a value < 0.

IOCTL	WDIIOC_SETOPTIONS
Description	Lets you set the options of the card. You can either enable or disable the card.
Input	None
Output	(int *)arg)
Return	On success, returns 0. Otherwise, returns a value < 0.

IOCTL	WDIIOC_KEEPLIVE
Description	Pings the card to tell it not to reset your computer.
Input	None
Output	None
Return	On success, returns 0. Otherwise, returns a value < 0.

IOCTL	WDIOC_SETTIMEOUT
Description	Sets the watchdog timeout
Input	arg: 1 to 255 seconds
Output	None
Return	On success, returns 0. Otherwise, returns a value < 0.

IOCTL	WDIOC_GETTIMEOUT
Description	Gets the current watchdog timeout.
Input	None
Output	arg: 1 to 255 seconds
Return	On success, returns 0. Otherwise, returns a value < 0.

Examples

The example file **watchdog-simple.c** acks the watchdog every 10 seconds.

```
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <fcntl.h>

int main(void)
{
    int fd = open("/dev/watchdog", O_WRONLY);
    int ret = 0;
    if (fd == -1) {
        perror("watchdog");
        exit(EXIT_FAILURE);
    }
    while (1) {
        ret = write(fd, "\0", 1);
        if (ret != 1) {
            ret = -1;
            break;
        }
        sleep(10);
    }
    close(fd);
    return ret;
}
```

System Recovery

The V2201-LX is installed with the Embedded Linux operating system, which is located in the mSATA shipped with the V2201-LX computer. Although it rarely happens, you may find on occasion that operating system files and/or the disk file system are damaged. This chapter describes how to recover the Linux operating system.

The following topics are covered in this chapter:

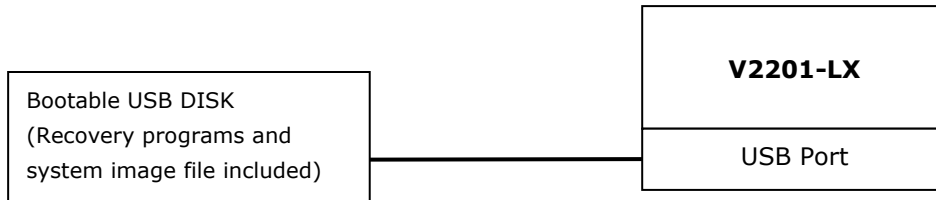
- ❑ **Recovery Environment**
- ❑ **Recovery Procedure**
- ❑ **Saving the System to the USB Drive**

Recovery Environment

The recovery environment includes the V2201 embedded computer and a bootable USB disk with the recovery programs and system image file.

Hardware

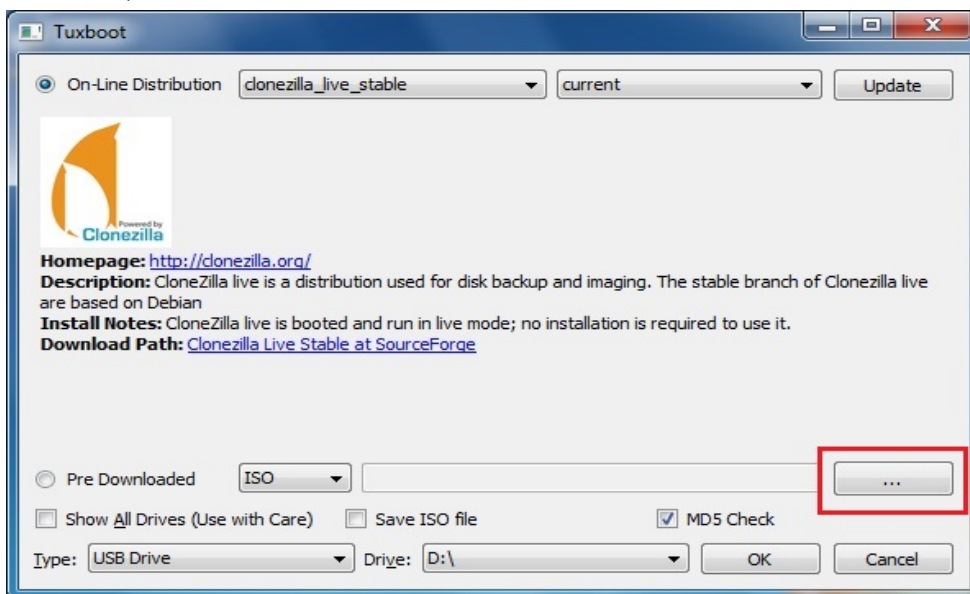
The hardware used includes a PC, a V2201 computer and a USB disk with the recovery programs. **(Note: The USB disk should be at least 2 GB.)**



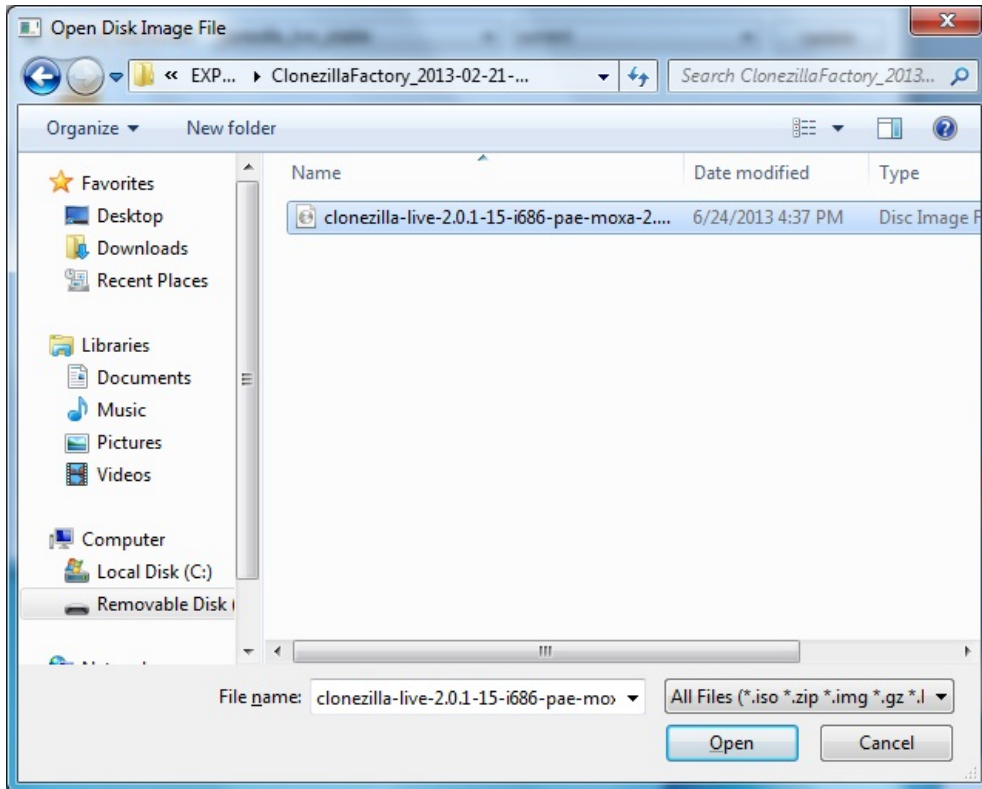
Recovery Procedure

Step 1: Prepare your USB drive

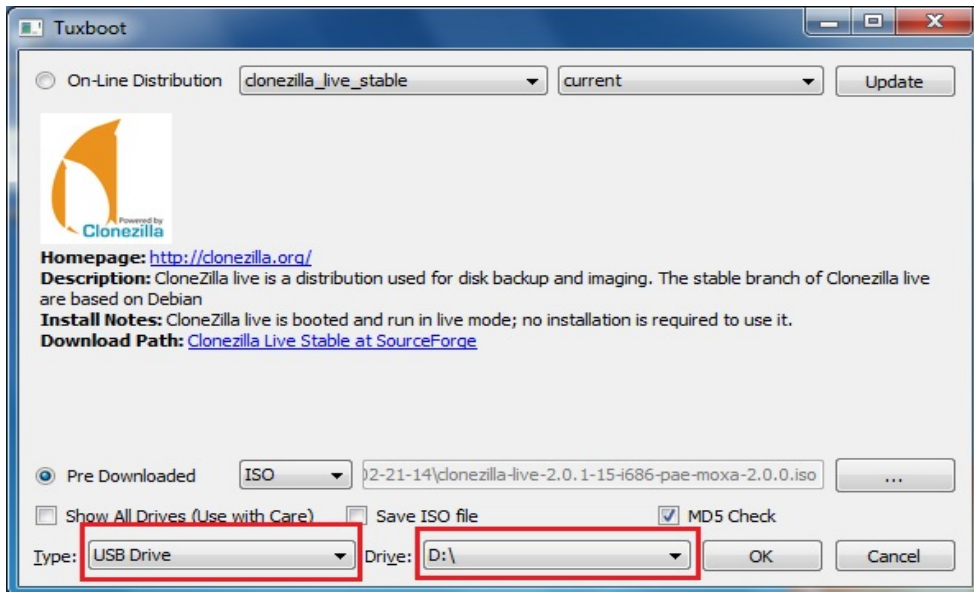
1. Execute **tuxboot-windows-23.exe** from the **Recovery** folder on the Software CD, select **Pre Download**, and then click "..."



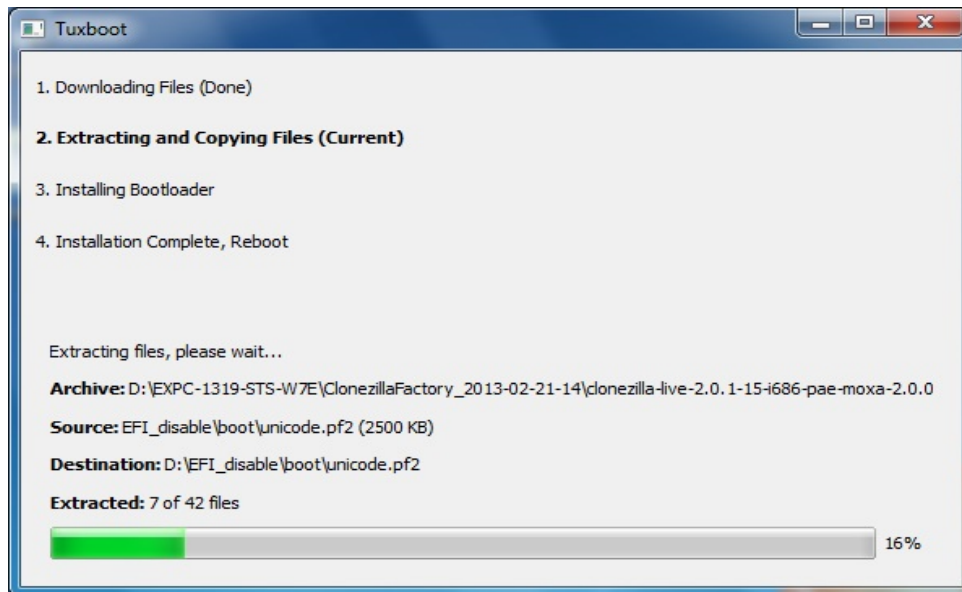
2. Select the ISO file in the directory <Software DVD> \Recovery\



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



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



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



- Manually copy the **os_image** directory from the <Software DVD> \Recovery\V2201-LX_V1.1_FW\Clonezilla\FWR_V2201-LX_V1.1_Build_15103018 on the Software DVD to \home\partimag\ on the USB drive.

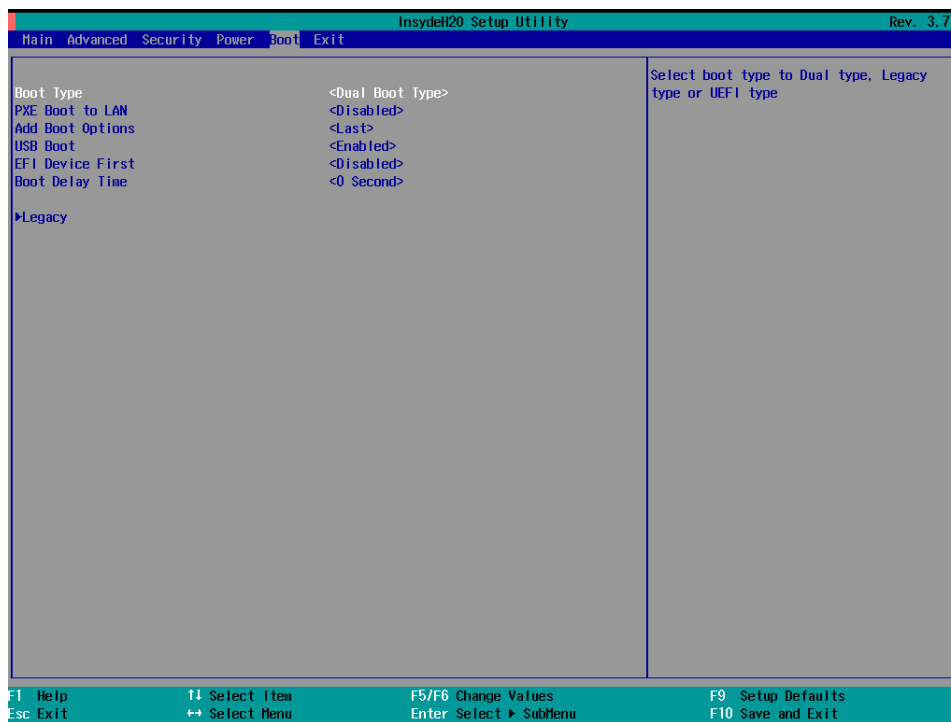
Step 2: Change the BIOS Settings

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

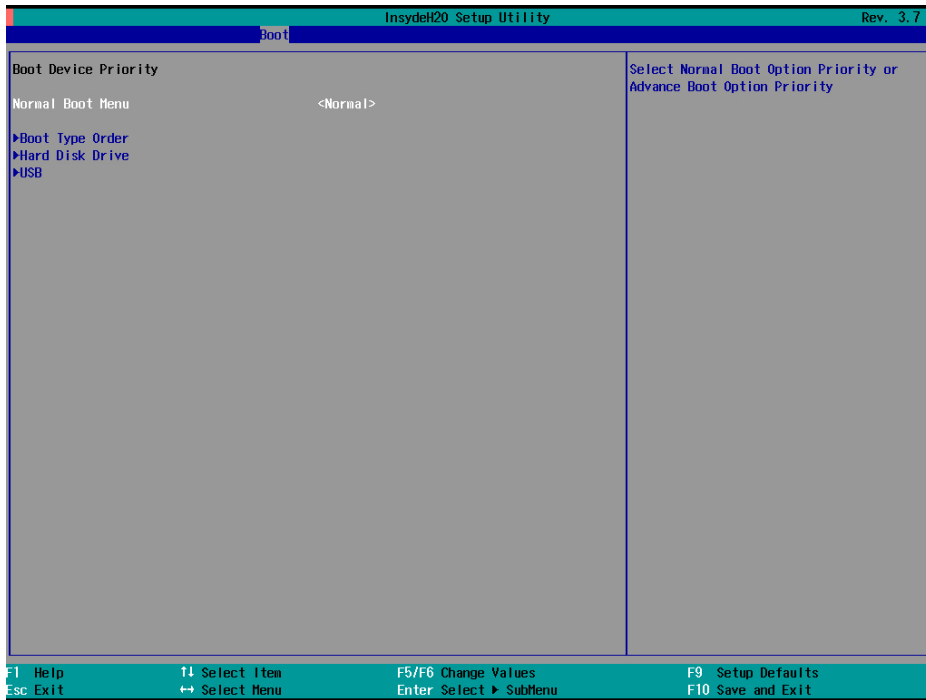
1. Turn on the computer and press **F2**. Select **SCU** in the following screen.



2. Select **Boot** and then select **Legacy**. Press **Enter** to continue.

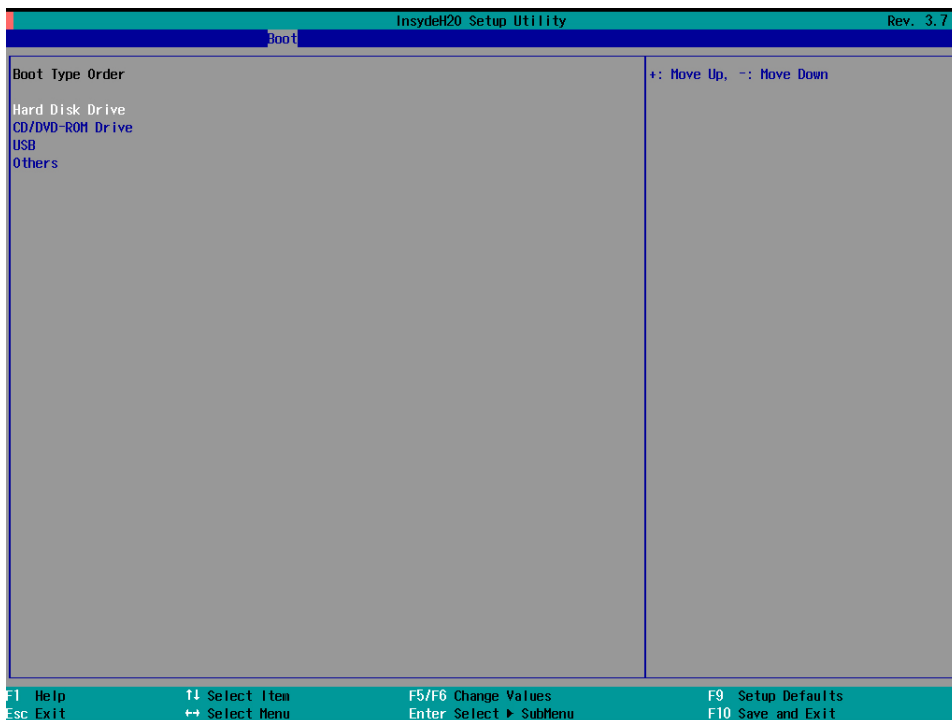


3. Select **Boot Type Order**.



4. Select USB disk and then press "+" to move it to the first boot device position.

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



5. Press **F10** and then press **Enter** to save and exit the BIOS setup.

Step 3: Restore the system from the USB drive

Connect the USB disk to any of the V2201'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.

There are 2 kinds of recovery process in Clonezilla: **auto mode** and **expert mode**:

- Select **auto mode** to complete the recovery task **if you want Clonezilla to help you recover the MBR and expand the image automatically**.
- Select **expert mode** to see a **list of selectable options for completing the recovery task**.

Auto mode:

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) LZ 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 "/" 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_
  
```

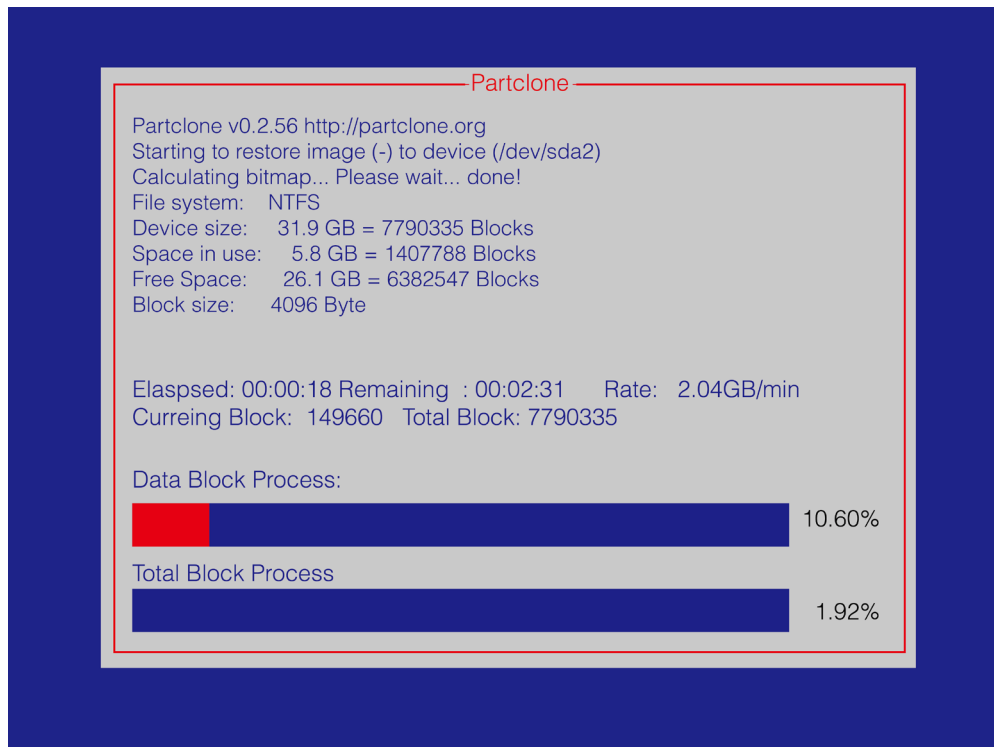
3. Enter **y** to continue the restore process.

```
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] _
```


- Wait for the process to finish.



NOTE You can press any key or use **CTRL+C** to cancel the recovery process and exit Clonezilla.

- 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...

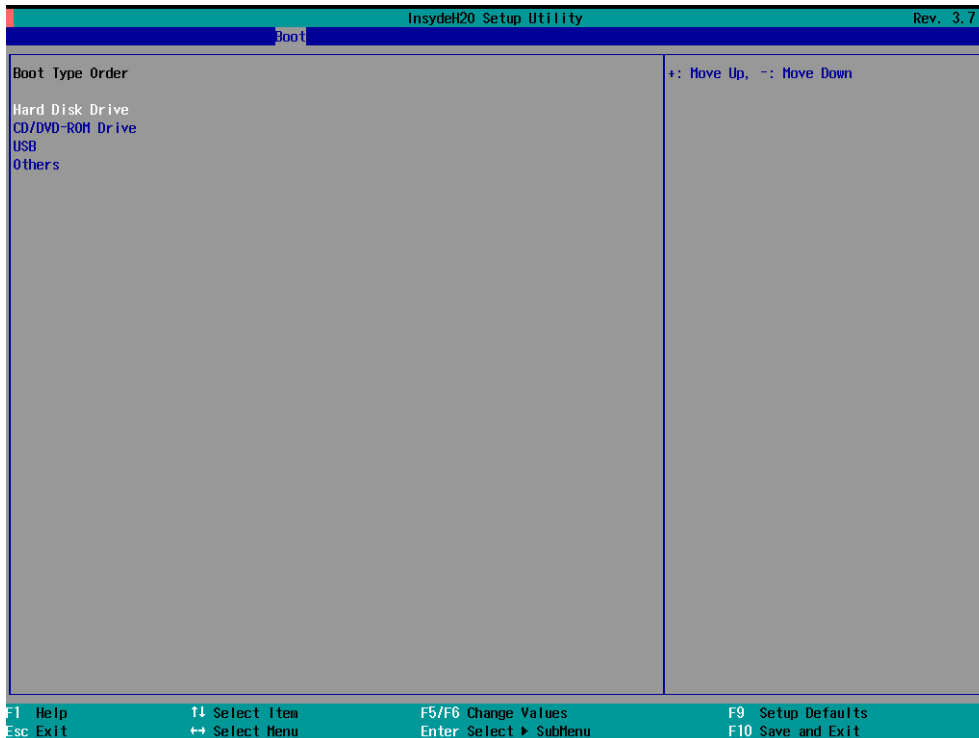
"ocs-live-restore" is finished.
Now you can choose to:
(0) Poweroff
(1) Reboot
(2) Enter command line prompt
(3) Start over
[2]
```

- 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 **F2** to enter the BIOS setup menu.

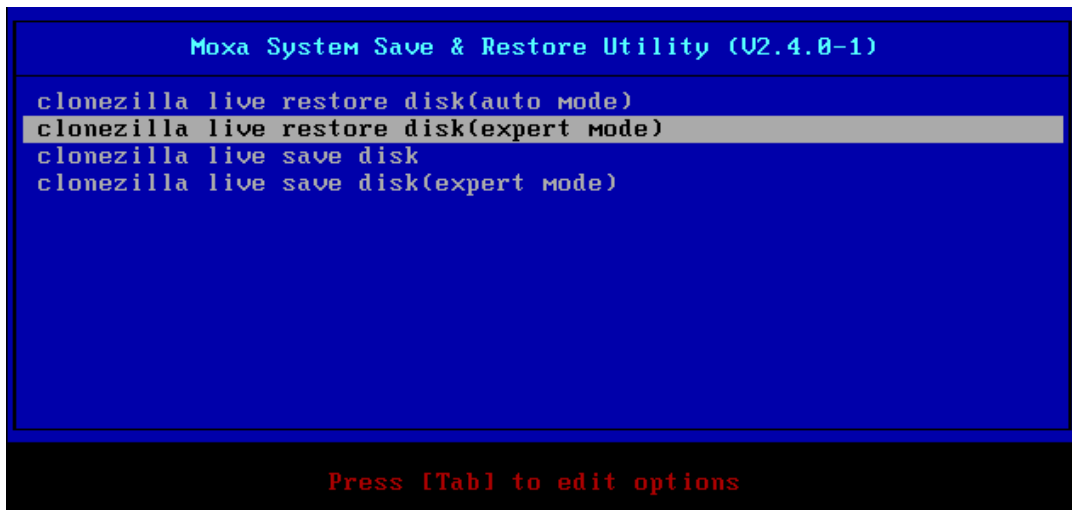
1. Select **Hard Disk Drive** and then press + to move to the first boot device position, and then press **Enter**. Make sure the hard disk has first boot priority.



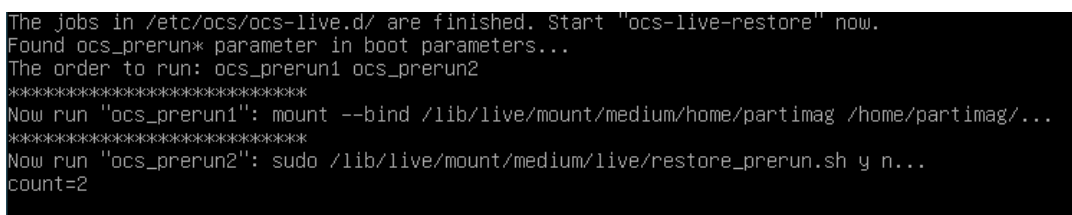
2. Press **F10** and then press **Enter** to save and exit BIOS settings.

Expert mode:

1. Select **clonezilla live restore disk(expert mode)**.



2. Wait for the USB drive boot process to finish. A number of storage areas will be shown for you to confirm; press **Enter** to continue the restore process.



3. Choose which storage area you want to restore.

If your device only has one storage area, this step will be skipped.

```
The jobs in /etc/ocs/ocs-live.d/ are finished. Start "ocs-live-restore" now.
Found ocs_prerun* parameter in boot parameters...
The order to run: ocs_prerun1 ocs_prerun2
*****
Now run "ocs_prerun1": mount --bind /lib/live/mount/medium/home/partimag /home/partimag/...
*****
Now run "ocs_prerun2": sudo /lib/live/mount/medium/live/restore_prerun.sh y n...
count=2
[0] /dev/sda_VMWareS_9G
[1] /dev/sdb_VMWareS_4G
Please Enter the target device number:0
```

4. If you want to restore MBR(Master Boot Record), press **y** to continue the restore process.

```
# ocs_live_extra_param will be used only when ocs_live_run=ocs-live-restore (not for ocs-live-genera
l or any other), then it will be passed to ocs-sr. Therefore these parameters are actually those of
ocs-sr.
# Ex: ocs_live_extra_param="-b -c restoredisk sarge-r5 hda"
ocs_live_extra_param="-g auto -e1 auto -e2 -c -icds -j2 -k -p true restoredisk os_image sda"

# ocs_live_keymap is for keymap used in Clonezilla live. Man install-keymap for more details. Ex:
# ocs_live_keymap="NONE" (won't change the default layout)
# ocs_live_keymap="/usr/share/keymaps/i386/azerty/fr-latin9.kmap.gz" (French keyboard)
# //NOTE// ocs_live_keymap is deprecated. It's better to use the parameters live-config.keyboard-lay
outs or keyboard-layouts for live-config to configure the keyboard layout. Ref: http://live.debian.n
et/manual/html/live-manual.en.html#customizing-locale-and-language
ocs_live_keymap="NONE"

# batch mode or not (yes/no), if no, will run interactively.
ocs_live_batch="yes"

# ocs_lang is the language used in Clonezilla live. Available value: en_US.UTF-8, zh_TW.UTF-8... (se
e $DRBL_SCRIPT_PATH/lang/bash/)
ocs_lang=""

# ocs_live_run_tty is the tty for the ocs_live_run. Default it will be "/dev/tty1"
ocs_live_run_tty=""

ocs_encryptfs_cipher="aes"
ocs_encryptfs_key_bytes="16"
Press any key to restore MBR...(y/n)?y
```

5. If you want to expand the file system (modify the partition table), press **y** to continue the restore process.

```
Disk /dev/sda: 9 GiB, 9663676416 bytes, 18874368 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x0001ce8d

Device      Boot  Start      End  Sectors  Size Id Type
/dev/sda1 *    2048    1026047  1024000  500M 83 Linux
/dev/sda2          1026048 15648767 14622720   7G  8e Linux LVM
Do you want to expand filesystem(y/n)?y
```

6. After confirming the storage information, press **Enter** to continue the restore process.

```
# ocs_live_run_tty is the tty for the ocs_live_run. Default it will be "/dev/tty1"
ocs_live_run_tty=""

ocs_encryptfs_cipher="aes"
ocs_encryptfs_key_bytes="16"
Press any key to restore MBR...(y/n)?y
1+0 records in
1+0 records out
512 bytes (512 B) copied, 0.0230861 s, 22.2 kB/s
Warning: Unable to open /dev/sr0 read-write (Read-only file system). /dev/sr0 has been opened read
only.
Warning: Unable to open /dev/sr0 read-write (Read-only file system). /dev/sr0 has been opened read
only.
Disk /dev/sda: 9 GiB, 9663676416 bytes, 18874368 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x0001ce8d

Device      Boot  Start      End  Sectors  Size Id Type
/dev/sda1 *    2048    1026047  1024000    500M 83 Linux
/dev/sda2          1026048 15648767 14622720     7G 8e Linux LVM
Do you want to expand filesystem(y/n)?y
-----
TARGET_DEVICE_PARTITION_ARRAY=2
TARGET_DEVICE_PARTITION_ARRAY[-1]=1
TARGET_DEVICE_LAST_PARTITION=/dev/sda2
-----
Press any key to continue.
```

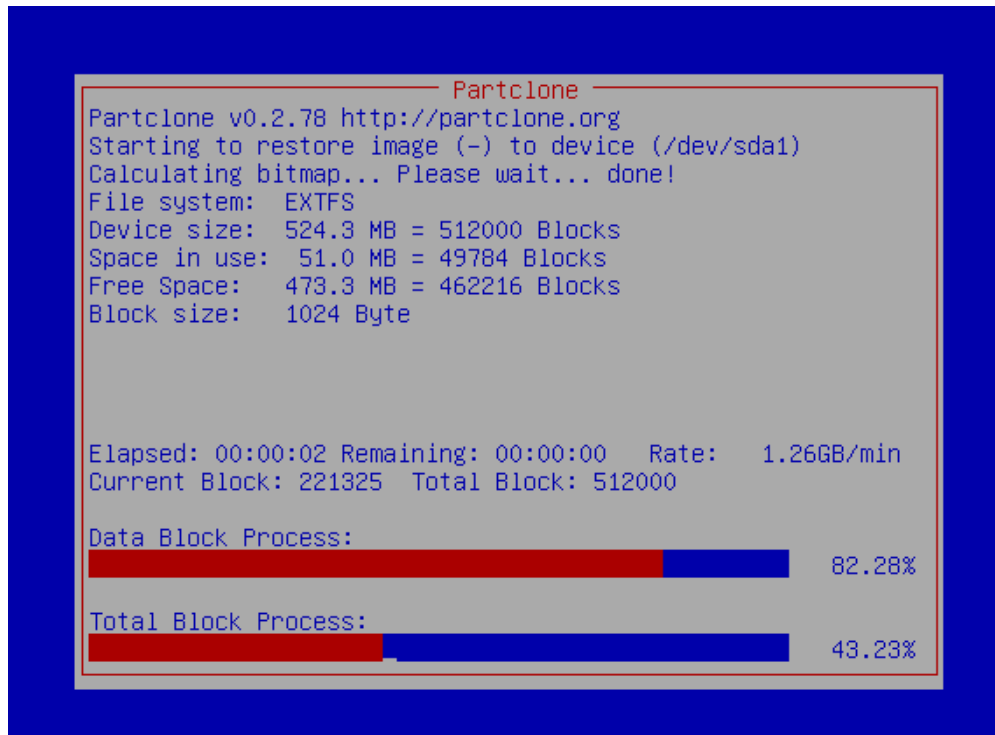
7. Enter **y** to continue the restore process.

```
The following step is to restore an image to the hard disk/partition(s) on this machine: "/home/part
imag/os_image" -> "sda sda1 sda2"
The image was created at: 2015-1104-0835
WARNING!!! WARNING!!! WARNING!!!
WARNING. THE EXISTING DATA IN THIS HARDDISK/PARTITION(S) WILL BE OVERWRITTEN! ALL EXISTING DATA WILL
BE LOST:
*****
Machine: VMware Virtual Platform
sda (9664MB_VMWare_Virtual_S_No_disk_serial_no)
sda1 (500M_ext4(In_VMWare_Virtual_S)_No_disk_serial_no)
sda2 (7G_lvm(In_VMWare_Virtual_S)_No_disk_serial_no)
*****
Are you sure you want to continue? (y/n) y
```

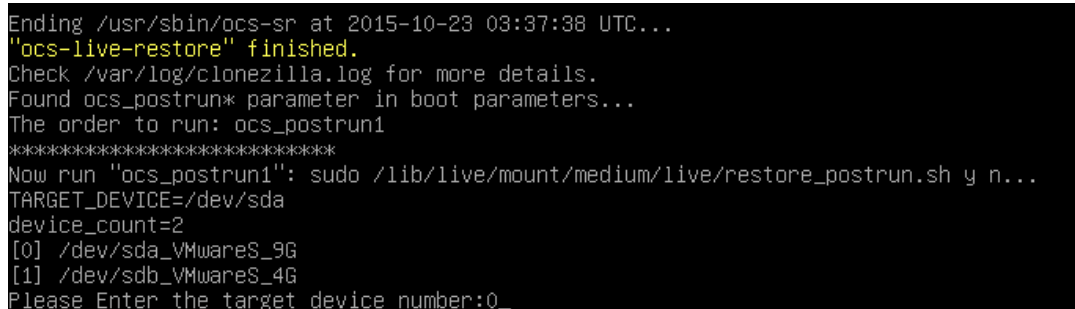
8. Enter **y** to confirm again.

```
WARNING!!! WARNING!!! WARNING!!!
WARNING. THE EXISTING DATA IN THIS HARDDISK/PARTITION(S) WILL BE OVERWRITTEN! ALL EXISTING DATA WILL
BE LOST:
*****
Machine: VMware Virtual Platform
sda (9664MB_VMWare_Virtual_S_No_disk_serial_no)
sda1 (500M_ext4(In_VMWare_Virtual_S)_No_disk_serial_no)
sda2 (7G_lvm(In_VMWare_Virtual_S)_No_disk_serial_no)
*****
Are you sure you want to continue? (y/n) y_
```

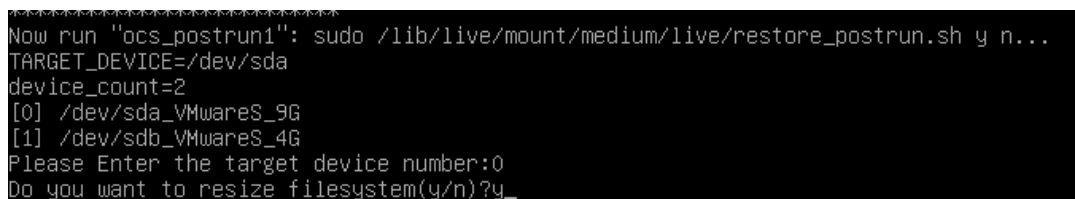
9. Wait for the process to finish.



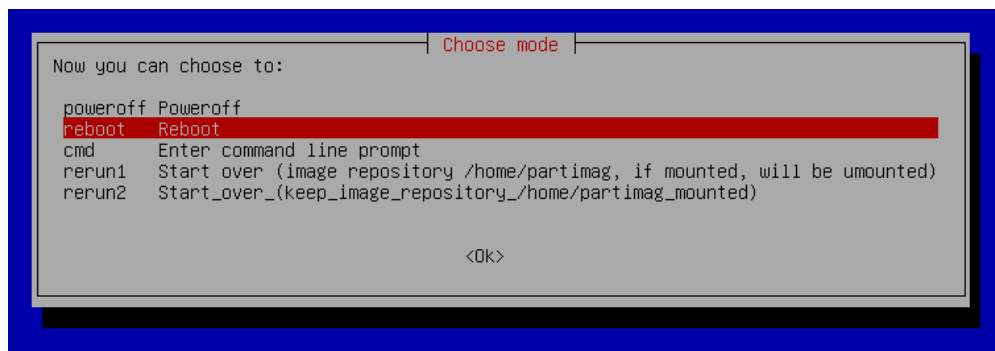
10. Choose which storage in the file system you want to resize.



11. If you want to resize the file system, press **y** to continue the restore process.



12. Select **reboot** to reboot the computer.



13. Remove the USB drive after the computer has been rebooted.

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 removing 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.

Auto mode:

1. Select **clonezilla live save disk**. (If you want to configure more parameters, refer to the next section on "Expert mode.")



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) L2 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 MODULE].
[ 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...
Unmounted partitions (including extended or swap): sda1
Collecting info.. done!
Searching for swap partition(s)...
Excluding busy partition or disk...
Unmounted 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...RETV=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]
```

Expert mode:

1. Select **clonezilla live save disk(expert mode)**.

```

Moxa System Save & Restore Utility (V2.4.0-1)

clonezilla live restore disk(auto mode)
clonezilla live restore disk(expert mode)
clonezilla live save disk
clonezilla live save disk(expert mode)

Press [Tab] to edit options
```

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

Choose which storage area you want to save.

If your device only has one storage area, this step will be skipped.

```
The jobs in /etc/ocs/ocs-live.d/ are finished. Start "ocs-live-restore" now.
Found ocs_prerun* parameter in boot parameters...
The order to run: ocs_prerun1 ocs_prerun2 ocs_prerun3
*****
Now run "ocs_prerun1": mount -o remount,rw /lib/live/mount/medium/...
*****
Now run "ocs_prerun2": mount --bind /lib/live/mount/medium/home/partimag /home/partimag/...
*****
Now run "ocs_prerun3": sudo /lib/live/mount/medium/live/save_prerun.sh...
[0] /dev/sda_VMWareS_9G
[1] /dev/sdb_VMWareS_4G
Please Enter the target device number:0
```


6

Proactive Monitoring

The V2201 series supports the **Moxa Proactive Monitoring** utility. See the *Moxa Proactive Monitoring Linux Software User's Manual* for details. The manual can be found on the product CD/DVD or downloaded from Moxa's website. Note that the V2201 does not support hardware relay.

A

Software Components

Component	Version	Description
acl	2.2.52-2	Access control list utilities
acpi	1.7-1	displays information on ACPI devices
adduser	3.113+nmu3	add and remove users and groups
anacron	2.3-23	cron-like program that doesn't go by time
apache2	2.4.10-10	Apache HTTP Server
apache2-bin	2.4.10-10	Apache HTTP Server (modules and other binary files)
apache2-data	2.4.10-10	Apache HTTP Server (common files)
apache2-utils	2.4.10-10	Apache HTTP Server (utility programs for web servers)
apt	1.0.9.8	commandline package manager
apt-listchanges	2.85.13+nmu1	package change history notification tool
apt-utils	1.0.9.8	package management related utility programs
aptitude	0.6.11-1+b1	terminal-based package manager
aptitude-common	0.6.11-1	architecture independent files for the aptitude package manager
aptitude-doc-en	0.6.11-1	English manual for aptitude, a terminal-based package manager
at	3.1.16-1	Delayed job execution and batch processing
avahi-autoipd	0.6.31-5	Avahi IPv4LL network address configuration daemon
base-files	8+deb8u1	Debian base system miscellaneous files
base-passwd	3.5.37	Debian base system master password and group files
bash	4.3-11+b1	GNU Bourne Again SHell
bash-completion	1:2.1-4	programmable completion for the bash shell
bc	1.06.95-9	GNU bc arbitrary precision calculator language
bind9-host	1:9.9.5.dfsg-9	Version of 'host' bundled with BIND 9.X
binutils	2.25-5	GNU assembler, linker and binary utilities
bluetooth	5.23-2	Bluetooth support
bluez	5.23-2+b1	Bluetooth tools and daemons
bridge-utils	1.5-9	Utilities for configuring the Linux Ethernet bridge
bsdmainutils	9.0.6	collection of more utilities from FreeBSD
bsdutils	1:2.25.2-6	basic utilities from 4.4BSD-Lite
build-essential	11.7	Informational list of build-essential packages
busybox	1:1.22.0-9+deb8u1	Tiny utilities for small and embedded systems
bzip2	1.0.6-7+b3	high-quality block-sorting file compressor - utilities
ca-certificates	20141019	Common CA certificates
console-setup	1.123	console font and keymap setup program
console-setup-linux	1.123	Linux specific part of console-setup

Component	Version	Description
coreutils	8.23-4	GNU core utilities
cpio	2.11+dfsg-4.1	GNU cpio -- a program to manage archives of files
cpp	4:4.9.2-2	GNU C preprocessor (cpp)
cpp-4.8	4.8.4-1	GNU C preprocessor
cpp-4.9	4.9.2-10	GNU C preprocessor
crda	3.13-1	wireless Central Regulatory Domain Agent
cron	3.0pl1-127	process scheduling daemon
dash	0.5.7-4+b1	POSIX-compliant shell
dbus	1.8.18-0+deb8u1	simple interprocess messaging system (daemon and utilities)
dc	1.06.95-9	GNU dc arbitrary precision reverse-polish calculator
debconf	1.5.56	Debian configuration management system
debconf-i18n	1.5.56	full internationalization support for debconf
debian-archive-keyring	2014.3	GnuPG archive keys of the Debian archive
debian-faq	5.0.3	Debian Frequently Asked Questions
debianutils	4.4+b1	Miscellaneous utilities specific to Debian
dictionaries-common	1.23.17	spelling dictionaries - common utilities
diffutils	1:3.3-1+b1	File comparison utilities
dmidecode	2.12-3	SMBIOS/DMI table decoder
dmsetup	2:1.02.90-2.2	Linux Kernel Device Mapper userspace library
dnsutils	1:9.9.5.dfsg-9	Clients provided with BIND
docutils-common	0.12+dfsg-1	text processing system for reStructuredText - common data
docutils-doc	0.12+dfsg-1	text processing system for reStructuredText - documentation
dpkg	1.17.25	Debian package management system
dpkg-dev	1.17.25	Debian package development tools
e2fslibs:amd64	1.42.12-1.1	ext2/ext3/ext4 file system libraries
e2fsprogs	1.42.12-1.1	ext2/ext3/ext4 file system utilities
easy-rsa	2.2.2-1	Simple shell based CA utility
emacsen-common	2.0.8	Common facilities for all emacsen
ethtool	1:3.16-1	display or change Ethernet device settings
fakeroot	1.20.2-1	tool for simulating superuser privileges
file	1:5.22+15-2	Determines file type using "magic" numbers
findutils	4.4.2-9+b1	utilities for finding files--find, xargs
firmware-linux-free	3.3	Binary firmware for various drivers in the Linux kernel
fontconfig	2.11.0-6.3	generic font configuration library - support binaries
fontconfig-config	2.11.0-6.3	generic font configuration library - configuration
fonts-dejavu-core	2.34-1	Vera font family derivate with additional characters
g++	4:4.9.2-2	GNU C++ compiler
g++-4.9	4.9.2-10	GNU C++ compiler
gcc	4:4.9.2-2	GNU C compiler
gcc-4.8	4.8.4-1	GNU C compiler
gcc-4.8-base:amd64	4.8.4-1	GCC, the GNU Compiler Collection (base package)
gcc-4.9	4.9.2-10	GNU C compiler

Component	Version	Description
gcc-4.9-base:amd64	4.9.2-10	GCC, the GNU Compiler Collection (base package)
geoip-database	20150317-1	IP lookup command line tools that use the GeoIP library (country database)
gettext-base	0.19.3-2	GNU Internationalization utilities for the base system
gnupg	1.4.18-7	GNU privacy guard - a free PGP replacement
gnupg-agent	2.0.26-6	GNU privacy guard - password agent
gnupg2	2.0.26-6	GNU privacy guard - a free PGP replacement (new v2.x)
gpgv	1.4.18-7	GNU privacy guard - signature verification tool
grep	2.20-4.1	GNU grep, egrep and fgrep
groff-base	1.22.2-8	GNU troff text-formatting system (base system components)
grub-common	2.02~beta2-22	GRand Unified Bootloader (common files)
grub-pc	2.02~beta2-22	GRand Unified Bootloader, version 2 (PC/BIOS version)
grub-pc-bin	2.02~beta2-22	GRand Unified Bootloader, version 2 (PC/BIOS binaries)
grub2-common	2.02~beta2-22	GRand Unified Bootloader (common files for version 2)
gzip	1.6-4	GNU compression utilities
hdparm	9.43-2	tune hard disk parameters for high performance
hicolor-icon-theme	0.13-1	default fallback theme for FreeDesktop.org icon themes
host	1:9.9.5.dfsg-9	Transitional package
hostname	3.15	utility to set/show the host name or domain name
iamerican	3.3.02-6	American English dictionary for ispell (standard version)
ibritish	3.3.02-6	British English dictionary for ispell (standard version)
ienglish-common	3.3.02-6	Common files for British and American ispell dictionaries
ifupdown	0.7.53.1	high level tools to configure network interfaces
init	1.22	System-V-like init utilities - metapackage
init-system-helpers	1.22	helper tools for all init systems
initramfs-tools	0.12	generic modular initramfs generator
initscripts	2.88dsf-59	scripts for initializing and shutting down the system
insserv	1.14.0-5	boot sequence organizer using LSB init.d script dependency information
install-info	5.2.0.dfsg.1-6	Manage installed documentation in info format
iproute	1:3.16.0-2	transitional dummy package for iproute2
iproute2	3.16.0-2	networking and traffic control tools
iptables	1.4.21-2+b1	administration tools for packet filtering and NAT
iputils-ping	3:20121221-5+b2	Tools to test the reachability of network hosts
irqbalance	1.0.6-3	Daemon to balance interrupts for SMP systems
isc-dhcp-client	4.3.1-6	DHCP client for automatically obtaining an IP address

Component	Version	Description
isc-dhcp-common	4.3.1-6	common files used by all of the isc-dhcp packages
iso-codes	3.57-1	ISO language, territory, currency, script codes and their translations
ispell	3.3.02-6	International Ispell (an interactive spelling corrector)
iw	3.17-1	tool for configuring Linux wireless devices
kbd	1.15.5-2	Linux console font and keytable utilities
keyboard-configuration	1.123	system-wide keyboard preferences
klibc-utils	2.0.4-2	small utilities built with klibc for early boot
kmod	3.18	tools for managing Linux kernel modules
krb5-locales	1.12.1+dfsg-19	Internationalization support for MIT Kerberos
less	458-3	pager program similar to more
libacl1:amd64	2.2.52-2	Access control list shared library
libalgorithm-c3-perl	0.09-1	Perl module for merging hierarchies using the C3 algorithm
libalgorithm-diff-perl	1.19.02-3	module to find differences between files
libalgorithm-diff-xs-perl	0.04-3+b1	module to find differences between files (XS accelerated)
libalgorithm-merge-perl	0.08-2	Perl module for three-way merge of textual data
libapache2-mod-php5	5.6.9+dfsg-0+deb8u1	server-side, HTML-embedded scripting language (Apache 2 module)
libapr1:amd64	1.5.1-3	Apache Portable Runtime Library
libaprutil1:amd64	1.5.4-1	Apache Portable Runtime Utility Library
libaprutil1-dbd-sqlite3:amd64	1.5.4-1	Apache Portable Runtime Utility Library - SQLite3 Driver
libaprutil1-ldap:amd64	1.5.4-1	Apache Portable Runtime Utility Library - LDAP Driver
libapt-inst1.5:amd64	1.0.9.8	deb package format runtime library
libapt-pkg4.12:amd64	1.0.9.8	package management runtime library
libarchive-extract-perl	0.72-1	generic archive extracting module
libasan0:amd64	4.8.4-1	AddressSanitizer -- a fast memory error detector
libasan1:amd64	4.9.2-10	AddressSanitizer -- a fast memory error detector
libasprintf0c2:amd64	0.19.3-2	GNU library to use fprintf and friends in C++
libassuan0:amd64	2.1.2-2	IPC library for the GnuPG components
libatk1.0-0:amd64	2.14.0-1	ATK accessibility toolkit
libatk1.0-data	2.14.0-1	Common files for the ATK accessibility toolkit
libatomic1:amd64	4.9.2-10	support library providing __atomic built-in functions
libattr1:amd64	1:2.4.47-2	Extended attribute shared library
libaudit-common	1:2.4-1	Dynamic library for security auditing - common files
libaudit1:amd64	1:2.4-1+b1	Dynamic library for security auditing
libauthen-sasl-perl	2.1600-1	Authen::SASL - SASL Authentication framework
libavahi-client3:amd64	0.6.31-5	Avahi client library
libavahi-common-data:amd64	0.6.31-5	Avahi common data files
libavahi-common3:amd64	0.6.31-5	Avahi common library
libbind9-90	1:9.9.5.dfsg-9	BIND9 Shared Library used by BIND

Component	Version	Description
libblkid1:amd64	2.25.2-6	block device id library
libboost-iostreams1.55.0:amd64	1.55.0+dfsg-3	Boost.Iostreams Library
libbsd0:amd64	0.7.0-2	utility functions from BSD systems - shared library
libbz2-1.0:amd64	1.0.6-7+b3	high-quality block-sorting file compressor library - runtime
libc-bin	2.19-18	GNU C Library: Binaries
libc-dev-bin	2.19-18	GNU C Library: Development binaries
libc6:amd64	2.19-18	GNU C Library: Shared libraries
libc6-dev:amd64	2.19-18	GNU C Library: Development Libraries and Header Files
libcairo2:amd64	1.14.0-2.1	Cairo 2D vector graphics library
libcap-ng0:amd64	0.7.4-2	An alternate POSIX capabilities library
libcap2:amd64	1:2.24-8	POSIX 1003.1e capabilities (library)
libcap2-bin	1:2.24-8	POSIX 1003.1e capabilities (utilities)
libcgi-fast-perl	1:2.04-1	CGI subclass for work with FCGI
libcgi-pm-perl	4.09-1	module for Common Gateway Interface applications
libcilkrts5:amd64	4.9.2-10	Intel Cilk Plus language extensions (runtime)
libclass-accessor-perl	0.34-1	Perl module that automatically generates accessors
libclass-c3-perl	0.26-1	pragma for using the C3 method resolution order
libclass-c3-xs-perl	0.13-2+b1	Perl module to accelerate Class::C3
libclass-isa-perl	0.36-5	report the search path for a class's ISA tree
libcloog-isl4:amd64	0.18.2-1+b2	Chunky Loop Generator (runtime library)
libcomerr2:amd64	1.42.12-1.1	common error description library
libcpan-meta-perl	2.142690-1	Perl module to access CPAN distributions metadata
libcryptsetup4:amd64	2:1.6.6-5	disk encryption support - shared library
libcups2:amd64	1.7.5-11+deb8u1	Common UNIX Printing System(tm) - Core library
libcurl3-gnutls:amd64	7.38.0-4+deb8u2	easy-to-use client-side URL transfer library (GnuTLS flavour)
libcwidget3:amd64	0.5.17-2	high-level terminal interface library for C++ (runtime files)
libdaemon0:amd64	0.14-6	lightweight C library for daemons - runtime library
libdata-optlist-perl	0.109-1	module to parse and validate simple name/value option pairs
libdata-section-perl	0.200006-1	module to read chunks of data from a module's DATA section
libdatrie1:amd64	0.2.8-1	Double-array trie library
libdb5.3:amd64	5.3.28-9	Berkeley v5.3 Database Libraries [runtime]
libdbus-1-3:amd64	1.8.18-0+deb8u1	simple interprocess messaging system (library)
libdebconfclient0:amd64	0.192	Debian Configuration Management System (C-implementation library)
libdevmapper1.02.1:amd64	2:1.02.90-2.2	Linux Kernel Device Mapper userspace library
libdns-export100	1:9.9.5.dfsg-9	Exported DNS Shared Library
libdns100	1:9.9.5.dfsg-9	DNS Shared Library used by BIND
libdpkg-perl	1.17.25	Dpkg perl modules
libdrm-intel1:amd64	2.4.58-2	Userspace interface to intel-specific kernel DRM

Component	Version	Description
		services -- runtime
libdrm-nouveau2:amd64	2.4.58-2	Userspace interface to nouveau-specific kernel DRM services -- runtime
libdrm-radeon1:amd64	2.4.58-2	Userspace interface to radeon-specific kernel DRM services -- runtime
libdrm2:amd64	2.4.58-2	Userspace interface to kernel DRM services -- runtime
libedit2:amd64	3.1-20140620-2	BSD editline and history libraries
libelf1:amd64	0.159-4.2	library to read and write ELF files
libencode-locale-perl	1.03-1	utility to determine the locale encoding
libestr0	0.1.9-1.1	Helper functions for handling strings (lib)
libevent-2.0-5:amd64	2.0.21-stable-2	Asynchronous event notification library
libexpat1:amd64	2.1.0-6+b3	XML parsing C library - runtime library
libfakeroot:amd64	1.20.2-1	tool for simulating superuser privileges - shared libraries
libfcgi-perl	0.77-1+b1	helper module for FastCGI
libffi6:amd64	3.1-2+b2	Foreign Function Interface library runtime
libfile-fcntllock-perl	0.22-1+b1	Perl module for file locking with fcntl(2)
libfile-listing-perl	6.04-1	module to parse directory listings
libfont-afm-perl	1.20-1	Font::AFM - Interface to Adobe Font Metrics files
libfontconfig1:amd64	2.11.0-6.3	generic font configuration library - runtime
libfontenc1:amd64	1:1.1.2-1+b2	X11 font encoding library
libfreetype6:amd64	2.5.2-3	FreeType 2 font engine, shared library files
libfuse2:amd64	2.9.3-15+deb8u1	Filesystem in Userspace (library)
libgc1c2:amd64	1:7.2d-6.4	conservative garbage collector for C and C++
libgcc-4.8-dev:amd64	4.8.4-1	GCC support library (development files)
libgcc-4.9-dev:amd64	4.9.2-10	GCC support library (development files)
libgcc1:amd64	1:4.9.2-10	GCC support library
libgcrypt20:amd64	1.6.3-2	LGPL Crypto library - runtime library
libgdbm3:amd64	1.8.3-13.1	GNU dbm database routines (runtime version)
libgdk-pixbuf2.0-0:amd64	2.31.1-2+b1	GDK Pixbuf library
libgdk-pixbuf2.0-common	2.31.1-2	GDK Pixbuf library - data files
libgeoip1:amd64	1.6.2-4	non-DNS IP-to-country resolver library
libgl1-mesa-dri:amd64	10.3.2-1	free implementation of the OpenGL API -- DRI modules
libgl1-mesa-glx:amd64	10.3.2-1	free implementation of the OpenGL API -- GLX runtime
libglapi-mesa:amd64	10.3.2-1	free implementation of the GL API -- shared library
libglib2.0-0:amd64	2.42.1-1	GLib library of C routines
libglib2.0-data	2.42.1-1	Common files for GLib library
libgmp10:amd64	2:6.0.0+dfsg-6	Multiprecision arithmetic library
libgnutls-deb0-28:amd64	3.3.8-6+deb8u1	GNU TLS library - main runtime library
libgnutls-openssl27:amd64	3.3.8-6+deb8u1	GNU TLS library - OpenSSL wrapper
libgomp1:amd64	4.9.2-10	GCC OpenMP (GOMP) support library
libgpg-error0:amd64	1.17-3	library for common error values and messages in GnuPG components
libgpgme11:amd64	1.5.1-6	GPGME - GnuPG Made Easy (library)
libgpm2:amd64	1.20.4-6.1+b2	General Purpose Mouse - shared library
libgraphite2-3:amd64	1.2.4-3	Font rendering engine for Complex Scripts -- library

Component	Version	Description
libgssapi-krb5-2:amd64	1.12.1+dfsg-19	MIT Kerberos runtime libraries - krb5 GSS-API Mechanism
libgtk2.0-0:amd64	2.24.25-3	GTK+ graphical user interface library
libgtk2.0-bin	2.24.25-3	programs for the GTK+ graphical user interface library
libgtk2.0-common	2.24.25-3	common files for the GTK+ graphical user interface library
libharfbuzz0b:amd64	0.9.35-2	OpenType text shaping engine (shared library)
libhogweed2:amd64	2.7.1-5	low level cryptographic library (public-key cryptos)
libhtml-form-perl	6.03-1	module that represents an HTML form element
libhtml-format-perl	2.11-1	module for transforming HTML into various formats
libhtml-parser-perl	3.71-1+b3	collection of modules that parse HTML text documents
libhtml-tagset-perl	3.20-2	Data tables pertaining to HTML
libhtml-tree-perl	5.03-1	Perl module to represent and create HTML syntax trees
libhttp-cookies-perl	6.01-1	HTTP cookie jars
libhttp-daemon-perl	6.01-1	simple http server class
libhttp-date-perl	6.02-1	module of date conversion routines
libhttp-message-perl	6.06-1	perl interface to HTTP style messages
libhttp-negotiate-perl	6.00-2	implementation of content negotiation
libice6:amd64	2:1.0.9-1+b1	X11 Inter-Client Exchange library
libicu52:amd64	52.1-8	International Components for Unicode
libidn11:amd64	1.29-1+b2	GNU Libidn library, implementation of IETF IDN specifications
libintl-perl	1.23-1	Uniform message translations system compatible i18n library
libio-html-perl	1.001-1	open an HTML file with automatic charset detection
libio-socket-ssl-perl	2.002-2	Perl module implementing object oriented interface to SSL sockets
libio-string-perl	1.08-3	Emulate IO::File interface for in-core strings
libirs-export91	1:9.9.5.dfsg-9	Exported IRS Shared Library
libisc-export95	1:9.9.5.dfsg-9	Exported ISC Shared Library
libisc95	1:9.9.5.dfsg-9	ISC Shared Library used by BIND
libisccc90	1:9.9.5.dfsg-9	Command Channel Library used by BIND
libiscfg-export90	1:9.9.5.dfsg-9	Exported ISC CFG Shared Library
libiscfg90	1:9.9.5.dfsg-9	Config File Handling Library used by BIND
libisl10:amd64	0.12.2-2	manipulating sets and relations of integer points bounded by linear constraints
libitm1:amd64	4.9.2-10	GNU Transactional Memory Library
libiw30:amd64	30~pre9-8	Wireless tools - library
libjasper1:amd64	1.900.1-debian1-2.4	JasPer JPEG-2000 runtime library
libjbig0:amd64	2.1-3.1	JBIGkit libraries
libjpeg62-turbo:amd64	1:1.3.1-12	libjpeg-turbo JPEG runtime library
libjson-c2:amd64	0.11-4	JSON manipulation library - shared library
libk5crypto3:amd64	1.12.1+dfsg-19	MIT Kerberos runtime libraries - Crypto Library
libkeyutils1:amd64	1.5.9-5+b1	Linux Key Management Utilities (library)
libklibc	2.0.4-2	minimal libc subset for use with initramfs
libkmod2:amd64	3.18	libkmod shared library

Component	Version	Description
libkrb5-3:amd64	1.12.1+dfsg-19	MIT Kerberos runtime libraries
libkrb5support0:amd64	1.12.1+dfsg-19	MIT Kerberos runtime libraries - Support library
libksba8:amd64	1.3.2-1	X.509 and CMS support library
liblcms2-2:amd64	2.6-3+b3	Little CMS 2 color management library
libldap-2.4-2:amd64	2.4.40+dfsg-1	OpenLDAP libraries
libllvm3.5:amd64	1:3.5-10	Modular compiler and toolchain technologies, runtime library
liblocale-gettext-perl	1.05-8+b1	module using libc functions for internationalization in Perl
liblockfile-bin	1.09-6	support binaries for and cli utilities based on liblockfile
liblockfile1:amd64	1.09-6	NFS-safe locking library
liblog-message-perl	0.8-1	powerful and flexible message logging mechanism
liblog-message-simple-perl	0.10-2	simplified interface to Log::Message
liblogging-stdlog0:amd64	1.0.4-1	easy to use and lightweight logging library
liblognorm1:amd64	1.0.1-3	Log normalizing library
liblsan0:amd64	4.9.2-10	LeakSanitizer -- a memory leak detector (runtime)
liblua5.1-0:amd64	5.1.5-7.1	Shared library for the Lua interpreter version 5.1
liblwp-mediatypes-perl	6.02-1	module to guess media type for a file or a URL
liblwp-protocol-https-perl	6.06-2	HTTPS driver for LWP::UserAgent
liblwres90	1:9.9.5.dfsg-9	Lightweight Resolver Library used by BIND
liblzma5:amd64	5.1.1alpha+20120614-2+b3	XZ-format compression library
liblzo2-2:amd64	2.08-1.2	data compression library
libmagic1:amd64	1:5.22+15-2	File type determination library using "magic" numbers
libmailtools-perl	2.13-1	Manipulate email in perl programs
libmn10:amd64	1.0.3-5	minimalistic Netlink communication library
libmodule-build-perl	0.421000-2	framework for building and installing Perl modules
libmodule-pluggable-perl	5.1-1	module for giving modules the ability to have plugins
libmodule-signature-perl	0.73-1+deb8u2	module to manipulate CPAN SIGNATURE files
libmount1:amd64	2.25.2-6	device mounting library
libmpc3:amd64	1.0.2-1	multiple precision complex floating-point library
libmpfr4:amd64	3.1.2-2	multiple precision floating-point computation
libmro-compat-perl	0.12-1	mro::* interface compatibility for Perls < 5.9.5
libncurses5:amd64	5.9+20140913-1+b1	shared libraries for terminal handling
libncurses5-dev:amd64	5.9+20140913-1+b1	developer's libraries for ncurses
libncursesw5:amd64	5.9+20140913-1+b1	shared libraries for terminal handling (wide character support)
libnet-http-perl	6.07-1	module providing low-level HTTP connection client
libnet-smtp-ssl-perl	1.01-3	Perl module providing SSL support to Net::SMTP
libnet-ssleay-perl	1.65-1+b1	Perl module for Secure Sockets Layer (SSL)
libnet-telnet-perl	3.04-1	Perl module to script telnetable connections
libnetfilter-acct1:amd64	1.0.2-1.1	Netfilter acct library

Component	Version	Description
libnettle4:amd64	2.7.1-5	low level cryptographic library (symmetric and one-way cryptos)
libnewt0.52:amd64	0.52.17-1+b1	Not Erik's Windowing Toolkit - text mode windowing with slang
libnfnetlink0:amd64	1.0.1-3	Netfilter netlink library
libnfsidmap2:amd64	0.25-5	NFS idmapping library
libnl-3-200:amd64	3.2.24-2	library for dealing with netlink sockets
libnl-genl-3-200:amd64	3.2.24-2	library for dealing with netlink sockets - generic netlink
libnuma1:amd64	2.0.10-1	Libraries for controlling NUMA policy
libonig2:amd64	5.9.5-3.2	Oniguruma regular expressions library
libp11-kit0:amd64	0.20.7-1	Library for loading and coordinating access to PKCS#11 modules - runtime
libpackage-constants-perl	0.04-1	List constants defined in a package
libpam-modules:amd64	1.1.8-3.1	Pluggable Authentication Modules for PAM
libpam-modules-bin	1.1.8-3.1	Pluggable Authentication Modules for PAM - helper binaries
libpam-runtime	1.1.8-3.1	Runtime support for the PAM library
libpam0g:amd64	1.1.8-3.1	Pluggable Authentication Modules library
libpango-1.0-0:amd64	1.36.8-3	Layout and rendering of internationalized text
libpangocairo-1.0-0:amd64	1.36.8-3	Layout and rendering of internationalized text
libpangoft2-1.0-0:amd64	1.36.8-3	Layout and rendering of internationalized text
libpaper-utils	1.1.24+nmu4	library for handling paper characteristics (utilities)
libpaper1:amd64	1.1.24+nmu4	library for handling paper characteristics
libparams-util-perl	1.07-2+b1	Perl extension for simple stand-alone param checking functions
libparse-debianchangelog-perl	1.2.0-1.1	parse Debian changelogs and output them in other formats
libpci3:amd64	1:3.2.1-3	Linux PCI Utilities (shared library)
libpciaccess0:amd64	0.13.2-3+b1	Generic PCI access library for X
libpcre3:amd64	2:8.35-3.3	Perl 5 Compatible Regular Expression Library - runtime files
libpcsclite1:amd64	1.8.13-1	Middleware to access a smart card using PC/SC (library)
libperl-dev	5.20.2-3+deb8u1	Perl library: development files
libperl4-corelibs-perl	0.003-1	libraries historically supplied with Perl 4
libperl5.20	5.20.2-3+deb8u1	shared Perl library
libpipeline1:amd64	1.4.0-1	pipeline manipulation library
libpixman-1-0:amd64	0.32.6-3	pixel-manipulation library for X and cairo
libpkcs11-helper1:amd64	1.11-2	library that simplifies the interaction with PKCS#11
libpng12-0:amd64	1.2.50-2+b2	PNG library - runtime
libpod-latex-perl	0.61-1	module to convert Pod data to formatted LaTeX
libpod-readme-perl	0.11-1	Perl module to convert POD to README file
libpopt0:amd64	1.16-10	lib for parsing cmdline parameters
libprocps3:amd64	2:3.3.9-9	library for accessing process information from /proc
libpsl0:amd64	0.5.1-1	Library for Public Suffix List (shared libraries)
libpthreads20:amd64	2.0.7-20	GNU Portable Threads
libpython-stdlib:amd64	2.7.9-1	interactive high-level object-oriented language (default python version)

Component	Version	Description
libpython2.7-minimal:amd64	2.7.9-2	Minimal subset of the Python language (version 2.7)
libpython2.7-stdlib:amd64	2.7.9-2	Interactive high-level object-oriented language (standard library, version 2.7)
libqdbm14	1.8.78-5+b1	QDBM Database Libraries without GDBM wrapper[runtime]
libquadmath0:amd64	4.9.2-10	GCC Quad-Precision Math Library
libreadline6:amd64	6.3-8+b3	GNU readline and history libraries, run-time libraries
libregexp-common-perl	2013031301-1	module with common regular expressions
librtmp1:amd64	2.4+20150115.gita107cef-1	toolkit for RTMP streams (shared library)
libsasl2-2:amd64	2.1.26.dfsg1-13	Cyrus SASL - authentication abstraction library
libsasl2-modules:amd64	2.1.26.dfsg1-13	Cyrus SASL - pluggable authentication modules
libsasl2-modules-db:amd64	2.1.26.dfsg1-13	Cyrus SASL - pluggable authentication modules (DB)
libselinux1:amd64	2.3-2	SELinux runtime shared libraries
libsemanage-common	2.3-1	Common files for SELinux policy management libraries
libsemanage1:amd64	2.3-1+b1	SELinux policy management library
libsensors4:amd64	1:3.3.5-2	library to read temperature/voltage/fan sensors
libsepol1:amd64	2.3-2	SELinux library for manipulating binary security policies
libsigc++-2.0-0c2a:amd64	2.4.0-1	type-safe Signal Framework for C++ - runtime
libsigsegv2:amd64	2.10-4+b1	Library for handling page faults in a portable way
libslang2:amd64	2.3.0-2	S-Lang programming library - runtime version
libsm6:amd64	2:1.2.2-1+b1	X11 Session Management library
libsmartcols1:amd64	2.25.2-6	smart column output alignment library
libsnmp-base	5.7.2.1+dfsg-1	SNMP configuration script, MIBs and documentation
libsnmp30:amd64	5.7.2.1+dfsg-1	SNMP (Simple Network Management Protocol) library
libsoftware-license-perl	0.103010-3	module providing templated software licenses
libsqlite3-0:amd64	3.8.7.1-1+deb8u1	SQLite 3 shared library
libsqlite3-dev:amd64	3.8.7.1-1+deb8u1	SQLite 3 development files
libss2:amd64	1.42.12-1.1	command-line interface parsing library
libssh2-1:amd64	1.4.3-4.1	SSH2 client-side library
libssl1.0.0:amd64	1.0.1k-3+deb8u1	Secure Sockets Layer toolkit - shared libraries
libstdc++-4.9-dev:amd64	4.9.2-10	GNU Standard C++ Library v3 (development files)
libstdc++6:amd64	4.9.2-10	GNU Standard C++ Library v3
libsub-exporter-perl	0.986-1	sophisticated exporter for custom-built routines
libsub-install-perl	0.928-1	module for installing subroutines into packages easily
libsub-name-perl	0.12-1	module for assigning a new name to referenced sub
libswitch-perl	2.17-2	switch statement for Perl
libsystemd0:amd64	215-17+deb8u1	systemd utility library
libtasn1-6:amd64	4.2-3+deb8u1	Manage ASN.1 structures (runtime)

Component	Version	Description
libterm-ui-perl	0.42-1	Term::ReadLine UI made easy
libtext-charwidth-perl	0.04-7+b3	get display widths of characters on the terminal
libtext-iconv-perl	1.7-5+b2	converts between character sets in Perl
libtext-soundex-perl	3.4-1+b2	implementation of the soundex algorithm
libtext-template-perl	1.46-1	perl module to process text templates
libtext-unidecode-perl	1.22-1	Text::Unidecode -- US-ASCII transliterations of Unicode text
libtext-wrapi18n-perl	0.06-7	internationalized substitute of Text::Wrap
libthai-data	0.1.21-1	Data files for Thai language support library
libthai0:amd64	0.1.21-1	Thai language support library
libtiff5:amd64	4.0.3-12.3	Tag Image File Format (TIFF) library
libtimedate-perl	2.3000-2	collection of modules to manipulate date/time information
libtinfo-dev:amd64	5.9+20140913-1+b1	developer's library for the low-level terminfo library
libtinfo5:amd64	5.9+20140913-1+b1	shared low-level terminfo library for terminal handling
libtirpc1:amd64	0.2.5-1	transport-independent RPC library
libtokyocabinet9:amd64	1.4.48-3	Tokyo Cabinet Database Libraries [runtime]
libtsan0:amd64	4.9.2-10	ThreadSanitizer -- a Valgrind-based detector of data races (runtime)
libtxc-dxtn-s2tc0:amd64	0~git20131104-1.1	Texture compression library for Mesa
libubsan0:amd64	4.9.2-10	UBSan -- undefined behaviour sanitizer (runtime)
libudev1:amd64	215-17+deb8u1	libudev shared library
liburi-perl	1.64-1	module to manipulate and access URI strings
libusb-0.1-4:amd64	2:0.1.12-25	userspace USB programming library
libustr-1.0-1:amd64	1.0.4-3+b2	Micro string library: shared library
libutempter0	1.1.5-4	A privileged helper for utmp/wtmp updates (runtime)
libuuid-perl	0.05-1+b1	Perl extension for using UUID interfaces as defined in e2fsprogs
libuuid1:amd64	2.25.2-6	Universally Unique ID library
libwebp5:amd64	0.4.1-1.2+b2	Lossy compression of digital photographic images.
libwebpdemux1:amd64	0.4.1-1.2+b2	Lossy compression of digital photographic images.
libwebpmux1:amd64	0.4.1-1.2+b2	Lossy compression of digital photographic images.
libwrap0:amd64	7.6.q-25	Wietse Venema's TCP wrappers library
libwww-perl	6.08-1	simple and consistent interface to the world-wide web
libwww-robotrules-perl	6.01-1	database of robots.txt-derived permissions
libx11-6:amd64	2:1.6.2-3	X11 client-side library
libx11-data	2:1.6.2-3	X11 client-side library
libx11-xcb1:amd64	2:1.6.2-3	Xlib/XCB interface library
libx86-1:amd64	1.1+ds1-10	x86 real-mode library
libxapian22	1.2.19-1	Search engine library
libxau6:amd64	1:1.0.8-1	X11 authorisation library
libxaw7:amd64	2:1.0.12-2+b1	X11 Athena Widget library
libxcb-dri2-0:amd64	1.10-3+b1	X C Binding, dri2 extension
libxcb-dri3-0:amd64	1.10-3+b1	X C Binding, dri3 extension

Component	Version	Description
libxcb-glx0:amd64	1.10-3+b1	X C Binding, glx extension
libxcb-present0:amd64	1.10-3+b1	X C Binding, present extension
libxcb-render0:amd64	1.10-3+b1	X C Binding, render extension
libxcb-shape0:amd64	1.10-3+b1	X C Binding, shape extension
libxcb-shm0:amd64	1.10-3+b1	X C Binding, shm extension
libxcb-sync1:amd64	1.10-3+b1	X C Binding, sync extension
libxcb1:amd64	1.10-3+b1	X C Binding
libxcomposite1:amd64	1:0.4.4-1	X11 Composite extension library
libxcursor1:amd64	1:1.1.14-1+b1	X cursor management library
libxdamage1:amd64	1:1.1.4-2+b1	X11 damaged region extension library
libxdmcp6:amd64	1:1.1.1-1+b1	X11 Display Manager Control Protocol library
libxext6:amd64	2:1.3.3-1	X11 miscellaneous extension library
libxfixes3:amd64	1:5.0.1-2+b2	X11 miscellaneous 'fixes' extension library
libxft2:amd64	2.3.2-1	FreeType-based font drawing library for X
libxi6:amd64	2:1.7.4-1+b2	X11 Input extension library
libxinerama1:amd64	2:1.1.3-1+b1	X11 Xinerama extension library
libxml-libxml-perl	2.0116+dfsg-1+deb8u1	Perl interface to the libxml2 library
libxml-namespacesupport-perl	1.11-1	Perl module for supporting simple generic namespaces
libxml-parser-perl	2.41-3	Perl module for parsing XML files
libxml-sax-base-perl	1.07-1	base class for SAX drivers and filters
libxml-sax-expat-perl	0.40-2	Perl module for a SAX2 driver for Expat (XML::Parser)
libxml-sax-perl	0.99+dfsg-2	Perl module for using and building Perl SAX2 XML processors
libxml2:amd64	2.9.1+dfsg1-5	GNOME XML library
libxmu6:amd64	2:1.1.2-1	X11 miscellaneous utility library
libxmuu1:amd64	2:1.1.2-1	X11 miscellaneous micro-utility library
libxpm4:amd64	1:3.5.11-1+b1	X11 pixmap library
libxrandr2:amd64	2:1.4.2-1+b1	X11 RandR extension library
libxrender1:amd64	1:0.9.8-1+b1	X Rendering Extension client library
libxshmfence1:amd64	1.1-4	X shared memory fences - shared library
libxt6:amd64	1:1.1.4-1+b1	X11 toolkit intrinsics library
libxtables10	1.4.21-2+b1	netfilter xtables library
libxtst6:amd64	2:1.2.2-1+b1	X11 Testing -- Record extension library
libxv1:amd64	2:1.0.10-1+b1	X11 Video extension library
libxxf86dga1:amd64	2:1.1.4-1+b1	X11 Direct Graphics Access extension library
libxxf86vm1:amd64	1:1.1.3-1+b1	X11 XFree86 video mode extension library
linux-base	3.5	Linux image base package
linux-compiler-gcc-4.8-x86	3.16.7-ckt11-1	Compiler for Linux on x86 (meta-package)
linux-headers-3.16.0-4-amd64	3.16.7-ckt11-1	Header files for Linux 3.16.0-4-amd64
linux-headers-3.16.0-4-common	3.16.7-ckt11-1	Common header files for Linux 3.16.0-4
linux-headers-amd64	3.16+63	Header files for Linux amd64 configuration (meta-package)
linux-image-3.16.0-4-amd64	3.16.7-ckt11-1	Linux 3.16 for 64-bit PCs
linux-image-amd64	3.16+63	Linux for 64-bit PCs (meta-package)
linux-kbuild-3.16	3.16-3	Kbuild infrastructure for Linux 3.16
linux-libc-dev:amd64	3.16.7-ckt11-1	Linux support headers for userspace development
live-manual	1:4.0.1-1	Live Systems Documentation (metapackage)
live-manual-epub	1:4.0.1-1	Live Systems Documentation (epub)
live-manual-html	1:4.0.1-1	Live Systems Documentation (html)

Component	Version	Description
live-manual-odf	1:4.0.1-1	Live Systems Documentation (odf)
live-manual-pdf	1:4.0.1-1	Live Systems Documentation (pdf)
live-manual-txt	1:4.0.1-1	Live Systems Documentation (txt)
live-tools	4.0.2-1.1	Live System Extra Components
locales	2.19-18	GNU C Library: National Language (locale) data [support]
lockfile-progs	0.1.17	Programs for locking and unlocking files and mailboxes
login	1:4.2-3	system login tools
logrotate	3.8.7-1+b1	Log rotation utility
lsb-base	4.1+Debian13+nmu1	Linux Standard Base 4.1 init script functionality
lsb-release	4.1+Debian13+nmu1	Linux Standard Base version reporting utility
lsuf	4.86+dfsg-1	Utility to list open files
m4	1.4.17-4	macro processing language
make	4.0-8.1	utility for directing compilation
man-db	2.7.0.2-5	on-line manual pager
manpages	3.74-1	Manual pages about using a GNU/Linux system
manpages-dev	3.74-1	Manual pages about using GNU/Linux for development
mawk	1.3.3-17	a pattern scanning and text processing language
memtest86+	5.01-2	thorough real-mode memory tester
menu	2.1.47	generates programs menu for all menu-aware applications
mime-support	3.58	MIME files 'mime.types' & 'mailcap', and support programs
mlocate	0.26-1	quickly find files on the filesystem based on their name
mount	2.25.2-6	Tools for mounting and manipulating filesystems
multiarch-support	2.19-18	Transitional package to ensure multiarch compatibility
mutt	1.5.23-3	text-based mailreader supporting MIME, GPG, PGP and threading
ncurses-base	5.9+20140913-1	basic terminal type definitions
ncurses-bin	5.9+20140913-1+b1	terminal-related programs and man pages
ncurses-term	5.9+20140913-1	additional terminal type definitions
net-tools	1.60-26+b1	NET-3 networking toolkit
netbase	5.3	Basic TCP/IP networking system
netcat-traditional	1.10-41	TCP/IP swiss army knife
nfacct	1.0.1-1.1	netfilter accounting object tool
nfs-common	1:1.2.8-9	NFS support files common to client and server
ntpdate	1:4.2.6.p5+dfsg-7	client for setting system time from NTP servers
opencsc	0.14.0-2	Smart card utilities with support for PKCS#15 compatible cards
opencsc-pkcs11:amd64	0.14.0-2	Smart card utilities with support for PKCS#15 compatible cards
openssh-client	1:6.7p1-5	secure shell (SSH) client, for secure access to remote machines
openssh-server	1:6.7p1-5	secure shell (SSH) server, for secure access from remote machines
openssh-sftp-server	1:6.7p1-5	secure shell (SSH) sftp server module, for SFTP

Component	Version	Description
		access from remote machines
openssl	1.0.1k-3+deb8u1	Secure Sockets Layer toolkit - cryptographic utility
openvpn	2.3.4-5	virtual private network daemon
os-prober	1.65	utility to detect other OSes on a set of drives
passwd	1:4.2-3	change and administer password and group data
patch	2.7.5-1	Apply a diff file to an original
pciutils	1:3.2.1-3	Linux PCI Utilities
perl	5.20.2-3+deb8u1	Larry Wall's Practical Extraction and Report Language
perl-base	5.20.2-3+deb8u1	minimal Perl system
perl-modules	5.20.2-3+deb8u1	Core Perl modules
php5	5.6.9+dfsg-0+deb8u1	server-side, HTML-embedded scripting language (metapackage)
php5-cli	5.6.9+dfsg-0+deb8u1	command-line interpreter for the php5 scripting language
php5-common	5.6.9+dfsg-0+deb8u1	Common files for packages built from the php5 source
php5-json	1.3.6-1	JSON module for php5
php5-readline	5.6.9+dfsg-0+deb8u1	Readline module for php5
pinentry-gtk2	0.8.3-2	GTK+-2-based PIN or pass-phrase entry dialog for GnuPG
pm-utils	1.4.1-15	utilities and scripts for power management
pmount	0.9.23-3+b1	mount removable devices as normal user
powermgmt-base	1.31+nmu1	Common utils and configs for power management
powertop	2.6.1-1	diagnose issues with power consumption and management
procps	2:3.3.9-9	/proc file system utilities
psmisc	22.21-2	utilities that use the proc file system
python	2.7.9-1	interactive high-level object-oriented language (default version)
python-apt	0.9.3.11	Python interface to libapt-pkg
python-apt-common	0.9.3.11	Python interface to libapt-pkg (locales)
python-chardet	2.3.0-1	universal character encoding detector for Python2
python-debian	0.1.27	Python modules to work with Debian-related data formats
python-debianbts	1.12	Python interface to Debian's Bug Tracking System
python-defusedxml	0.4.1-2	XML bomb protection for Python stdlib modules (for Python 2)
python-docutils	0.12+dfsg-1	text processing system for reStructuredText (implemented in Python 2)
python-minimal	2.7.9-1	minimal subset of the Python language (default version)
python-pil:amd64	2.6.1-2	Python Imaging Library (Pillow fork)
python-pkg-resources	5.5.1-1	Package Discovery and Resource Access using pkg_resources
python-pygments	2.0.1+dfsg-1.1	syntax highlighting package written in Python
python-reportbug	6.6.3	Python modules for interacting with bug

Component	Version	Description
		tracking systems
python-roman	2.0.0-1	module for generating/analyzing Roman numerals for Python 2
python-six	1.8.0-1	Python 2 and 3 compatibility library (Python 2 interface)
python-soappy	0.12.22-1	SOAP Support for Python
python-support	1.0.15	automated rebuilding support for Python modules
python-wstools	0.4.3-2	WSDL parsing tools Python module
python2.7	2.7.9-2	Interactive high-level object-oriented language (version 2.7)
python2.7-minimal	2.7.9-2	Minimal subset of the Python language (version 2.7)
readline-common	6.3-8	GNU readline and history libraries, common files
rename	0.20-3	Perl extension for renaming multiple files
rpcbind	0.2.1-6	converts RPC program numbers into universal addresses
rsync	3.1.1-3	fast, versatile, remote (and local) file-copying tool
rsyslog	8.4.2-1	reliable system and kernel logging daemon
sed	4.2.2-4+b1	The GNU sed stream editor
sensible-utils	0.0.9	Utilities for sensible alternative selection
sgml-base	1.26+nmu4	SGML infrastructure and SGML catalog file support
shared-mime-info	1.3-1	FreeDesktop.org shared MIME database and spec
snmp	5.7.2.1+dfsg-1	SNMP (Simple Network Management Protocol) applications
snmpd	5.7.2.1+dfsg-1	SNMP (Simple Network Management Protocol) agents
sqlite3	3.8.7.1-1+deb8u1	Command line interface for SQLite 3
ssh	1:6.7p1-5	secure shell client and server (metapackage)
ssl-cert	1.0.35	simple debconf wrapper for OpenSSL
startpar	0.59-3	run processes in parallel and multiplex their output
sudo	1.8.10p3-1+deb8u2	Provide limited super user privileges to specific users
sysstat	11.0.1-1	system performance tools for Linux
systemd	215-17+deb8u1	system and service manager
systemd-sysv	215-17+deb8u1	system and service manager - SysV links
sysv-rc	2.88dsf-59	System-V-like runlevel change mechanism
sysvinit-utils	2.88dsf-59	System-V-like utilities
tar	1.27.1-2+b1	GNU version of the tar archiving utility
task-english	3.31+deb8u1	General English environment
task-laptop	3.31+deb8u1	laptop
task-ssh-server	3.31+deb8u1	SSH server
tasksel	3.31+deb8u1	tool for selecting tasks for installation on Debian systems
tasksel-data	3.31+deb8u1	official tasks used for installation of Debian systems
tcpd	7.6.q-25	Wietse Venema's TCP wrapper utilities

Component	Version	Description
time	1.7-25	GNU time program for measuring CPU resource usage
traceroute	1:2.0.20-2+b1	Traces the route taken by packets over an IPv4/IPv6 network
tzdata	2015e-0+deb8u1	time zone and daylight-saving time data
ucf	3.003	Update Configuration File(s): preserve user changes to config files
udev	215-17+deb8u1	/dev/ and hotplug management daemon
usbmount	0.0.22	automatically mount and unmount USB mass storage devices
user-setup	1.61	Set up initial user and password
util-linux	2.25.2-6	Miscellaneous system utilities
util-linux-locales	2.25.2-6	Locales files for util-linux
uuid-runtime	2.25.2-6	runtime components for the Universally Unique ID library
vbetool	1.1-3	run real-mode video BIOS code to alter hardware state
vim	2:7.4.488-7	Vi IMproved - enhanced vi editor
vim-common	2:7.4.488-7	Vi IMproved - Common files
vim-runtime	2:7.4.488-7	Vi IMproved - Runtime files
vim-tiny	2:7.4.488-7	Vi IMproved - enhanced vi editor - compact version
w3m	0.5.3-19	WWW browsable pager with excellent tables/frames support
wamerican	7.1-1	American English dictionary words for /usr/share/dict
watchdog	5.14-3	system health checker and software/hardware watchdog handler
wget	1.16-1	retrieves files from the web
whiptail	0.52.17-1+b1	Displays user-friendly dialog boxes from shell scripts
whois	5.2.7	intelligent WHOIS client
wireless-regdb	2014.11.18-1	wireless regulatory database
wireless-tools	30~pre9-8	Tools for manipulating Linux Wireless Extensions
wpa_supplicant	2.3-1+deb8u1	client support for WPA and WPA2 (IEEE 802.11i)
x11-common	1:7.7+7	X Window System (X.Org) infrastructure
x11-utils	7.7+2	X11 utilities
xauth	1:1.0.9-1	X authentication utility
xbitmaps	1.1.1-2	Base X bitmaps
xdg-user-dirs	0.15-2	tool to manage well known user directories
xkb-data	2.12-1	X Keyboard Extension (XKB) configuration data
xml-core	0.13+nmu2	XML infrastructure and XML catalog file support
xterm	312-2	X terminal emulator
xz-utils	5.1.1alpha+20120614-2+b3	XZ-format compression utilities
zlib1g:amd64	1:1.2.8.dfsg-2+b1	compression library - runtime