

DA-681A Series Linux User's Manual

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DA-681A Series Linux User's Manual

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Introduction

Thank you for purchasing the Moxa DA-681A Series of x86 ready-to-run embedded computers. This manual introduces the software configuration and management of the DA-681A-LX, which runs the Linux operating system. For hardware installation, connector interfaces, setup, and upgrading the BIOS, please refer to the “DA-681A 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**
- ❑ **Product Features**
- ❑ **Software Specifications**

Overview

The Moxa DA-681A Series x86-based rack-mount embedded computers are designed for control, monitoring, data acquisition, and protocol conversion applications. With its robust design, the DA-681A is suitable for industrial automation applications, such as power automation, transportation, and oil and gas.

The DA-681A's main operating system is based on the 3rd Gen Intel® Core™ Celeron 1047UE 1.4 GHz CPU and HM65 chipset, which supports standard x86, 1 x VGA, 4 x USB, 6 Gigabit LAN ports, 2 RS/232/422/485 3-in-1 serial ports, and 10 RS-485 (RS-422 by CV) ports. The DA-681A has a mini PCIe socket for mSATA and comes with Linux pre-installed; Windows 7 Embedded is also supported by the CTOS (Configuration to Order Service) process.

Another plus is that the serial ports come with 2 kV digital galvanic isolation protection to guarantee communication reliability in harsh industrial environments. In addition, the state-of-art IEC 61850-3, IEEE 1613, and IEC 60255 compliance all-in-one design provides rich interfaces especially well suited for of power substation automation applications.

Product Features

The DA-681A Series Basic System has the following features:

- IEC 61850-3, IEEE 1613, and IEC 60255 compliant for power substation automation systems (DPP and DPP-T models only)
- 3rd Gen Intel® Core™ Celeron 1047UE 1.4 GHz CPU
- 1 built-in DDR3 memory socket
- 1 mSATA for OS and 1 SATA III for storage expansion
- 6 Gigabit Ethernet ports for network redundancy
- 4 USB 2.0 ports for high speed peripherals
- 2 isolated RS-232/422/485 and 10 isolated RS-485 ports
- Embedded Debian 8 Linux (W7E by CTOS)
- Supports both 100 to 240 VAC and VDC power inputs (single power and dual power models available)
- Optional IRIG-B expansion module available on DPP and DPP-T models

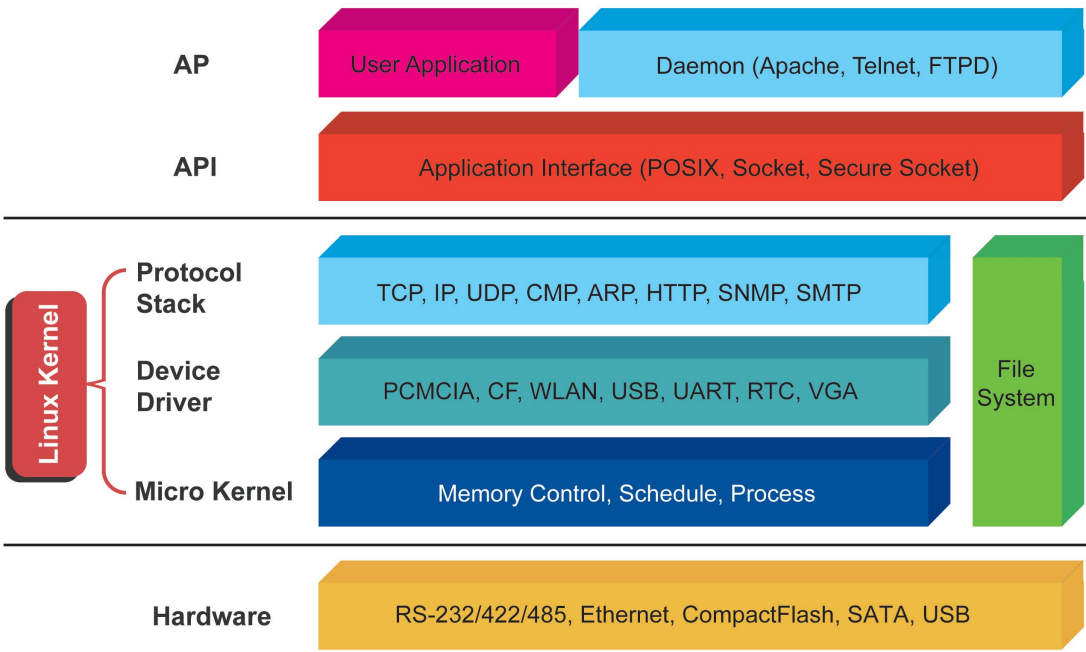


ATTENTION

Refer to section “Baud Rate Speed” for calculation of baud rate speed supported.

Software Specifications

The Linux operating system pre-installed on the DA-681A 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. In addition to Standard POSIX APIs, device drivers for Moxa UART and other special peripherals are also included. An example software architecture is shown below:



ATTENTION

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



ATTENTION

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

Software Configuration

In this chapter, we explain how to operate a DA-681A-LX computer directly or from a PC near you. There are three ways to connect to the DA-681A-LX computer: through VGA monitor, by using Telnet over the network, 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 a VGA 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 a VGA Console

Connect the display monitor to the DA-681A-LX VGA 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:
Last login: Fri Aug 21 09:03:18 2015 from 192.168.31.41
Linux Moxa 3.16.0-4-amd64 #1 SMP Debian 3.16.7-ckt11-1+deb8u3 (2015-08-04) x86_64
GNU/Linux

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

For further information check:
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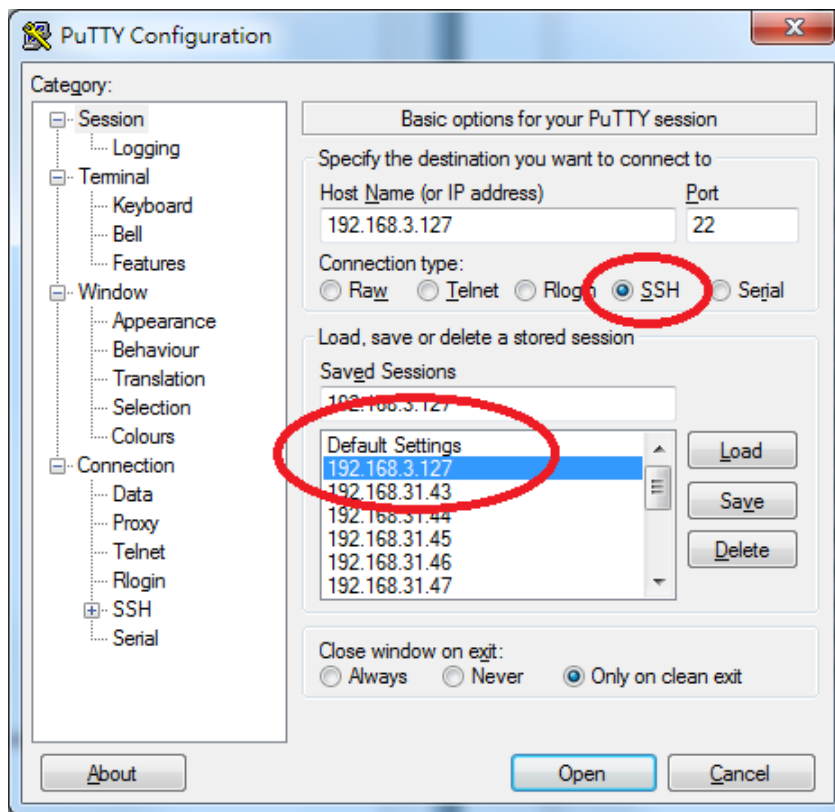
moxa@Moxa:~$
```

Connecting from an SSH Console

The DA-681A-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 DA-681A-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 DA-681A-LX's console utility via SSH.

```
#ssh 192.168.3.127
```

Select **yes** to open the connection.

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

Adjusting the System Time

The DA-681A-LX has two time settings. One is the system time, and the other is provided by an RTC (Real Time Clock) built into the DA-681A-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.

```
# 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 -w
```

```
root@Moxa:/home/moxa# date
Tue Jun 30 10:10:23 EDT 2015
root@Moxa:/home/moxa# hwclock
Tue 30 Jun 2015 10:10:26 AM EDT -0.987182 seconds
root@Moxa:/home/moxa# date 063010112015
Tue Jun 30 10:11:00 EDT 2015
root@Moxa:/home/moxa# hwclock -w
root@Moxa:/home/moxa# date ; hwclock
Tue Jun 30 10:11:20 EDT 2015
Tue 30 Jun 2015 10:11:21 AM EDT -0.245011 seconds
root@Moxa:/home/moxa#
```

NTP Client

The DA-681A-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:/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#
```



ATTENTION

Before using the NTP client utility, check your IP address and network settings 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 DA-681A 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, which are named after accounts in `/etc/passwd`.

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
0 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.nist.gov
hwclock -w
exit 0
```

2. Change mode of `fixtime.sh`

```
# 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:

```
0 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,fmask=0022,dmask=0022,codepage=437,iocha
rset=utf8,shortname=mixed,errors=remount-ro)
/dev/sdc1 on /media/usb1 type vfat
(rw,nodev,noexec,noatime,nodiratime,sync,fmask=0022,dmask=0022,codepage=437,iocha
rset=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 DA-681A-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:

❑ Changing the Network Settings

- Changing the "interfaces" Configuration File
- Adjusting IP Addresses with "ifconfig"

❑ DNS Client

- /etc/hostname
- /etc/resolv.conf
- /etc/nsswitch.conf

❑ Apache Web Server

- Default Homepage

❑ IPTABLES

- IPTABLES Hierarchy
- IPTABLES Modules
- Observe and Erase Chain Rules
- Define Policy for Chain Rules
- Append or Delete Rules

❑ NAT (Network Address Translation)

- NAT Example
- Enabling NAT at Bootup

❑ PPP (Point to Point Protocol)

- Connecting to a PPP Server over a Simple Dial-up Connection
- Connecting to a PPP Server over a Hard-wired Link
- Checking the Connection
- Setting up a Machine for Incoming PPP Connections

❑ PPPoE

❑ NFS (Network File System) Client

❑ SNMP (Simple Network Management Protocol)

❑ OpenVPN

- Ethernet Bridging for Private Networks on Different Subnets
- Ethernet Bridging for Private Networks on the Same Subnet
- Routed IP

Changing the Network Settings

The DA-681A-LX computer has 6 Ethernet ports named LAN1 to LAN6. The default IP addresses and netmasks of the network interfaces are as follows:

	Default IP Address	Netmask
LAN 1	192.168.3.127	255.255.255.0
LAN 2	192.168.4.127	255.255.255.0
LAN 3	192.168.5.127	255.255.255.0
LAN 4	192.168.6.127	255.255.255.0
LAN 5	192.168.7.127	255.255.255.0
LAN 6	192.168.8.127	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 directory.

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

2. Type **vi interfaces** to edit the network configuration file with **vi** editor. You can configure the DA-681A-LX's Ethernet ports for static or dynamic (DHCP) IP addresses.

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

Static IP Address

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

```
# The loopback network interface
auto lo eth0 eth1 eth2 eth3 eth4 eth5
iface lo inet loopback

# The primary network interface
allow-hotplug eth0
iface eth0 inet static
    address 192.168.3.127
    netmask 255.255.255.0
    broadcast 192.168.3.255

allow-hotplug eth1
iface eth1 inet static
    address 192.168.4.127
    netmask 255.255.255.0
    broadcast 192.168.4.255

allow-hotplug eth2
iface eth2 inet static
    address 192.168.5.127
    netmask 255.255.255.0
    broadcast 192.168.5.255
```

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
allow-hotplug eth0
iface eth0 inet dhcp
```

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

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

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

Adjusting IP Addresses with “ifconfig”

IP settings can be adjusted during run-time, but the new settings will not be saved to the flash ROM without modifying the file **/etc/network/interfaces**. For example, type the command **# ifconfig eth1 192.168.1.1** to change the IP address of LAN1 to 192.168.1.1.

```
MOXA:~# ifconfig eth1 192.168.1.1
MOXA:~#
```

DNS Client

The DA-681A-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:~# vi /etc/hostname
MOXA
```

2. Re-configure the hostname.

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

3. Check the new hostname.

```
MOXA:~# hostname
```

/etc/resolv.conf

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

```
nameserver 168.95.1.1
```

```
MOXA:/etc# cat resolv.conf
```

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

/etc/nsswitch.conf

This file defines the sequence of files, **/etc/hosts** or **/etc/resolv.conf**, to be read to resolve the IP address.

The **hosts** line in **/etc/nsswitch.conf** means use **/etc/host** first and DNS service to resolve the address.

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

passwd:          compat
group:           compat
shadow:          compat

hosts:           files dns
networks:        files

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

netgroup:        nis
```

Apache Web Server

Default Homepage

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

Save your own homepage to the following directory:

/var/www/html/

Save your CGI page to the following directory:

/var/www/html/cgi-bin/

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

http://192.168.3.127/

To test the default CGI page, type:

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



ATTENTION

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

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 DA-681A-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 packet IP address.

Destination NAT (DNAT)—changes the first destination packet IP address.

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

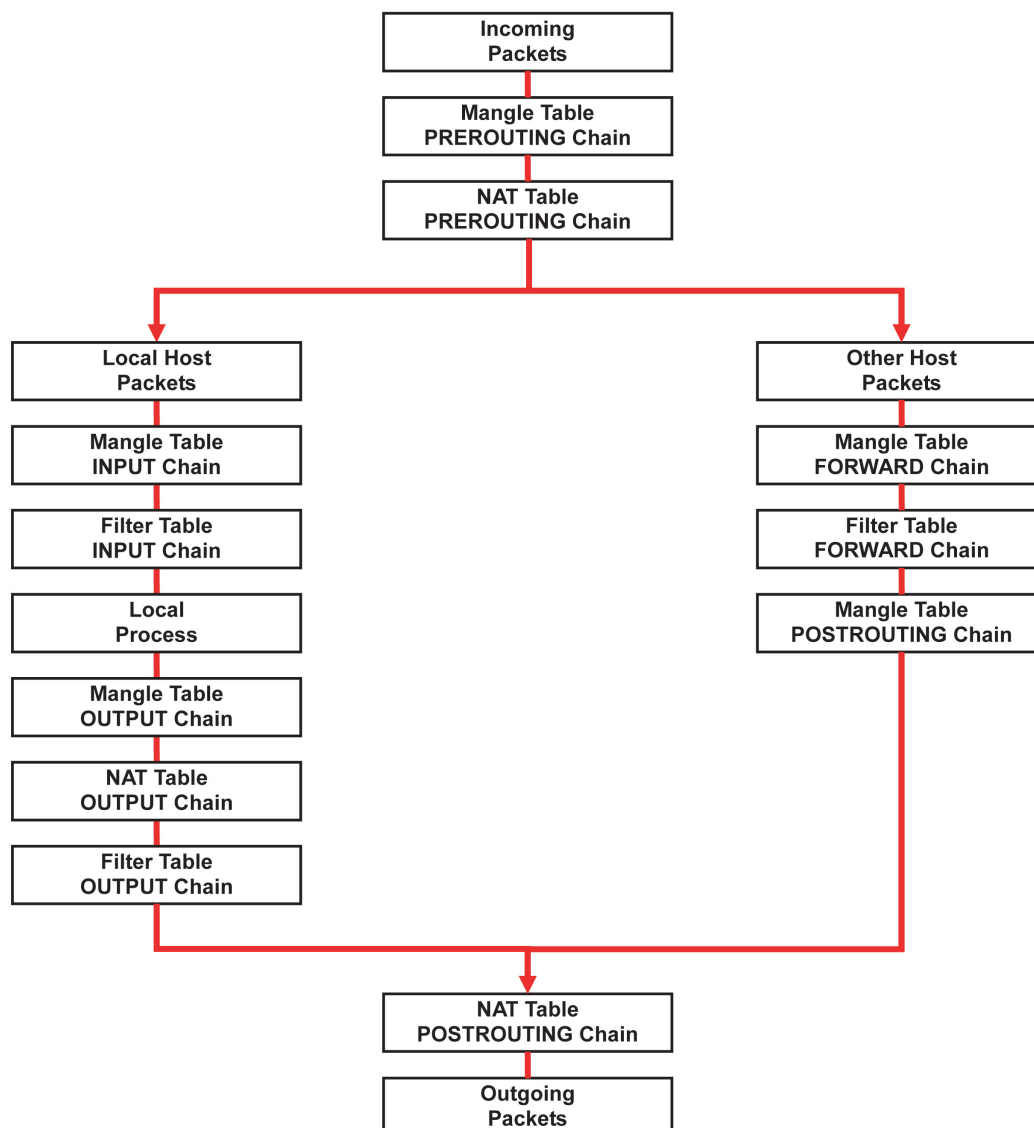
PREROUTING chain—pre-processes packets before the routing process.

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 DA-681A-LX supports the following sub-modules. Be sure to 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
```

Use **lsmod** to check if the **ip_tables** module has already been loaded in the DA-681A-LX. Use **modprobe** to insert and enable the module.

Use the following command to load the modules (**iptables_filter**, **iptables_mangle**, **iptables_nat**):

```
# modprobe iptable_filter
```

Use **iptables**, **iptables-restore**, **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.

Examples:

```
# 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 DA-681A-LX.
- OUTPUT: For locally-generated packets.
- FORWARD: For packets routed out through the DA-681A-LX.
- PREROUTING: To alter packets as soon as they come in.
- POSTROUTING: To alter packets as they are about to be sent out.

Examples:

```
#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] [-A] [INPUT, OUTPUT, FORWARD] [-i 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 DA-681A-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 DA-681A-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 DA-681A-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.



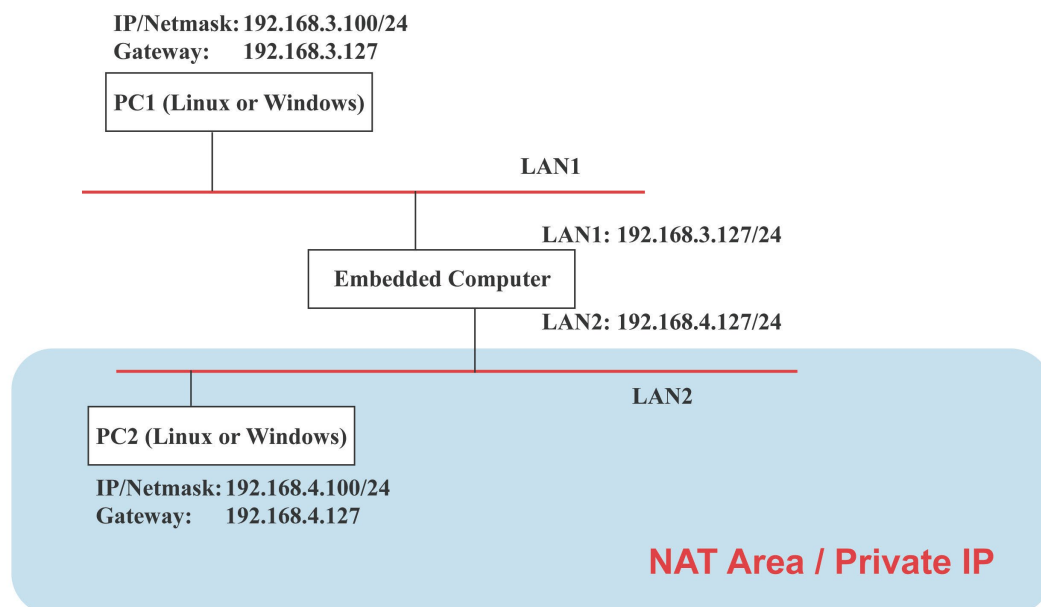
ATTENTION

Click on the following links 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`):



```
#ehco 1 > /proc/sys/net/ipv4/ip_forward
```

```
#modprobe ipt_MASQUERADE
```

```
#iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE
```

Enabling NAT at Bootup

In most real world situations, you will want to use a simple shell script to enable NAT when the DA-681A-LX boots up. The following script is an example.

```
#!/bin/bash
# If you put this shell script in the /home/nat.sh
# Remember to chmod 744 /home/nat.sh
# Edit the rc.local file to make this shell startup automatically.
# vi /etc/rc.local
# Add a line in the end of rc.local /home/nat.sh

EXIF= "eth0" #This is an external interface for setting up a valid IP address.
EXNET= "192.168.4.0/24" #This is an internal network address.

# Step 1. Insert modules.

# Here 2> /dev/null means the standard error messages will be dump to null device.

modprobe ip_tables 2> /dev/null
modprobe ip_nat_ftp 2> /dev/null
modprobe ip_nat_irc 2> /dev/null
modprobe ip_conntrack 2> /dev/null
modprobe ip_conntrack_ftp 2> /dev/null
modprobe ip_conntrack_irc 2> /dev/null

# Step 2. Define variables, enable routing and erase default rules.

PATH=/bin:/sbin:/usr/bin:/usr/sbin:/usr/local/bin:/usr/local/sbin
export PATH
echo "1" > /proc/sys/net/ipv4/ip_forward
/sbin/iptables -F
/sbin/iptables -X
/sbin/iptables -Z
/sbin/iptables -F -t nat
/sbin/iptables -X -t nat
/sbin/iptables -Z -t nat
/sbin/iptables -P INPUT ACCEPT
/sbin/iptables -P OUTPUT ACCEPT
/sbin/iptables -P FORWARD ACCEPT
/sbin/iptables -t nat -P PREROUTING ACCEPT
/sbin/iptables -t nat -P POSTROUTING ACCEPT
/sbin/iptables -t nat -P OUTPUT ACCEPT

# Step 3. Enable IP masquerade.
```

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 DA-681A-LX's Ethernet port. Since PPP is a peer-to-peer system, the DA-681A-LX can also use PPP to link two networks (or a local network to the Internet) to create a Wide Area Network (WAN).

**ATTENTION**

Click on the following links for more information about PPP.

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

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

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

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

```
#pppd connect 'chat -v "" ATDT5551212 CONNECT ""' ogin: username word: password'
/dev/ttyMO 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/ttyMO 115200 crtscts modem
```

The pppd options are described below:

connect 'chat etc...'	This option gives the command to contact the PPP server. The chat program is used to dial a remote computer. The entire command is enclosed in single quotes because pppd expects a one-word argument for the connect option. The options for chat are given below:
-v	verbose mode; log what we do to syslog
" "	Double quotes—don't wait for a prompt, but instead do ... (note that you must include a space after the second quotation mark)
ATDT5551212	Dial the modem, and then ...
CONNECT	Wait for an answer.
" "	Send a return (null text followed by the usual return)
ogin: username word: password	Log in with username and password.

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 computer and modem (at 115200 this is a must).
modem	Indicates that this is a modem device; pppd will hang up the phone before and after making the call.
defaultroute	Once the PPP link is established, make it the default route; if you have a PPP link to the Internet, this is probably what you want.
192.1.1.17	This is a degenerate case of a general option of the form x.x.x.x:y.y.y.y. Here x.x.x.x is the local IP address and y.y.y.y is the IP address of the remote end of the PPP connection. If this option is not specified, or if just one side is specified, then x.x.x.x defaults to the IP address associated with the local machine's hostname (located in /etc/hosts), and y.y.y.y is determined by the remote machine.

Connecting to a PPP Server over a Hard-wired Link

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

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

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

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

Checking the Connection

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

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

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

ppp0 should be one of them, and you should recognize the first IP address as your own and the **P-t-P address** (point-to-point address, the address of your server). The output is 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 is similar to the following:

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

Try typing:

```
#netstat -nr
```

This should show 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    10
0.0.0.0       129.67.1.165 0.0.0.0      UG        0      0   6298
ppp0
```

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

Setting up a Machine for Incoming PPP Connections

Method 1: `pppd` dial-in with `pppd` commands

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

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

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

```
* * "" *
```

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

The following example does not check the username and password:

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

Method 2: `pppd` dial-in with `pppd` script

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

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

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

# Set up routing to go through this PPP link
defaultroute

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

# Speed
115200
```

```
# Keep modem up even if connection fails
persist
crtsets
modem
192.168.16.1:192.168.16.2
debug
-detach
```

Configure the chat script `/etc/ppp/ppp-ttyM0.chat`

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

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

```
# pppd call dialin
```



ATTENTION

If you hope to have auto dial-in service, you can respawn the dial-in service in `/etc/inittab`.

```
MOXA:~# echo "p0:2345:respawn:pppd call dialin" >> /etc/inittab
```

PPPoE

The following procedure is for setting up PPPoE:

1. Connect the DA-681A-LX's LAN port to an ADSL modem with a cross-over cable, HUB, or switch.
2. Log in to the DA-681A-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 file **/etc/ppp/options.eth0**. If you use LAN2 to connect to the ADSL modem, then 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 desired.

7. Set up DNS.

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

```
nameserver ip_addr_of_first_dns_server
nameserver ip_addr_of_second_dns_server
```

For example:

```
nameserver 168.95.1.1
nameserver 139.175.10.20
```

```
MOXA:/etc# cat resolv.conf
#
# resolv.conf This file is the resolver configuration file
# See resolver(5).
#
#nameserver 192.168.1.16
nameserver 168.95.1.1
nameserver 139.175.10.20
nameserver 140.115.1.31
nameserver 140.115.236.10
MOXA:/etc#
```

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

```
#pppd eth0
```

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 it, 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 DA-681A-LX without worrying about the amount of disk space that will be available. The DA-681A-LX supports only NFS client protocol.



ATTENTION

Click on the following links for more information about NFS.

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

<http://nfs.sourceforge.net/nfs-howto/client.html>

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

1. Scan the NFS Server's shared directory.

```
#showmount -e HOST
```

showmount: Show the mount information of an NFS Server

-e: Show 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 192.168.3.100/home/public /home/nfs/public
```

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

SNMP (Simple Network Management Protocol)

The DA-681A-LX comes with the SNMP V1 (Simple Network Management Protocol) agent software pre-installed. It supports RFC1317 **RS-232 like group** and **RFC 1213 MIB-II**. The following example shows an SNMP agent responding to a query from the SNMP browser on the host site:

```
root@Moxa:/home/moxa# snmpwalk -v 2c -c public localhost
iso.3.6.1.2.1.1.1.0 = STRING: "Linux Moxa 3.16.0-4-amd64 #1 SMP Debian 3.16.7-ckt9-2
(2015-04-13) x86_64"
iso.3.6.1.2.1.1.2.0 = OID: iso.3.6.1.4.1.8691.12.681
iso.3.6.1.2.1.1.3.0 = Timeticks: (2075188) 5:45:51.88
iso.3.6.1.2.1.1.4.0 = STRING: "Moxa Inc., Embedded Computing Business. <www.moxa.com>"
iso.3.6.1.2.1.1.5.0 = STRING: "Moxa"
iso.3.6.1.2.1.1.6.0 = STRING: "Fl.4, No.135, Lane 235, Baoquao Rd., Xindian Dist.,
New Taipei City, Taiwan, R.O.C."
iso.3.6.1.2.1.1.7.0 = INTEGER: 72
iso.3.6.1.2.1.1.8.0 = Timeticks: (6) 0:00:00.06
iso.3.6.1.2.1.1.9.1.2.1 = OID: iso.3.6.1.6.3.11.3.1.1
iso.3.6.1.2.1.1.9.1.2.2 = OID: iso.3.6.1.6.3.15.2.1.1
iso.3.6.1.2.1.1.9.1.2.3 = OID: iso.3.6.1.6.3.10.3.1.1
iso.3.6.1.2.1.1.9.1.2.4 = OID: iso.3.6.1.6.3.1
iso.3.6.1.2.1.1.9.1.2.5 = OID: iso.3.6.1.2.1.49
iso.3.6.1.2.1.1.9.1.2.6 = OID: iso.3.6.1.2.1.4
iso.3.6.1.2.1.1.9.1.2.7 = OID: iso.3.6.1.2.1.50
iso.3.6.1.2.1.1.9.1.2.8 = OID: iso.3.6.1.6.3.16.2.2.1
iso.3.6.1.2.1.1.9.1.2.9 = OID: iso.3.6.1.6.3.13.3.1.3
iso.3.6.1.2.1.1.9.1.2.10 = OID: iso.3.6.1.2.1.92
iso.3.6.1.2.1.1.9.1.3.1 = STRING: "The MIB for Message Processing and Dispatching."
iso.3.6.1.2.1.1.9.1.3.2 = STRING: "The management information definitions for the SNMP
User-based Security Model."
iso.3.6.1.2.1.1.9.1.3.3 = STRING: "The SNMP Management Architecture MIB."
iso.3.6.1.2.1.1.9.1.3.4 = STRING: "The MIB module for SNMPv2 entities"
iso.3.6.1.2.1.1.9.1.3.5 = STRING: "The MIB module for managing TCP implementations"
iso.3.6.1.2.1.1.9.1.3.6 = STRING: "The MIB module for managing IP and ICMP
implementations"
iso.3.6.1.2.1.1.9.1.3.7 = STRING: "The MIB module for managing UDP implementations"
iso.3.6.1.2.1.1.9.1.3.8 = STRING: "View-based Access Control Model for SNMP."
iso.3.6.1.2.1.1.9.1.3.9 = STRING: "The MIB modules for managing SNMP Notification,
plus filtering."
iso.3.6.1.2.1.1.9.1.3.10 = STRING: "The MIB module for logging SNMP Notifications."
iso.3.6.1.2.1.1.9.1.4.1 = Timeticks: (6) 0:00:00.06
iso.3.6.1.2.1.1.9.1.4.2 = Timeticks: (6) 0:00:00.06
iso.3.6.1.2.1.1.9.1.4.3 = Timeticks: (6) 0:00:00.06
iso.3.6.1.2.1.1.9.1.4.4 = Timeticks: (6) 0:00:00.06
iso.3.6.1.2.1.1.9.1.4.5 = Timeticks: (6) 0:00:00.06
iso.3.6.1.2.1.1.9.1.4.6 = Timeticks: (6) 0:00:00.06
iso.3.6.1.2.1.1.9.1.4.7 = Timeticks: (6) 0:00:00.06
iso.3.6.1.2.1.1.9.1.4.8 = Timeticks: (6) 0:00:00.06
iso.3.6.1.2.1.1.9.1.4.9 = Timeticks: (6) 0:00:00.06
iso.3.6.1.2.1.1.9.1.4.10 = Timeticks: (6) 0:00:00.06
```

```
iso.3.6.1.2.1.25.1.1.0 = Timeticks: (55561825) 6 days, 10:20:18.25
iso.3.6.1.2.1.25.1.2.0 = Hex-STRING: 07 DF 09 03 0A 2C 05 00 2B 08 00
iso.3.6.1.2.1.25.1.3.0 = INTEGER: 393216
iso.3.6.1.2.1.25.1.4.0 = STRING: "BOOT_IMAGE=/boot/vmlinuz-3.16.0-4-amd64
root=LABEL=DA681A_MOXA ro initrd=/install/initrd.gz quiet
"
iso.3.6.1.2.1.25.1.5.0 = Gauge32: 3
iso.3.6.1.2.1.25.1.6.0 = Gauge32: 42
iso.3.6.1.2.1.25.1.7.0 = INTEGER: 0
iso.3.6.1.2.1.25.1.7.0 = No more variables left in this MIB View (It is past the end
of the MIB tree)
```



ATTENTION

Click on the following links for more information about RFC1317 RS-232 like group and RFC 1213 MIB-II.
<http://www.tldp.org/HOWTO/NFS-HOWTO/index.html>
<http://nfs.sourceforge.net/nfs-howto/client.html>

OpenVPN

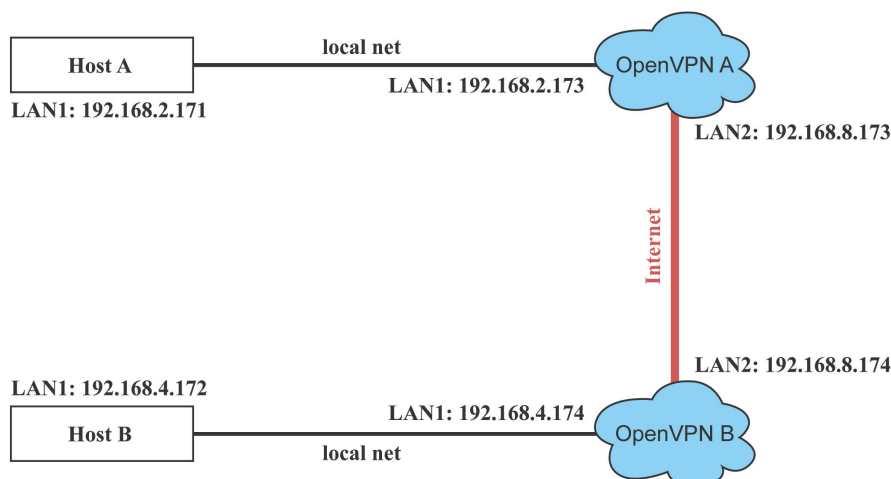
OpenVPN provides two types of tunnels for users to implement VPNs: **Routed IP Tunnels** and **Bridged Ethernet Tunnels**.

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 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 purpose.

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

```
# 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
```

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

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

6. 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
```

7. 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
```

8. 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
```

9. 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.

10. 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
```

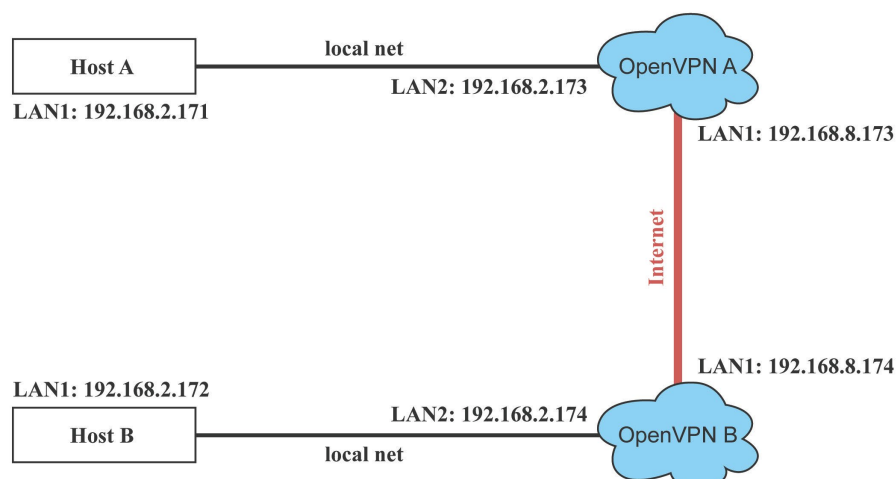
A successful ping indicates that you have created a VPN system that only allows authorized users from one internal network to access users at the remote site. For this system, all data is transmitted by UDP packets on port 5000 between OpenVPN peers.

11. 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.

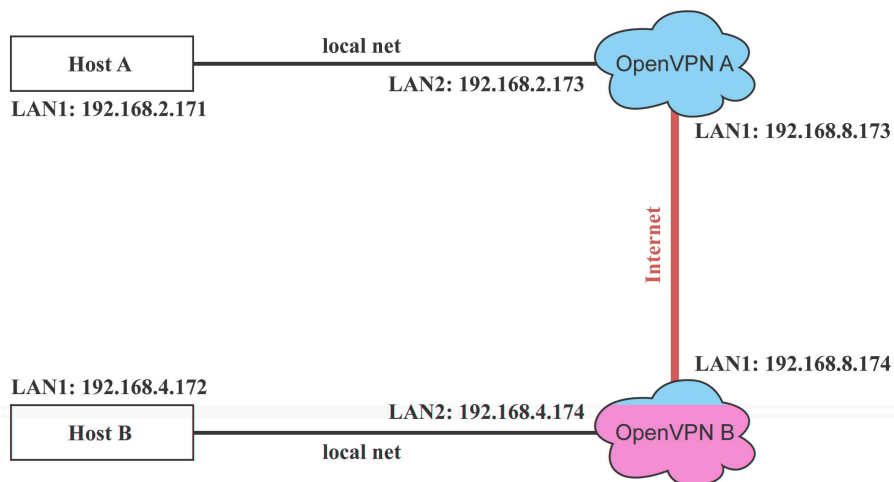


- The configuration procedure is almost the same as for the previous example. The only difference is that you will need to comment out the parameter **up** in **/etc/openvpn/tap0-br.conf** of OpenVPN A and **/etc/openvpn/tap0-br.conf** of OpenVPN B.

```
# 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

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



- 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
#-----end-----
```

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

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

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

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

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

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

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

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

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

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

The following topics are covered in this chapter:

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

Device API

The DA-681A 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 to ready the product information. The command is:

```
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 DA-681A supports standard Linux simple RTC control. You must include `<linux/rtc.h>`.

1. Function: `RTC_RD_TIME`

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

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

2. Function: `RTC_SET_TIME`

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

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

UART

The normal tty device nodes are `/dev/ttyM0` to `/dev/ttyM3`. The DA-681A supports standard Linux termios control with RS-232/422/485 serial ports.

Usage: `setinterface <device node> <interface-no>`

Device: The uart device node

interface-no: 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 uart interface, use:

```
# setinterface /dev/ttyM0 2
```

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 DA-681A. 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 1 seconds. The realtime is to lock itself into memory, so 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.

```
# Defaults compiled into the binary
#admin          = root
#interval       = 1
#logtick        = 1
#log-dir        = /var/log/watchdog
```

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

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

Check the run level removal.

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

IOCTL	WDIOC_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	WDIOC_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	WDIOC_KEEPAIVE
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 <https://www.kernel.org/doc/Documentation/watchdog/src/watchdog-test.c> acks the watchdog every 1 seconds.

```

/*
 * Watchdog Driver Test Program
 */

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <unistd.h>
#include <fcntl.h>
#include <signal.h>
#include <sys/ioctl.h>
#include <linux/types.h>
#include <linux/watchdog.h>

int fd;

/*
 * This function simply sends an IOCTL to the driver, which in turn ticks
 * the PC Watchdog card to reset its internal timer so it doesn't trigger
 * a computer reset.
 */
static void keep_alive(void)
{
    int dummy;

    ioctl(fd, WDIOC_KEEPAIVE, &dummy);
}

/*
 * The main program. Run the program with "-d" to disable the card,
 * or "-e" to enable the card.
 */

static void term(int sig)
{
    close(fd);
    fprintf(stderr, "Stopping watchdog ticks...\n");
}

```

```

    exit(0);
}

int main(int argc, char *argv[])
{
    int flags;
    unsigned int ping_rate = 1;

    fd = open("/dev/watchdog", O_WRONLY);

    if (fd == -1) {
        fprintf(stderr, "Watchdog device not enabled.\n");
        fflush(stderr);
        exit(-1);
    }

    if (argc > 1) {
        if (!strncasecmp(argv[1], "-d", 2)) {
            flags = WDIOS_DISABLECARD;
            ioctl(fd, WDIOC_SETOPTIONS, &flags);
            fprintf(stderr, "Watchdog card disabled.\n");
            fflush(stderr);
            goto end;
        } else if (!strncasecmp(argv[1], "-e", 2)) {
            flags = WDIOS_ENABLECARD;
            ioctl(fd, WDIOC_SETOPTIONS, &flags);
            fprintf(stderr, "Watchdog card enabled.\n");
            fflush(stderr);
            goto end;
        } else if (!strncasecmp(argv[1], "-t", 2) && argv[2]) {
            flags = atoi(argv[2]);
            ioctl(fd, WDIOC_SETTIMEOUT, &flags);
            fprintf(stderr, "Watchdog timeout set to %u seconds.\n", flags);
            fflush(stderr);
            goto end;
        } else if (!strncasecmp(argv[1], "-p", 2) && argv[2]) {
            ping_rate = strtoul(argv[2], NULL, 0);
            fprintf(stderr, "Watchdog ping rate set to %u seconds.\n", ping_rate);
            fflush(stderr);
        } else {
            fprintf(stderr, "-d to disable, -e to enable, -t <n> to set " \
                "the timeout,\n-p <n> to set the ping rate, and \n");
            fprintf(stderr, "run by itself to tick the card.\n");
            fflush(stderr);
            goto end;
        }
    }

    fprintf(stderr, "Watchdog Ticking Away!\n");
    fflush(stderr);

    signal(SIGINT, term);

    while(1) {

```

```
        keep_alive();  
        sleep(ping_rate);  
    }  
end:  
    close(fd);  
    return 0;  
}
```

System Recovery

The DA-681A-LX is installed with the Embedded Linux operating system, which is located in the mSATA shipped with the DA-681A-LX computer. Although it happens rarely, 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:

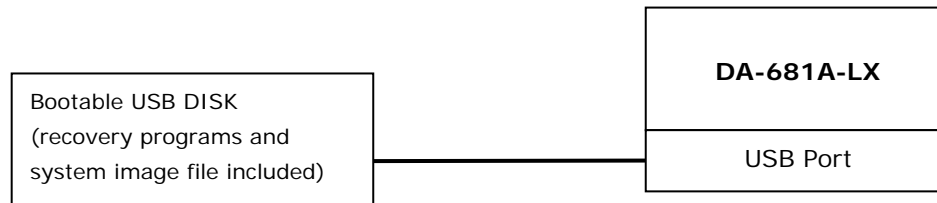
- ❑ **Recovery Environment**
- ❑ **Recovery Procedure**
- ❑ **Saving the System to the USB Drive**

Recovery Environment

The recovery environment includes the DA-681A embedded computer and a bootable USB disk with the recovery programs and system image file.

Hardware

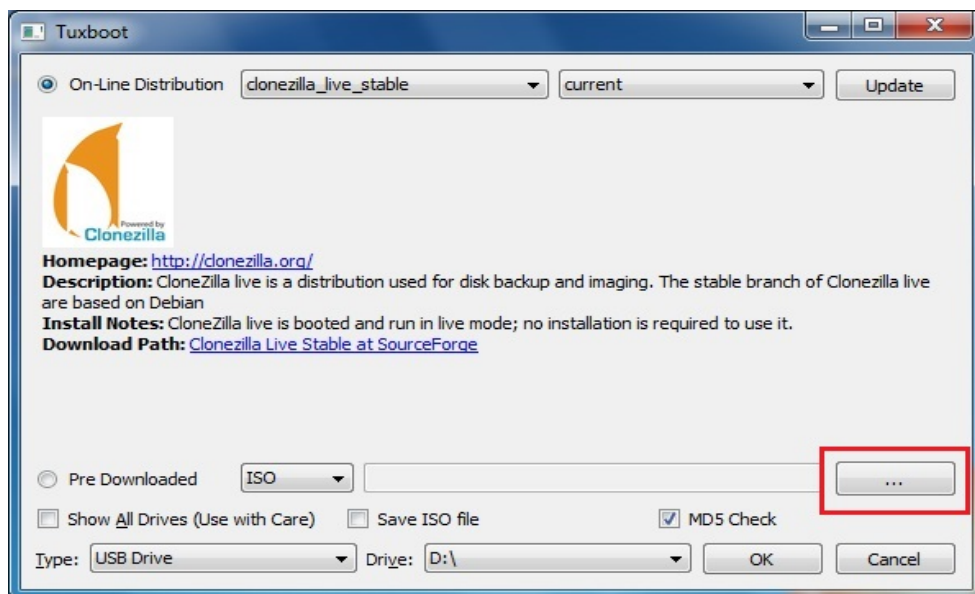
The hardware used includes a PC, a DA-681A computer and a USB disk with the recovery programs. **(Note: The USB disk should be at least 2 GB.)**



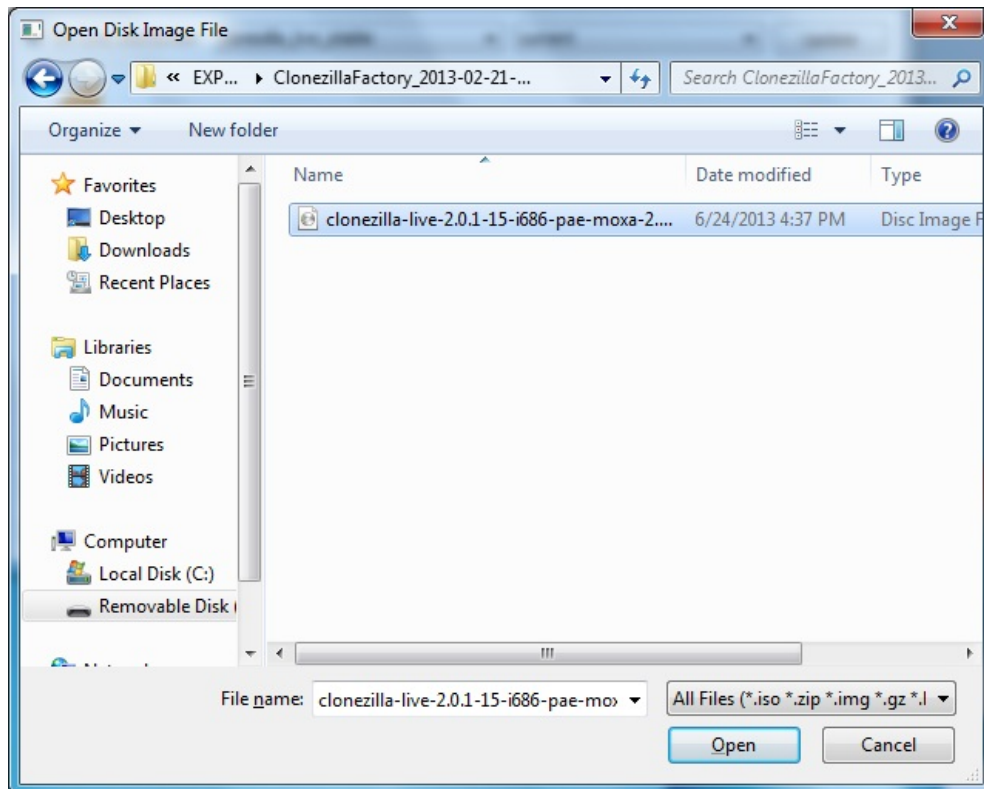
Recovery Procedure

Step 1: Prepare your USB drive

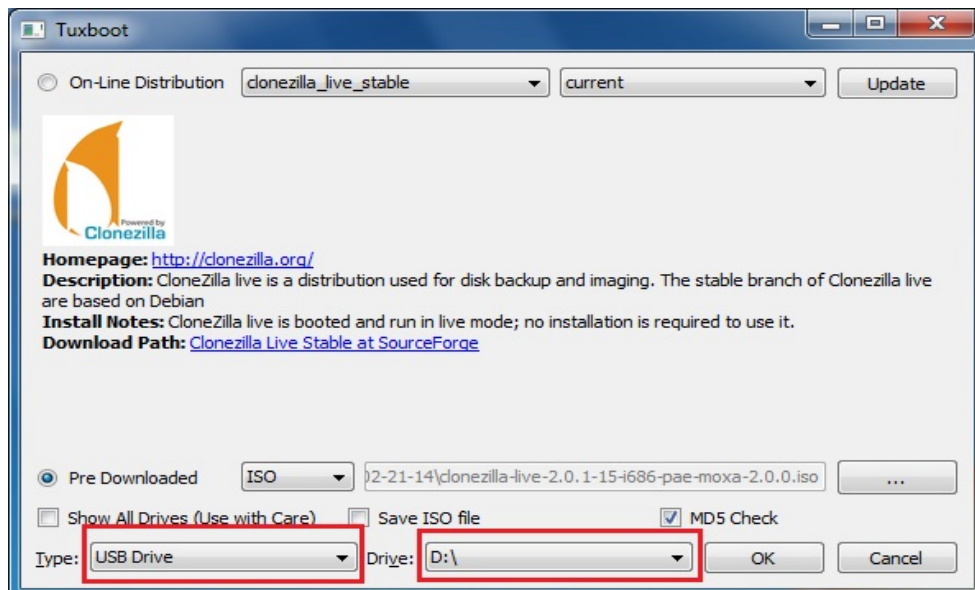
1. Execute **tuxboot-windows-23.exe** from the <Software DVD> \Recovery\DA-681A-LX_V1.0_FW folder on the Software CD, select **Pre Download**, and then click "..."



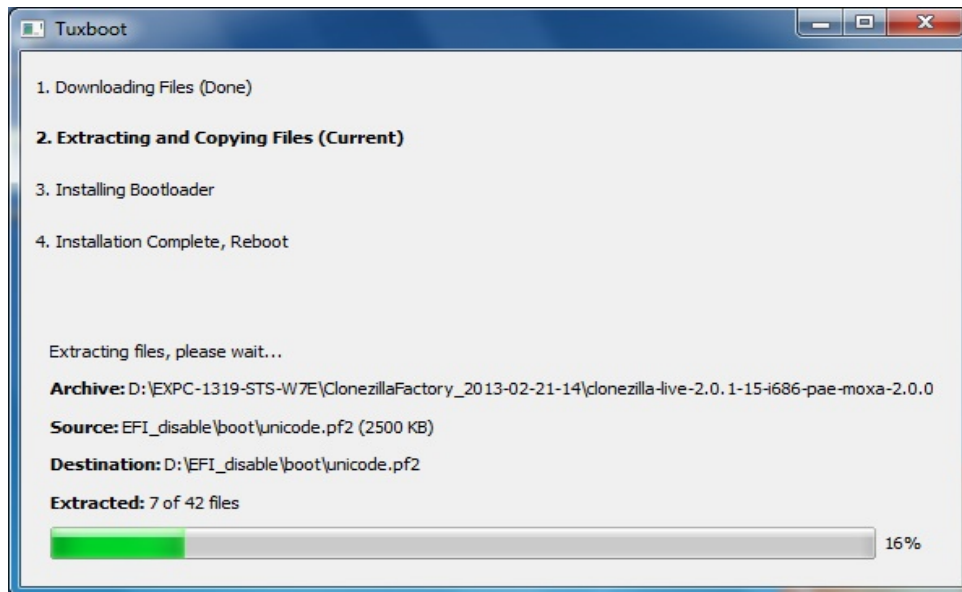
2. Select the ISO file in the directory <Software DVD> \Recovery\DA-681A-LX_V1.0_FW



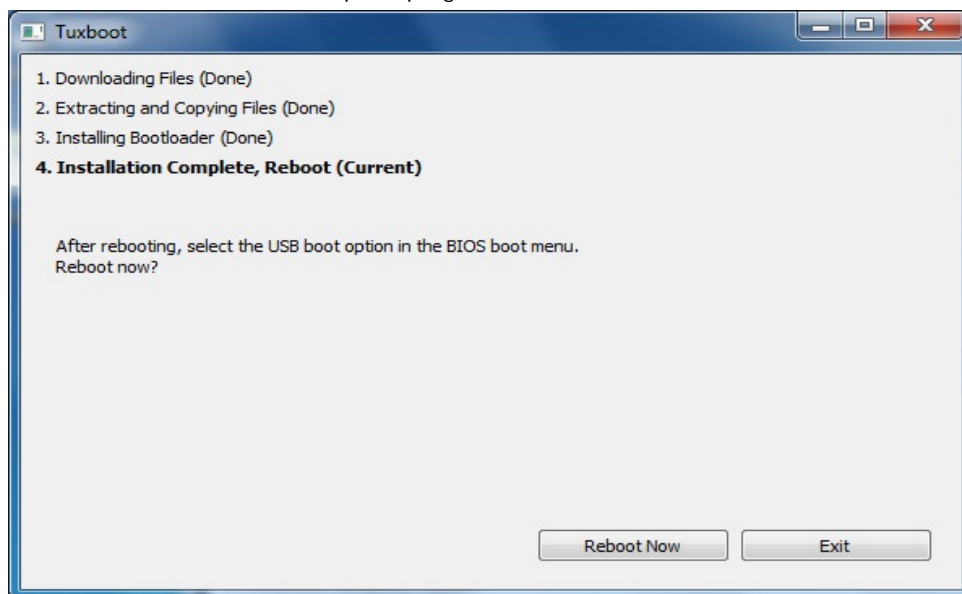
3. Select **USB Drive** type, select a **Drive**, and then click **OK** to continue.



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



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



6. Manually copy the **os_image** directory from the **<Software DVD>** \Recovery\DA-681A-LX_V1.0_FW\1.0_Build_15092410\Clonezilla folder on the Software DVD to \home\partimag\ on the USB drive.

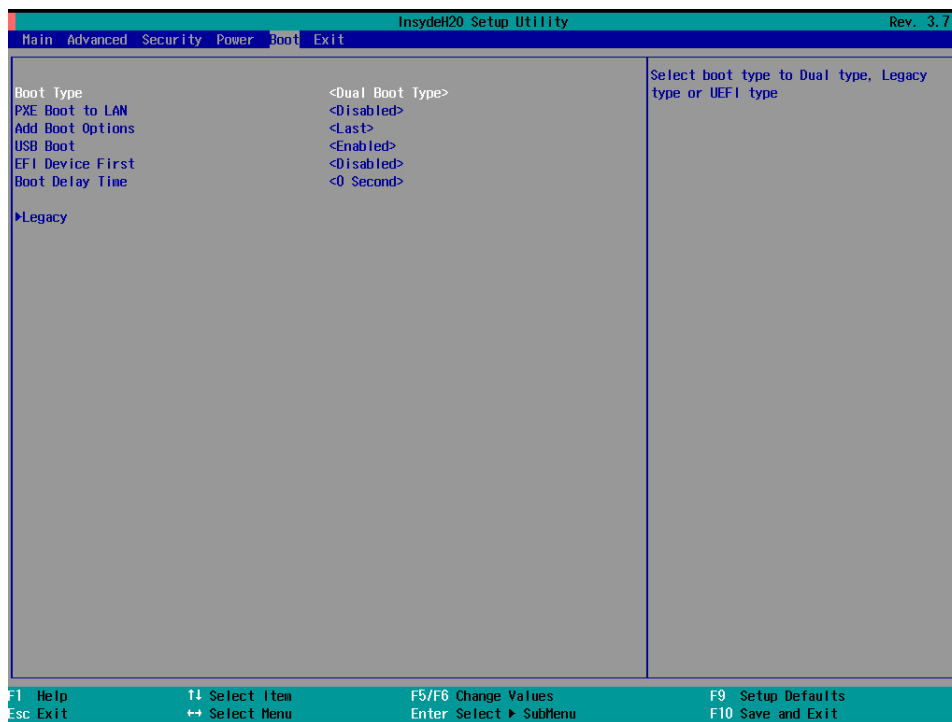
Step 2: Change the BIOS Settings

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

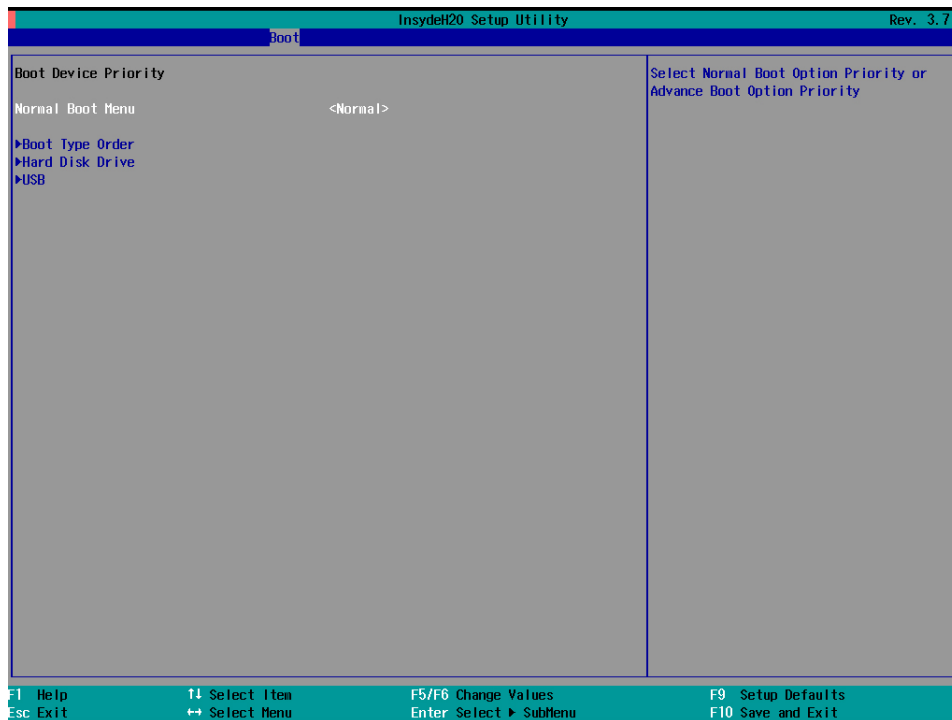
1. Turn on the computer and press **F2**. Select **SCU** in the following screen.



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

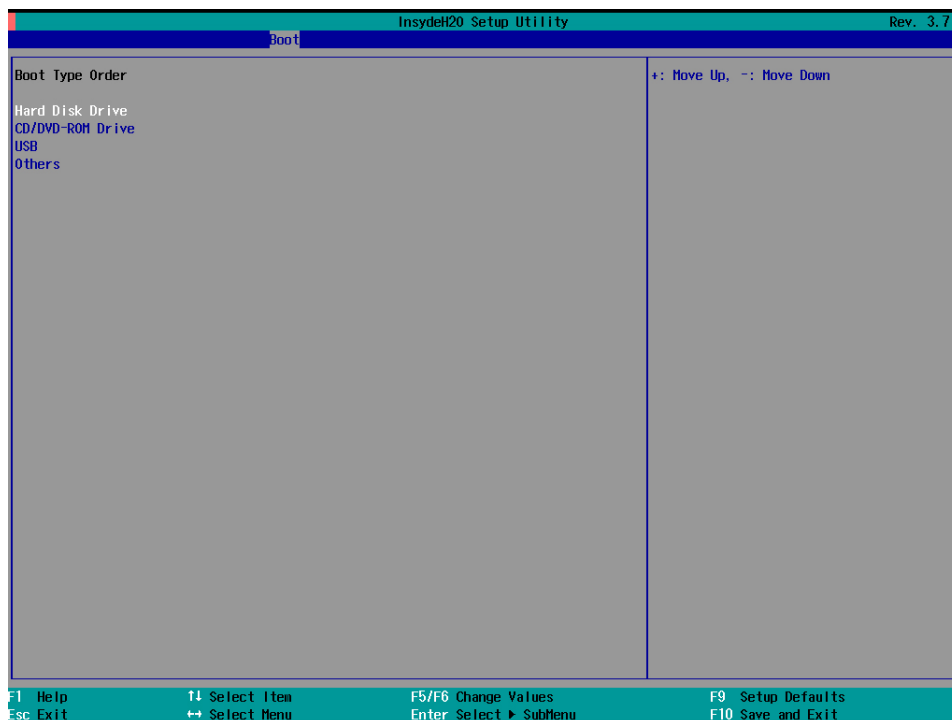


3. Select **Boot Type Order**.



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 DA-681A's USB ports and then reboot the computer. The system will boot from the USB disk and the Pre-installation Environment and the recovery utility will appear.

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



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

```
[ 5.153522] sd 0:0:0:0: [sda] Attached SCSI disk
[ 5.163726] sd 0:0:1:0: [sdb] Attached SCSI disk
[ 5.287941] sd 0:0:0:0: Attached scsi generic sg0 type 0
[ 5.310750] sd 0:0:1:0: Attached scsi generic sg1 type 0
[ 5.334915] sr 1:0:0:0: Attached scsi generic sg2 type 5
Begin: Loading essential drivers ... [ 5.690577] Atheros(R) L2 Ethernet Driver - version 2.2.3
[ 5.692430] Copyright (c) 2007 Atheros Corporation.
[ 5.776770] Broadcom NetXtreme II 5771x 10Gigabit Ethernet Driver bnx2x 1.62.00-6 (2011/01/30)
[ 5.914014] Btrfs loaded
[ 5.955475] device-mapper: uevent: version 1.0.3
[ 5.961407] device-mapper: ioctl: 4.19.1-ioctl (2011-01-07) initialised: dm-devel@redhat.com
done.
Begin: Running /scripts/init-premount ... done.
Begin: Mounting root file system ... [ 6.178946] Uniform Multi-Platform E-IDE driver
[ 6.186189] ide_generic: please use "probe_mask=0x3f" module parameter for probing all legacy ISA
IDE ports
[ 6.913744] FAT: utf8 is not a recommended IO charset for FAT filesystems, filesystem will be cas
e sensitive!
[ 7.047997] aufs: module is from the staging directory, the quality is unknown, you have been war
med.
[ 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

```

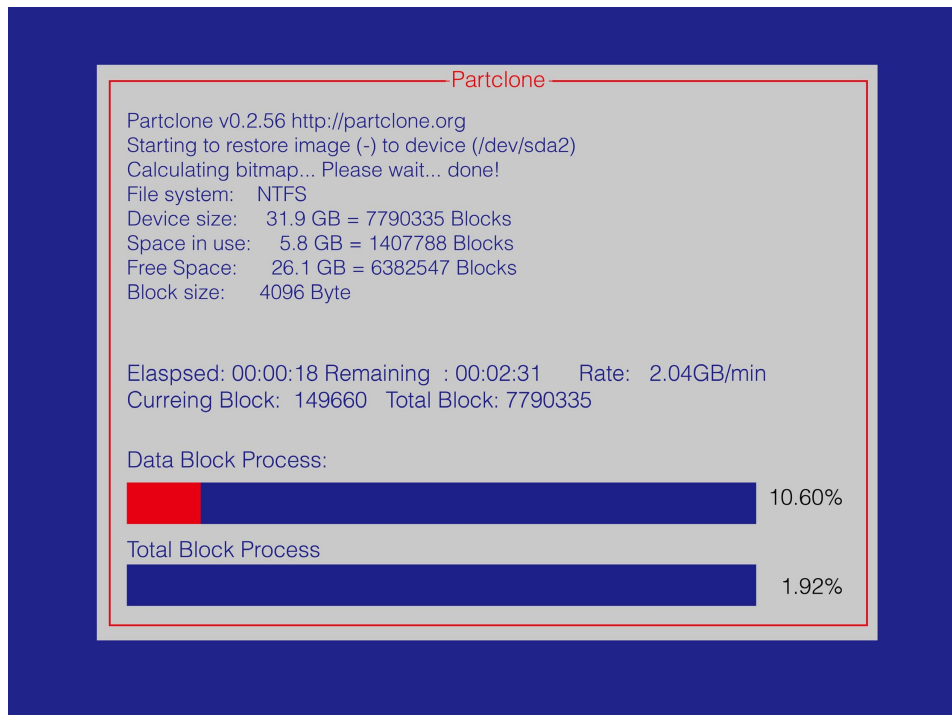
4. Enter **y** to confirm again.

```

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.



- 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 (11bntfs 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...

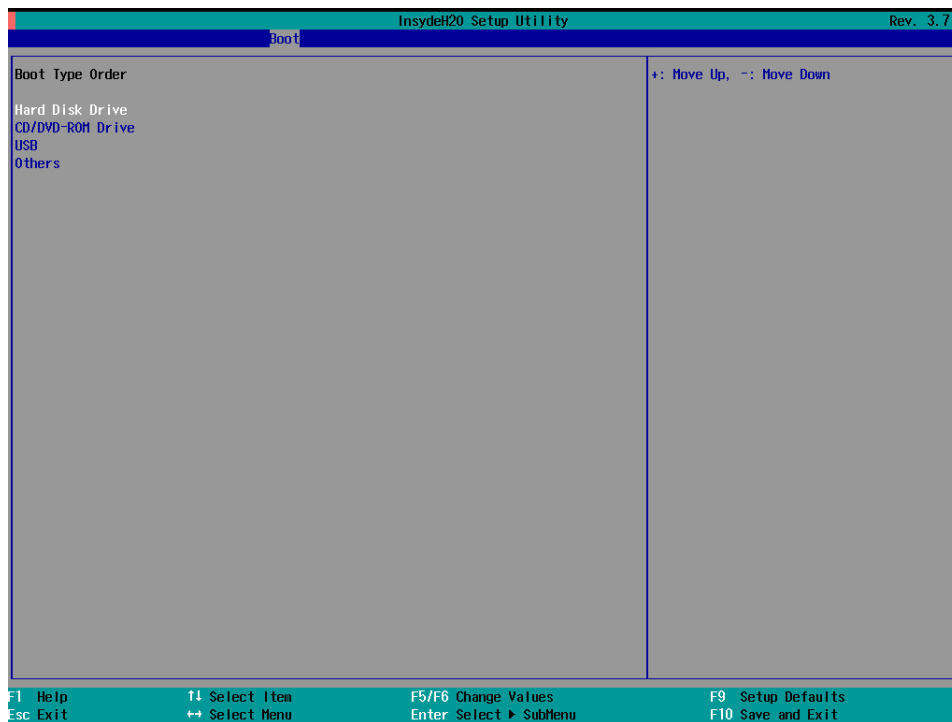
"ocs-live-restore" is finished.
Now you can choose to:
(0) Poweroff
(1) Reboot
(2) Enter command line prompt
(3) Start over
[2]
```

- 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.

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.

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



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

```
[ 5.141941] sd 0:0:1:0: [sdb] Attached SCSI disk
[ 5.257277] sd 0:0:0:0: Attached scsi generic sg0 type 0
[ 5.269691] sd 0:0:1:0: Attached scsi generic sg1 type 0
[ 5.280668] sr 1:0:0:0: Attached scsi generic sg2 type 5
Begin: Loading essential drivers ... [ 5.772551] Atheros(R) 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 "/" 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) on 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]
```

Software Components

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+deb8u1	Apache HTTP Server
apache2-bin	2.4.10-10+deb8u1	Apache HTTP Server (modules and other binary files)
apache2-data	2.4.10-10+deb8u1	Apache HTTP Server (common files)
apache2-utils	2.4.10-10+deb8u1	Apache HTTP Server (utility programs for web serve)
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 pa
aptitude-doc-en	0.6.11-1	English manual for aptitude, a terminal-based pack
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+deb8u2	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 bridg
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 - utili
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
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
da681a-irigb	1.0.0	moxa irigb driver for DA681A
da681a-mxser	1.0.0	mxser driver for DA681A
da681a-pled	1.0.0	pled driver for DA681A
da681a-relay	1.0.0	relay driver for DA681A
da681a-superio	1.0.0	superio driver for DA681A
da681a-wdt	1.0.0	watchdog driver for DA681A
dash	0.5.7-4+b1	POSIX-compliant shell
dbus	1.8.18-0+deb8u1	simple interprocess messaging system (daemon and u
dc	1.06.95-9	GNU dc arbitrary precision reverse-polish calculat
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
debutils	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+deb8u2	Clients provided with BIND
docutils-common	0.12+dfsg-1	text processing system for reStructuredText - comm
docutils-doc	0.12+dfsg-1	text processing system for reStructuredText - docu
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 k
firmware-realtek	0.43	Binary firmware for Realtek wired and wireless net
fontconfig	2.11.0-6.3	generic font configuration library - support binar
fontconfig-config	2.11.0-6.3	generic font configuration library - configuration
fonts-dejavu-core	2.34-1	Vera font family derivate with additional characte
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
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 li
gettext-base	0.19.3-2	GNU Internationalization utilities for the base sy
git	1:2.1.4-2.1	fast, scalable, distributed revision control syste
git-core	1:2.1.4-2.1	fast, scalable, distributed revision control syste
git-man	1:2.1.4-2.1	fast, scalable, distributed revision control syste
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
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 comp
grub-common	2.02-beta2-22	GRand Unified Bootloader (common

		files)
grub-pc	2.02-beta2-22	GRand Unified Bootloader, version 2 (PC/BIOS versi
grub-pc-bin	2.02-beta2-22	GRand Unified Bootloader, version 2 (PC/BIOS binar
grub2-common	2.02-beta2-22	GRand Unified Bootloader (common files for version
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 th
host	1:9.9.5.dfsg-9+deb8u2	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 v
ibritish	3.3.02-6	British English dictionary for ispell (standard ve
ienglish-common	3.3.02-6	Common files for British and American ispell dicti
ifstat	1.1-8+b1	InterFace STATistics Monitoring
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 sys
insserv	1.14.0-5	boot sequence organizer using LSB init.d script de
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 addr
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 an
ispell	3.3.02-6	International Ispell (an interactive spelling corr
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月18日	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 a
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 accel
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 (Apa
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
libaprutil1-ldap:amd64	1.5.4-1	Apache Portable Runtime Utility Library - LDAP Dri
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 functi
libattr1:amd64	1:2.4.47-2	Extended attribute shared library
libaudit-common	1:2.4-1	Dynamic library for security auditing - common fil
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+deb8u2	BIND9 Shared Library used by BIND

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 librar
libbz2-1.0:amd64	1.0.6-7+b3	high-quality block-sorting file compressor library
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 Fi
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 (GnuT
libcwidget3:amd64	0.5.17-2	high-level terminal interface library for C++ (run
libdaemon0:amd64	0.14-6	lightweight C library for daemons - runtime librar
libdata-optlist-perl	0.109-1	module to parse and validate simple name/value opt
libdata-section-perl	0.200006-1	module to read chunks of data from a module's DATA
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-implemen

libdevmapper1.02.1:amd64	2:1.02.90-2.2	Linux Kernel Device Mapper userspace library
libdns-export100	1:9.9.5.dfsg-9+deb8u2	Exported DNS Shared Library
libdns100	1:9.9.5.dfsg-9+deb8u2	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 s
libdrm-nouveau2:amd64	2.4.58-2	Userspace interface to nouveau-specific kernel DRM
libdrm-radeon1:amd64	2.4.58-2	Userspace interface to radeon-specific kernel DRM
libdrm2:amd64	2.4.58-2	Userspace interface to kernel DRM services -- runt
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
liberror-perl	0.17-1.1	Perl module for error/exception handling in an OO-
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+deb8u1	XML parsing C library - runtime library
libfakeroot:amd64	1.20.2-1	tool for simulating superuser privileges - shared
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+deb8u2	GDK Pixbuf library
libgdk-pixbuf2.0-common	2.31.1-2+deb8u2	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 modul

libgl1-mesa-glx:amd64	10.3.2-1	free implementation of the OpenGL API -- GLX runti
libglapi-mesa:amd64	10.3.2-1	free implementation of the GL API -- shared librar
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+deb8u2	GNU TLS library - main runtime library
libgnutls-openssl27:amd64	3.3.8-6+deb8u2	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 Gn
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 -- libra
libgssapi-krb5-2:amd64	1.12.1+dfsg-19	MIT Kerberos runtime libraries - krb5 GSS-API Mech
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 lib
libgtk2.0-common	2.24.25-3	common files for the GTK+ graphical user interface
libharfbuzz0b:amd64	0.9.35-2	OpenType text shaping engine (shared library)
libhogweed2:amd64	2.7.1-5	low level cryptographic library (public-key crypto
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 documen
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 tr
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+deb8u2	International Components for Unicode
libidn11:amd64	1.29-1+b2	GNU Libidn library, implementation of IETF IDN spe
libintl-perl	1.23-1	Uniform message translations system compatible i1
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
libio-string-perl	1.08-3	Emulate IO::File interface for in-core strings
libirs-export91	1:9.9.5.dfsg-9+deb8u2	Exported IRS Shared Library
libisc-export95	1:9.9.5.dfsg-9+deb8u2	Exported ISC Shared Library
libisc95	1:9.9.5.dfsg-9+deb8u2	ISC Shared Library used by BIND
libisccc90	1:9.9.5.dfsg-9+deb8u2	Command Channel Library used by BIND
libiscfg-export90	1:9.9.5.dfsg-9+deb8u2	Exported ISC CFG Shared Library
libiscfg90	1:9.9.5.dfsg-9+deb8u2	Config File Handling Library used by BIND
libisl10:amd64	0.12.2-2	manipulating sets and relations of integer points
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月18日	libkmod shared library
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, runti
liblocale-gettext-perl	1.05-8+b1	module using libc functions for internationalizati
liblockfile-bin	1.09-6	support binaries for and cli utilities based on li
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+deb8u2	Lightweight Resolver Library used by BIND
liblzma5:amd64	5.1.1alpha+20120614-2+b3	XZ-format compression library
liblz2-2:amd64	2.08-1.2	data compression library
libmagic1:amd64	1:5.22+15-2	File type determination library using "magic" numb
libmailtools-perl	2.13-1	Manipulate email in perl programs
libmnl0: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 plu
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 chara
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
libnettle4:amd64	2.7.1-5	low level cryptographic library (symmetric and one
libnewt0.52:amd64	0.52.17-1+b1	Not Erik's Windowing Toolkit - text mode windowing
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
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 PKC
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
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 (utilit
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 checki
libparse-debianchangelog-perl	1.2.0-1.1	parse Debian changelogs and output them in other f
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 - run
libpcsclite1:amd64	1.8.13-1	Middleware to access a smart card using PC/SC (lib
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#
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 /pr
libpsl0:amd64	0.5.1-1	Library for Public Suffix List (shared libraries)
libpth20:amd64	2.0.7-20	GNU Portable Threads
libpython-stdlib:amd64	2.7.9-1	interactive high-level object-oriented language (d
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 (s
libqdbm14	1.8.78-5+b1	QDBM Database Libraries without GDBM wrapper[runti
libquadmath0:amd64	4.9.2-10	GCC Quad-Precision Math Library

libreadline6:amd64	6.3-8+b3	GNU readline and history libraries, run-time libra
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 librari
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 p
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 ea
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)

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 Un
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 info
libtinfo-dev:amd64	5.9+20140913-1+b1	developer's library for the low-level terminfo lib
libtinfo5:amd64	5.9+20140913-1+b1	shared low-level terminfo library for terminal han
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 da
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 define
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
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
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 namespace
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::Pars
libxml-sax-perl	0.99+dfsg-2	Perl module for using and building Perl SAX2 XML p
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+deb8u3	Compiler for Linux on x86 (meta-package)
linux-headers-3.16.0-4-amd64	3.16.7-ckt11-1+deb8u3	Header files for Linux 3.16.0-4-amd64
linux-headers-3.16.0-4-common	3.16.7-ckt11-1+deb8u3	Common header files for Linux 3.16.0-4
linux-headers-amd64	3.16+63	Header files for Linux amd64 configuration (meta-p)
linux-image-3.16.0-4-amd64	3.16.7-ckt11-1+deb8u3	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+deb8u3	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)
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 [su]
lockfile-progs	0.1.17	Programs for locking and unlocking files and mailb
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 applica
mime-support	3.58	MIME files 'mime.types' & 'mailcap', and

		support p
mlocate	0.26-1	quickly find files on the filesystem based on thei
mount	2.25.2-6	Tools for mounting and manipulating filesystems
multiarch-support	2.19-18	Transitional package to ensure multiarch compatibi
mutt	1.5.23-3	text-based mailreader supporting MIME, GPG, PGP an
mxpromon	1.0.0	Moxa Proactive Monitoring
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
ntpd	1:4.2.6.p5+dfsg-7	client for setting system time from NTP servers
opensc	0.14.0-2	Smart card utilities with support for PKCS#15 comp
opensc-pkcs11:amd64	0.14.0-2	Smart card utilities with support for PKCS#15 comp
openssh-client	1:6.7p1-5	secure shell (SSH) client, for secure access to re
openssh-server	1:6.7p1-5	secure shell (SSH) server, for secure access from
openssh-sftp-server	1:6.7p1-5	secure shell (SSH) sftp server module, for SFTP ac
openssl	1.0.1k-3+deb8u1	Secure Sockets Layer toolkit - cryptographic utili
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 Langu
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 (met
php5-cli	5.6.9+dfsg-0+deb8u1	command-line interpreter for the php5 scripting la
php5-common	5.6.9+dfsg-0+deb8u1	Common files for packages built from the php5 sour

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 G
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 managem
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 (d
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 fo
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-docutils	0.12+dfsg-1	text processing system for reStructuredText (imple
python-minimal	2.7.9-1	minimal subset of the Python language (default ver
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_re
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 tracking s
python-roman	2.0.0-1	module for generating/analyzing Roman numerals for
python-six	1.8.0-1	Python 2 and 3 compatibility library (Python 2 int
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 (v
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 t
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) applicat
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 outp
sudo	1.8.10p3-1+deb8u2	Provide limited super user privileges to specific
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 Debia
tasksel-data	3.31+deb8u1	official tasks used for installation of Debian sys
tcpd	7.6.q-25	Wietse Venema's TCP wrapper utilities
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/IPv
tzdata	2015f-0+deb8u1	time zone and daylight-saving time data
ucf	3.003	Update Configuration File(s): preserve user change
udev	215-17+deb8u1	/dev/ and hotplug management daemon
usbmount	0.0.22	automatically mount and unmount USB mass storage d
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 I
vbetool	1.1-3	run real-mode video BIOS code to alter hardware st
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 s
wamerican	7.1-1	American English dictionary words for /usr/share/d
watchdog	5.14-3	system health checker and software/hardware watchd
wget	1.16-1	retrieves files from the web
whiptail	0.52.17-1+b1	Displays user-friendly dialog boxes from shell scr
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