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# **mlvpn Documentation**

***Release HEAD-4fdae2f-dirty***

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MLVPN is Open Source software, licensed under the [BSD License](#).

Source code is available on github <https://github.com/zehome/MLVPN/>



## 1.1 What is mlvpn

mlvpn is a piece of software, similar to [OpenVPN](#), which can create a network tunnel between two computers.

mlvpn encapsulates network packets, using UDP and send them encrypted over the internet to another location.

The primary use of mlvpn is to create bonded/[aggregated](#) network links in order to benefit from the bandwidth of multiple links.

Still, mlvpn can be used as a regular secure tunnel daemon, capable of handling failover scenarios.

### 1.1.1 Features

- Bandwidth aggregation of multiple internet connections
- Automatic failover, without changing IP addresses or interrupting TCP connections in case of a failure
- Encrypt and authenticate connections using [libsodium](#).
- Hot configuration reload (by signaling SIGHUP)
- Scriptable monitoring
- Remote monitoring through UNIX socket or TCP/HTTP socket. (JSON API)

### 1.1.2 Limitations

#### 1.1.3 Non equivalent links (3G/4G and \*DSL or WIFI and \*DSL)

mlvpn can aggregate very different links if reordering is enabled.

If you have a high latency 3G/4G link and a DSL connection, then adjust `reorder_buffer_size` to a reasonable value to get good performance.

Note that the created aggregated link will have the WORST latency of all the links. ie: the 3G/4G link.

Re-ordering is important because packets are not sent at the same speed on every path. Packets would come of order which confuses a LOT TCP. Without re-ordering, expect to have the bandwidth of the slowest link.

## 1.2 Getting started in mlvpn

### 1.2.1 Introduction

If you haven't, read [What is mlvpn](#).

### 1.2.2 Installation

#### Debian wheezy

If you trust me, you can use the mlvpn debian repository for Debian wheezy:

```
# Add the mlvpn repository signature
sudo apt-key adv --keyserver pgp.mit.edu --recv 3324C952
echo "deb http://debian.mlvpn.fr wheezy/" >/etc/apt/sources.list.d/mlvpn.list
sudo apt-get update
sudo apt-get install mlvpn
```

**Warning:** PLEASE DO NOT USE THIS REPOSITORY YET.

#### Debian jessie/sid

If you trust me, you can use the mlvpn debian repository for Debian sid:

```
# Add the mlvpn repository signature
sudo apt-key adv --keyserver pgp.mit.edu --recv 3324C952
echo "deb http://debian.mlvpn.fr unstable/" >/etc/apt/sources.list.d/mlvpn.list
sudo apt-get update
sudo apt-get install mlvpn
```

#### OpenBSD

Refer to the [README.OpenBSD](#) file inside the mlvpn repository for OpenBSD build instructions.

```
# Install dependencies
# DO NOT install libsodium from package on OpenBSD 5.6 or older
pkg_add git autoconf automake libev libsodium
# Adjust to your needs
export AUTOCONF_VERSION=2.69
export AUTOMAKE_VERSION=1.15
export CPPFLAGS="-I/usr/local/include $CPPFLAGS"
export LDFLAGS="-L/usr/local/lib $LDFLAGS"
git clone https://github.com/zehome/MLVPN mlvpn
cd mlvpn
./autogen.sh
./configure
make
# Install
sudo make install
sudo mkdir /etc/mlvpn
sudo cp /usr/local/share/doc/mlvpn/mlvpn.conf /etc/mlvpn/
sudo cp /usr/local/share/doc/mlvpn/mlvpn_updown.sh /etc/mlvpn/
```



```
sudo chown -R root /etc/mlvpn
sudo chmod 660 /etc/mlvpn/mlvpn.conf
sudo chmod 700 /etc/mlvpn/mlvpn_updown.sh
# Create a system user for mlvpn (unprivileged)
sudo groupadd _mlvpn
sudo useradd -c "mlvpn Daemon" -d /var/empty -s /sbin/nologin -L daemon -g _mlvpn _mlvpn
```

## FreeBSD

```
pkg install git libev libsodium
git clone --branch freebsd https://github.com/zehome/MLVPN mlvpn
cd mlvpn
make
```

---

**Note:** This port is not tested often and may break.

---

## Install from source

Please refer to the [README.md](#) file inside the mlvpn repository for source build instructions.

### 1.2.3 Configuration

mlvpn is using two configuration files for every tunnel you want to make.

#### mlvpn.conf

`mlvpn.conf(1)` is an ini-style configuration. It's used to set the interface name, the secret-key, network configuration of the multiple links and path to the second configuration script.

Please refer the the `mlvpn.conf(1)` manpage for further informations.

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**Note:** access the manpage using: **man mlvpn.conf**

---

#### mlvpn\_updown.sh

`mlvpn_updown.sh` is a script called by mlvpn when status change occurs in mlvpn.

For example, when mlvpn is launched and a link is activated, `mlvpn_updown.sh` is called in order to bring the tunnel device up and ready for communication.

## 1.3 Security in mlvpn

Security is a very strong focus for the mlvpn project.

mlvpn tries it's best to protect your systems and your datas by using *privilege separation*, strong cryptography, and continuous integration.

### 1.3.1 Privilege separation

mlvpn needs to access the kernel in order to create a tunnel device, and in order to configure the device. (needs root)  
In order to limit the scope of privileges, mlvpn spawns a small process, called the [priv] process, then another one.

**The priv process only performs the tasks where it needs privileges:**

- tunnel interface creation
- tunnel interface configuration
- open the mlvpn configuration file
- name resolution (requires to be out of the chroot)

The other process is run as an unprivileged user (usually \_mlvpn or mlvpn), in a chroot. It handles all the hard work exposed to the outside world.

This is the same technique used in [OpenSSH](#).

### 1.3.2 Cryptography

mlvpn uses [libsodium](#) for all the cryptographic needs.

In particular, mlvpn uses [secret-key authenticated encryption](#).

**Cryptography is used for two purposes:**

- Authentication
- Data protection

#### Authentication

mlvpn just uses a very simple protocol in order to make sure it communicates only if the two sides share the same secret key.

The secret key is stored as plain text in the mlvpn configuration file.

This configuration file must be owned by root, and chmoded to 0600 to prevent any other user from reading / writing to it.

Every control packet sent by mlvpn is encrypted and authenticated by both sides.

Authentication is done using Poly1305 MAC.

#### Encryption

Data packets can be encrypted/authenticated as well, but this can be disabled by using the *cleartext\_data* configuration flag.

This can be useful if you're on a budget, with lack of CPU.

If your data are going to the internet anyway, there is no point in trying to cipher them another time using mlvpn. (encrypting an ssh or https connections does not give you much benefit)

Encryption is done using the XSalsa20 algorithm.

## 1.4 Frequently Asked Questions

### 1.4.1 How much mlvpn costs

Free. mlvpn is licenced under the open source BSD licence.

### 1.4.2 Troubleshooting

#### **mlvpn does not launch**

Launch mlvpn manually. Check your permissions on mlvpn.conf (0600) and mlvpn\_updown.sh (0700), owned by root

#### **bandwidth agregation is terribad**

TODO



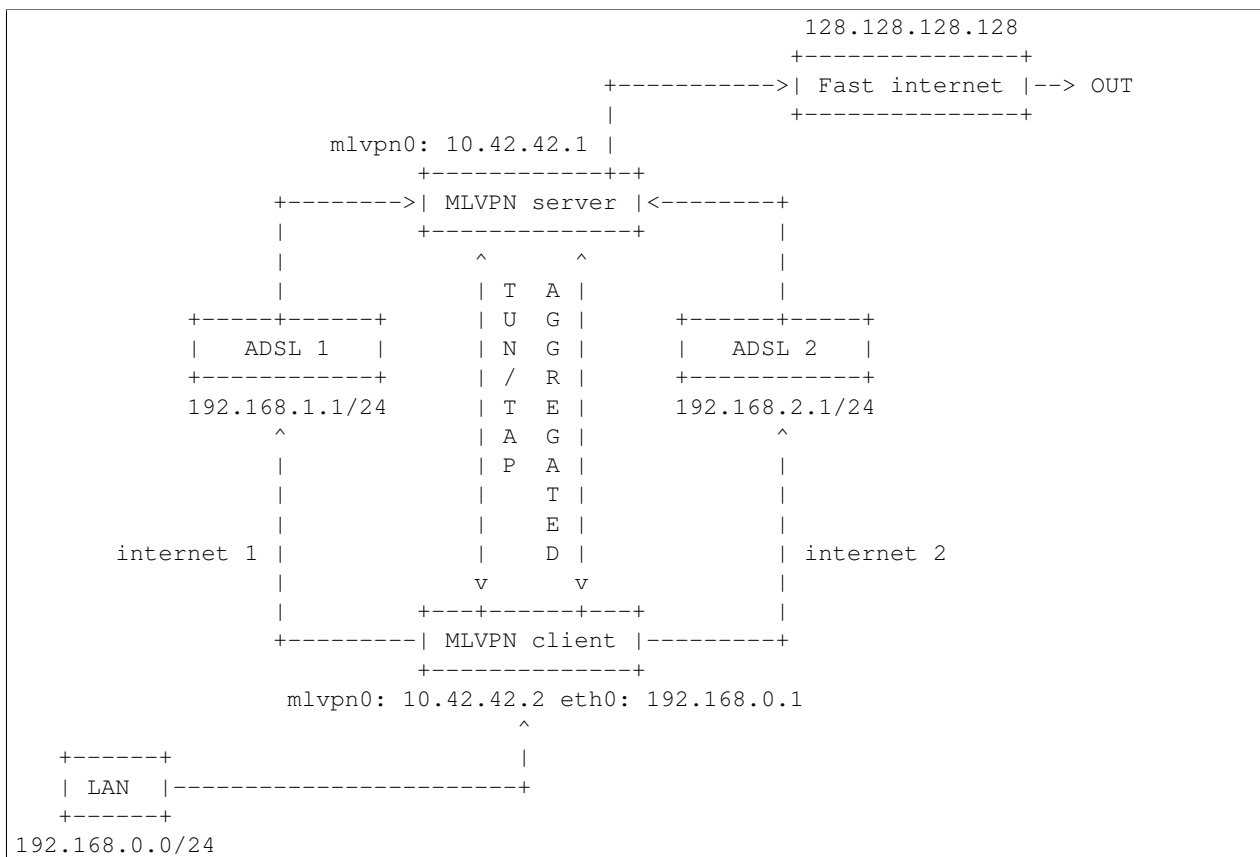
## Example scenarios

### 2.1 Linux with two ADSL uplinks for agregation and failover

#### 2.1.1 Introduction

This short guide will try to help you configure linux for policyrouting in order to automatically use the two adsl links at the same time.

#### 2.1.2 Example case



In this setup we have multiple machines:

- MLVPN server which has a fast internet connection (100Mbps)
  - Public IP Address: 128.128.128.128/32
  - Private mlvpn IP address: 10.42.42.1/30
- ADSL 1 router LOCAL IP address 192.168.1.1/24
- ADSL 2 router LOCAL IP address 192.168.2.1/24
- Local AREA network (where your standard “clients” are) on 192.168.0.0/24
- And finally our MLVPN client router:
  - Private IP address 192.168.1.2/24 to join ADSL1
  - Private IP address 192.168.2.2/24 to join ADSL2
  - Private IP address 192.168.0.1/24 for LAN clients
  - Private IP address 10.42.42.2/30 on mlvpn0.

Yeah seems a bit complicated, but that’s not that hard after all, we just have 4 routers.

## 2.1.3 Testing the basic configuration

At this time from “MLVPN client” you should be able to ping 192.168.2.1 and 192.168.1.1.

You should be able to access the internet using both links.

You can test it using standard routing.

Before we do anything: (Note: you may require installing iproute2)

```
root@mlvpncclient:~# ip route show
default via 192.168.1.1 dev eth0
192.168.0.0/24 dev eth0 proto kernel scope link src 192.168.0.1
192.168.1.0/24 dev eth0 proto kernel scope link src 192.168.1.2
192.168.2.0/24 dev eth0 proto kernel scope link src 192.168.2.2
```

This routing table means every packet to the internet will go thru 192.168.1.1. We can test it:

```
root@mlvpncclient:~# ping -n -c2 -I192.168.1.2 ping.ovh.net
PING ping.ovh.net (213.186.33.13) 56(84) bytes of data.
64 bytes from 213.186.33.13: icmp_req=1 ttl=51 time=42.1 ms
64 bytes from 213.186.33.13: icmp_req=2 ttl=51 time=41.7 ms
```

Ok I started to use “-I192.168.1.2” here. That’s not mandatory in this example, but this will become handy later.

“-I” means we tell the ping command to use 192.168.1.2 as source address of the packets we are sending to ping.ovh.net.

Now, we know our ADSL1 link is working properly.

Testing the second link will need us to modify the routing table.

```
root@mlvpncclient:~# ip route add 213.186.33.13 via 192.168.2.1
root@mlvpncclient:~# ip route show
default via 192.168.1.1 dev eth0
213.186.33.13 via 192.168.2.2 dev eth0
192.168.0.0/24 dev eth0 proto kernel scope link src 192.168.0.1
192.168.1.0/24 dev eth0 proto kernel scope link src 192.168.1.2
192.168.2.0/24 dev eth0 proto kernel scope link src 192.168.2.2
```

Notice the new 213.186.33.13 (ping.ovh.net) added to the routing table.

Again, we can test the link:

```
root@mlvpnclient:~# ping -n -c2 -I192.168.2.2 ping.ovh.net
PING ping.ovh.net (213.186.33.13) 56(84) bytes of data.
64 bytes from 213.186.33.13: icmp_req=1 ttl=51 time=62.4 ms
64 bytes from 213.186.33.13: icmp_req=2 ttl=51 time=61.1 ms
```

Noticed we changed the source address.

Everything is fine, let's cleanup the routing table:

```
root@mlvpnclient:~# ip route del 213.186.33.13
```

## 2.1.4 Configuring the source routing

### Concepts

Now you have two internet access, one fast internet access on the server side, but you have only one IP address on this server... How can you use your multiple ADSL links at the same time ?

That's fairly simple, but a bit complicated to setup. It's called "source routing".

Source routing means the kernel will take the decision to route a packet not only based on it's destination (like we have done just before), but also from where it came.

In our example, we want a packet coming from 192.168.2.2 to go thru ADSL 2 and a packet from 192.168.1.2 to go thru ADSL1. Simple yah?

### Let's configure it

First, you need to create multiple routing tables in the kernel.

That's better to name them, so yo do it by modifying **/etc/iproute2/rt\_tables**.

```
root@mlvpnclient:~# echo 101 adsl1 >> /etc/iproute2/rt_tables
root@mlvpnclient:~# echo 102 adsl2 >> /etc/iproute2/rt_tables
```

Your configuration file should now look like this

```
root@mlvpnclient:~# cat /etc/iproute2/rt_tables
#
# reserved values
#
255 local
254 main
253 default
0   unspec
#
# local
#
#1  inr.ruhep
101 adsl1
102 adsl2
```

We have "named" two new routing tables, but we did not create them. **/etc/iproute2/rt\_tables** file is optional.

We must add some routes to each table to activate them.

```
# Inserting routes in the adsl1 table
ip route add 192.168.1.0/24 dev eth0 scope link table adsl1
ip route add default via 192.168.1.1 dev eth0 table adsl1

# Inserting routes in the adsl2 table
ip route add 192.168.2.0/24 dev eth0 scope link table adsl2
ip route add default via 192.168.2.1 dev eth0 table adsl2

# ip rule is the source routing magic. This will redirect
# packets coming from source "X" to table "adsl1", "adsl2" or "default".
ip rule add from 192.168.1.0/24 table adsl1
ip rule add from 192.168.2.0/24 table adsl2
```

I've stripped `root@machine` for you, so you can copy paste ;-)

## Testing

First, show me your configuration! The first thing you should always do is displaying ip rules. (Which routing table will be used when ?)

(Please note rules are applied in order from 0 to 32767)

```
root@mlvpnclient:~# ip rule list
0:      from all lookup local
32764:  from 192.168.1.0/24 lookup adsl1
32765:  from 192.168.2.0/24 lookup adsl2
32766:  from all lookup main
32767:  from all lookup default
```

Then the routing tables:

```
root@mlvpnclient:~# ip route show table adsl1
192.168.1.0/24 dev eth0  scope link
default via 192.168.1.1 dev eth0
root@mlvpnclient:~# ip route show table adsl2
192.168.2.0/24 dev eth0  scope link
default via 192.168.2.1 dev eth0
root@mlvpnclient:~# ip route show table main
default via 192.168.1.1 dev eth0
213.186.33.13 via 192.168.2.2 dev eth0
192.168.0.0/24 dev eth0  proto kernel  scope link  src 192.168.0.1
192.168.1.0/24 dev eth0  proto kernel  scope link  src 192.168.1.2
192.168.2.0/24 dev eth0  proto kernel  scope link  src 192.168.2.2
```

## Ping test

```
root@mlvpnclient:~# ping -c2 -n -I192.168.1.1 ping.ovh.net
PING ping.ovh.net (213.186.33.13) 56(84) bytes of data.
64 bytes from 213.186.33.13: icmp_req=1 ttl=51 time=40.6 ms
64 bytes from 213.186.33.13: icmp_req=2 ttl=51 time=41.5 ms

root@mlvpnclient:~# ping -c2 -n -I192.168.2.1 ping.ovh.net
PING ping.ovh.net (213.186.33.13) 56(84) bytes of data.
64 bytes from 213.186.33.13: icmp_req=1 ttl=51 time=62.0 ms
64 bytes from 213.186.33.13: icmp_req=2 ttl=51 time=64.1 ms
```

Hey that's working fine !



## Scripting for startup ?

On Debian GNU/Linux that's pretty easy, just copy this script to `/usr/local/sbin/source_routing`:

```
#!/bin/sh

# Inserting routes in the adsl1 table
/sbin/ip route add 192.168.1.0/24 dev eth0 scope link table adsl1
/sbin/ip route add default via 192.168.1.1 dev eth0 table adsl1

# Inserting routes in the adsl2 table
/sbin/ip route add 192.168.2.0/24 dev eth0 scope link table adsl2
/sbin/ip route add default via 192.168.2.1 dev eth0 table adsl2

# ip rule is the source routing magic. This will redirect
# packets coming from source "X" to table "adsl1", "adsl2" or "default".
/sbin/ip rule add from 192.168.1.0/24 table adsl1
/sbin/ip rule add from 192.168.2.0/24 table adsl2
```

Verify permissions: **chmod +x /usr/local/sbin/source\_routing**

You can use post-up scripts of `/etc/network/interfaces` to run this script.

`/etc/network/interfaces`

```
auto eth0
iface eth0 inet static
    address 192.168.0.1
    netmask 255.255.255.0
    post-up /usr/local/sbin/source_routing

auto eth0:adsl1
iface eth0:adsl1 inet static
    address 192.168.1.2
    netmask 255.255.255.0
    gateway 192.168.1.1

auto eth0:adsl2
iface eth0:adsl2 inet static
    address 192.168.2.2
    netmask 255.255.255.0
```

Don't forget to execute the script once by hand or thru **service networking restart**.

## 2.1.5 Configuring MLVPN

MLVPN have two configuration files on each side.

### Client side

#### mlvpn0.conf

I've made the configuration file as small as possible to have a good overview.

Take a look at example config files for more details. (**man mlvpn.conf** can be usefull)

`/etc/mlvpn/mlvpn0.conf`

```
[general]
statuscommand = "/etc/mlvpn/mlvpn0_updown.sh"
tuntap = "tun"
mode = "client"
interface_name = "mlvpn0"
timeout = 30
password = "you have not changed me yet?"
reorder_buffer_size = 64

[ads11]
bindhost = "192.168.1.2"
remotehost = "128.128.128.128"
remoteport = 5080

[ads12]
bindhost = "192.168.2.2"
remotehost = "128.128.128.128"
remoteport = 5081
```

### mlvpn0\_updown.sh

This file *MUST* be chmod 700 (rwx—) owned by *root*.

```
chmod 700 /etc/mlvpn/mlvpn0_updown.sh; chown root:root /etc/mlvpn/mlvpn0_updown.sh
```

Again I stripped the script to the minimum.

*/etc/mlvpn/mlvpn0\_updown.sh*

```
#!/bin/bash

error=0; trap "error=$((error|1))" ERR

tuntap_intf="$1"
newstatus="$2"
rtun="$3"

[ -z "$newstatus" ] && exit 1

(
if [ "$newstatus" = "tuntap_up" ]; then
    echo "$tuntap_intf setup"
    /sbin/ip link set dev $tuntap_intf mtu 1400 up
    /sbin/ip addr add 10.42.42.2/30 dev $tuntap_intf
    /sbin/route add proof.ovh.net gw 10.42.42.2
elif [ "$newstatus" = "tuntap_down" ]; then
    echo "$tuntap_intf shutdown"
    /sbin/route del proof.ovh.net gw 10.42.42.2
elif [ "$newstatus" = "rtun_up" ]; then
    echo "rtun [{rtun}] is up"
elif [ "$newstatus" = "rtun_down" ]; then
    echo "rtun [{rtun}] is down"
fi
) >> /var/log/mlvpn_commands.log 2>&1

exit $errors
```

Again ensure permissions are correct or mlvpn will *NOT* execute the script.

## Server side

### mlvpn0.conf

```
[general]
statuscommand = "/etc/mlvpn/mlvpn0_updown.sh"
tuntap = "tun"
mode = "server"
interface_name = "mlvpn0"
timeout = 30
password = "pleasechangeme!"
reorder_buffer_size = 64

[adsl1]
bindport = 5080

[adsl2]
bindport = 5081
```

### mlvpn0\_updown.sh

```
#!/bin/bash

error=0; trap "error=$((error|1))" ERR
tuntap_intf="$1"
newstatus="$2"
rtun="$3"
[ -z "$newstatus" ] && exit 1
(
if [ "$newstatus" = "tuntap_up" ]; then
echo "$tuntap_intf setup"
/sbin/ip link set dev $tuntap_intf mtu 1400 up
/sbin/ip addr add 10.42.42.1/30 dev $tuntap_intf
# NAT thru our server (eth0 is our output interface on the server)
# mlvpn0 link
/sbin/iptables -t nat -A POSTROUTING -o eth0 -s 10.42.42.0/30 -j MASQUERADE
# LAN 192.168.0.0/24 from "client"
/sbin/ip route add 192.168.0.0/24 via 10.42.42.2
/sbin/iptables -t nat -A POSTROUTING -o eth0 -s 192.168.0.0/24 -j MASQUERADE
elif [ "$newstatus" = "tuntap_down" ]; then
/sbin/ip route del 192.168.0.0/24 via 10.42.42.2
/sbin/iptables -t nat -D POSTROUTING -o eth0 -s 10.42.42.0/30 -j MASQUERADE
/sbin/iptables -t nat -D POSTROUTING -o eth0 -s 192.168.0.0/24 -j MASQUERADE
fi
) >> /var/log/mlvpn_commands.log 2>&1
exit $errors
```

## 2.1.6 Testing

Double check permissions of /etc/mlvpn/\*.sh (chmod 700 owned by root)

Don't forget to accept UDP 5080 and 5081 on your firewall, server side.

```
root@server:~ # iptables -I INPUT -i eth0 -p udp --dport 5080 -s [ADSL1_PUBLICIP] -j ACCEPT
root@server:~ # iptables -I INPUT -i eth0 -p udp --dport 5081 -s [ADSL2_PUBLICIP] -j ACCEPT
```

Start mlvpn on server side manually

```
root@server:~ # mlvpn --user mlvpn -c /etc/mlvpn/mlvpn0.conf
```

Start mlvpn on client side manually

```
root@client:~ # mlvpn --user mlvpn -c /etc/mlvpn/mlvpn0.conf
```

Check logfiles on client

```
root@client:~ # cat /var/log/mlvpn_commands.log
mlvpn0 setup
rtun [adsl1] is up
rtun [adsl2] is up
```

Seems good. Let's test the ICMP echo reply. (ping)

```
# Testing connectivity to the server (tunnel address space)
root@client:~ # ping -n -c2 -I10.42.42.2 10.42.42.1
# Testing connectivity to the server (LAN address space)
root@client:~ # ping -n -c1 -I192.168.0.1 10.42.42.1
# Testing connectivity to the internet
root@client:~ # ping -n -c1 -I192.168.0.1 proof.ovh.net
# Download speed testing
root@client:~ # wget -O/dev/null http://proof.ovh.net/files/10Gio.dat
```

---

## Developer guide

---

### 3.1 Building debian packages for mlvpn

#### 3.1.1 Requirements

```
sudo apt-get install pbuilder cowbuilder git-buildpackage
```

#### 3.1.2 Prepare build environments

##### Configure pbuilder

.pbuilderrc:

```
# Template loosely taken from http://www.kirya.net/articles/build-i386-packages-on-amd64/
# do not specify variables when running cowbuilder --create or --update
if [ -f debian/changelog ]; then
    [ -z "$ARCH" ] && ARCH=$(dpkg --print-architecture)
    [ -z "$DIST" ] && DIST=$(dpkg-parsechangelog | sed -n 's/^Distribution: //p')
fi
PDEBUILD_PBUILDER="cowbuilder --build --basepath /var/cache/pbuilder/base-_${DIST}_${ARCH}.cow"
DEBBUILD_OPTS="-d ${OPTS}"
ARCHITECTURE=${ARCH}
BUILDRESULT=~/.build-area
MIRRORSITE=http://ftp.fr.debian.org/debian
EXTRAPACKAGES="$EXTRAPACKAGES lintian apt-utils"
AUTO_DEBSIGN=yes
HOOKDIR=${HOME}/.pbuilder/hooks/
PKGNAME_LOGFILE_EXTENTION="_${ARCH}.build"
# Allow a local repository for external backported dependencies.
OTHERMIRROR="deb [trusted=yes] file://${HOME}/build-area ."
BINDMOUNTS="${HOME}/build-area"
```

##### Generate base images for pbuilder

```
for arch in i386 amd64; do
    sudo cowbuilder --config ~/.pbuilderrc --create --distribution wheezy --architecture $arch --base
    sudo cowbuilder --config ~/.pbuilderrc --update --distribution wheezy --architecture $arch --base
done
```

### 3.1.3 Build packages

#### libsodium13 (for wheezy)

```
dget -x http://ftp.fr.debian.org/debian/pool/main/libs/libsodium/libsodium_1.0.0-1.dsc
cd libsodium_1.0.0
for dist in wheezy; do
    for arch in amd64 i386; do
        DIST=$dist ARCH=$arch pdebuild --debbuildopts -b
    done
done
```

#### mlvpn

```
git clone git@github.com:zehome/MLVPN.git mlvpn
cd mlvpn
git checkout debian-unstable
for dist in wheezy; do
    for arch in amd64 i386; do
        DIST=$dist ARCH=$arch git-buildpackage --git-builder="pdebuild --debbuildopts -b"
    done
done
```

## 3.2 Building mlvpn on OpenBSD

### 3.2.1 Installing requirements

```
pkg_add git autoconf automake libev libsodium
```

### 3.2.2 Building mlvpn

```
export AUTOCONF_VERSION=2.69
export AUTOMAKE_VERSION=1.14
export CPPFLAGS="-I/usr/local/include $CPPFLAGS"
export LDFLAGS="-L/usr/local/lib $LDFLAGS"
git clone https://github.com/zehome/MLVPN mlvpn
cd mlvpn
./autogen.sh
./configure
make
```

### 3.2.3 Configuration

Example configuration files for OpenBSD are located in `examples/mlvpn_updown.sh`.

## 3.3 Indices and tables

- search