

# 浙江大学

## 本科实验报告

课程名称：嵌入式系统

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# 浙江大学实验报告

课程名称： 嵌入式系统 实验类型： 综合

实验项目名称： 浙大校网 VPN

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实验地点： None 实验日期： 2015 年 3 月 29 日

## 一、 实验目的和要求

1. 了解 Acadia 或 RPi 或 WRTnode 中如何对网络进行配置；
2. 了解 Acadia 或 RPi 或 WRTnode 中如何对 VPN 进行连接。

## 二、 实验器材

### 硬件

- RPi 板一块；
- 5V/2A 电源一个；
- USB-TTL 串口线一根（PL2303 芯片）。
- PC（Windows）一台；
- 以太网线一根（可能还需要路由器等）；

### 软件

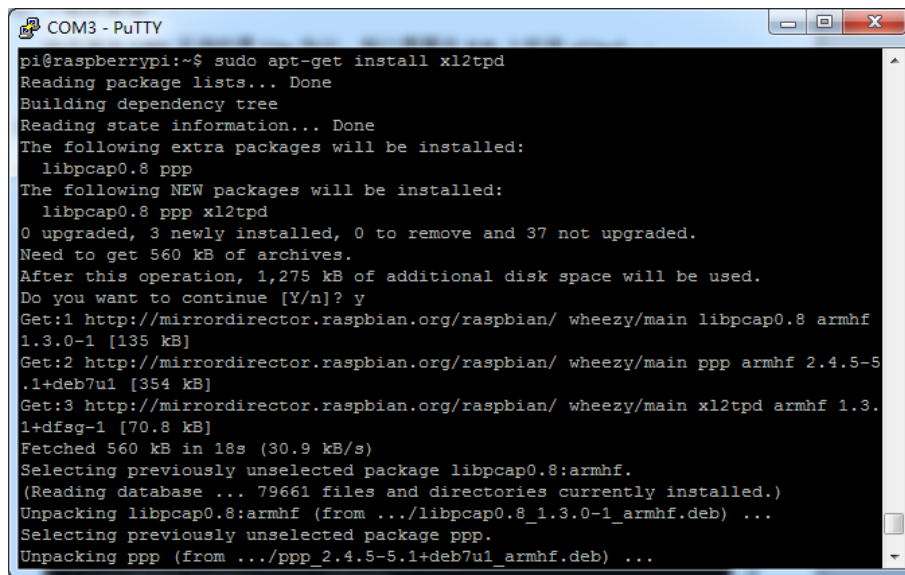
- PC 上的 USB-TTL 串口线配套的驱动程序；
- PC 上的串口终端软件，Putty；
- PC 上的 SSH 软件，Xshell。

## 三、 实验过程和数据记录及结果分析

1. 安装前置软件

a) 下载 xl2tpd 安装包

由于浙大 VPN 采用的是 l2tp 协议，所以需要在 RPi 上安装 xl2tpd。



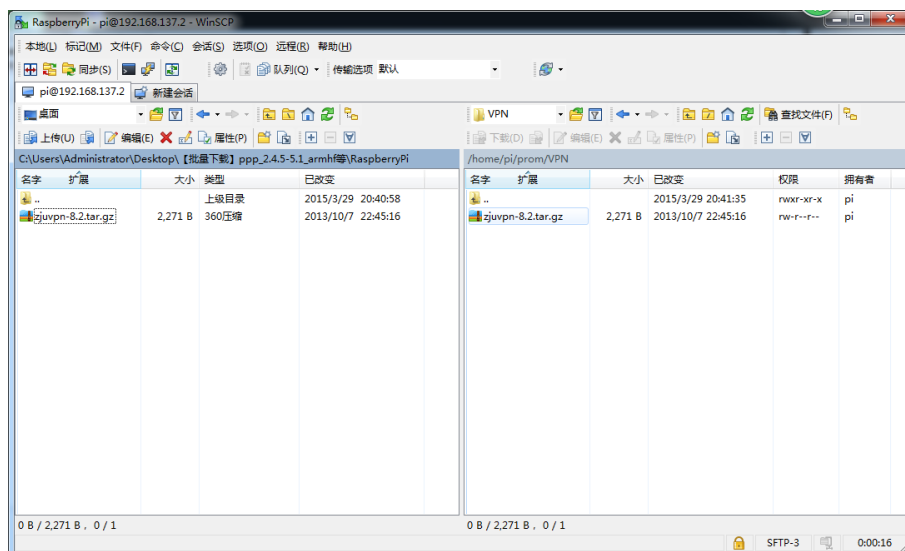
```
pi@raspberrypi:~$ sudo apt-get install xl2tpd
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
  libpcap0.8 ppp
The following NEW packages will be installed:
  libpcap0.8 ppp xl2tpd
0 upgraded, 3 newly installed, 0 to remove and 37 not upgraded.
Need to get 560 kB of archives.
After this operation, 1,275 kB of additional disk space will be used.
Do you want to continue [Y/n]? y
Get:1 http://mirrordirector.raspbian.org/raspbian/ wheezy/main libpcap0.8 armhf
1.3.0-1 [135 kB]
Get:2 http://mirrordirector.raspbian.org/raspbian/ wheezy/main ppp armhf 2.4.5-5
.1+deb7u1 [354 kB]
Get:3 http://mirrordirector.raspbian.org/raspbian/ wheezy/main xl2tpd armhf 1.3.
1+dfsg-1 [70.8 kB]
Fetched 560 kB in 18s (30.9 kB/s)
Selecting previously unselected package libpcap0.8:armhf.
(Reading database ... 79661 files and directories currently installed.)
Unpacking libpcap0.8:armhf (from .../libpcap0.8_1.3.0-1_armhf.deb) ...
Selecting previously unselected package ppp.
Unpacking ppp (from .../ppp_2.4.5-5.1+deb7u1_armhf.deb) ...
```

可以看到用到了 libpcap 和 ppp 等依赖。

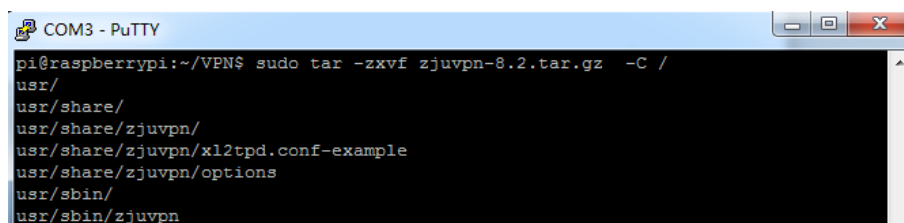
b) 下载 zjuvpn

学长们已经为 Linux 下连 VPN 写好了脚本，可以直接在 cc98 中下到。

由于主机是 Windows 系统，所以用 WinSCP 把软件通过 SSH 拷到 RPi 上。



解压缩文件到根目录。

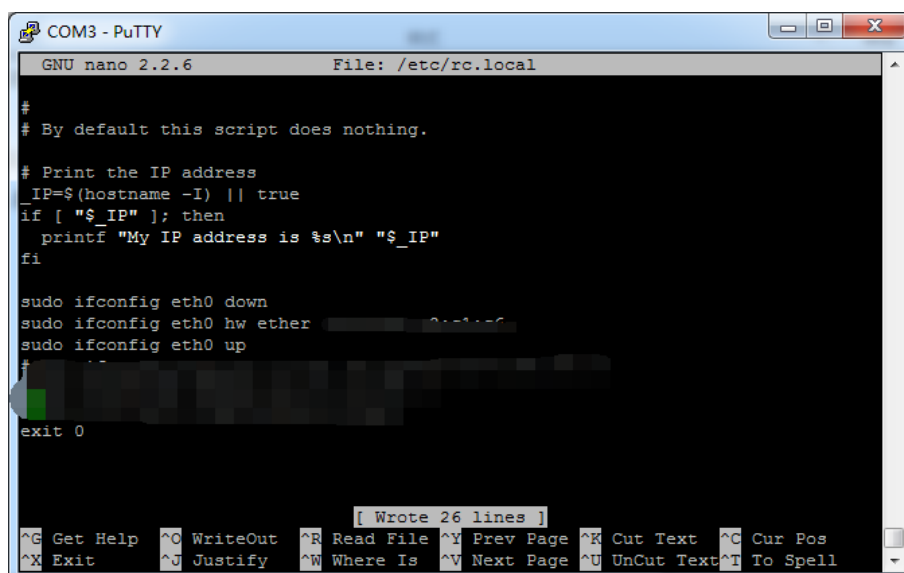


```
pi@raspberrypi:~/VPN$ sudo tar -zxvf zjuvpn-8.2.tar.gz -C /
usr/
usr/share/
usr/share/zjuvpn/
usr/share/zjuvpn/xl2tpd.conf-example
usr/share/zjuvpn/options
usr/sbin/
usr/sbin/zjuvpn
```

## 2. 设置静态 IP, MAC 地址

### a) 设置静态 IP, MAC 地址

由于玉泉的 VPN 账号是 IP 和 MAC 地址绑定的, 所以需要重设 RPi 的 MAC 地址和静态 IP。更改 IP 和 MAC 地址都需要先把网卡禁用, 最后重启的方法。为了以后方便, 就直接在 `/etc/rc.local` 中添加命令, 不用时注释掉即可。



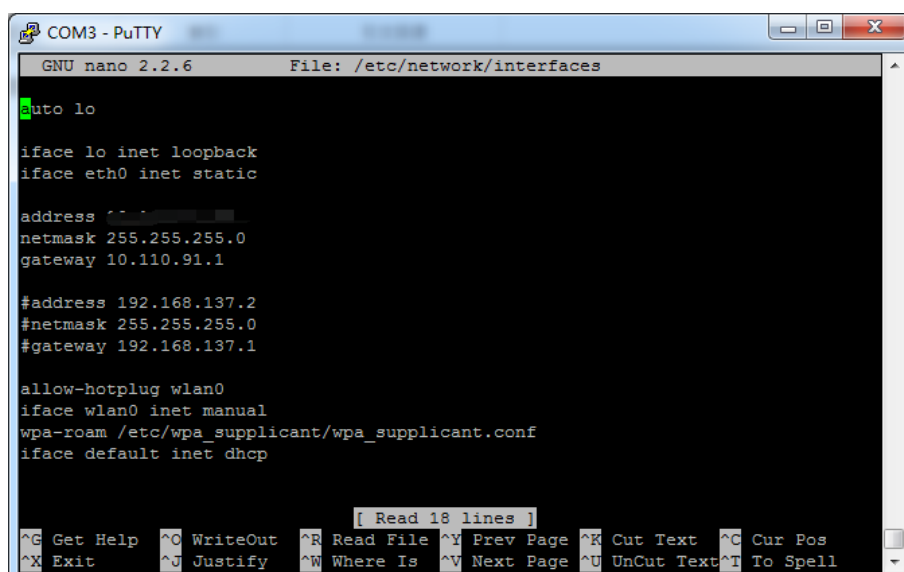
```
GNU nano 2.2.6 File: /etc/rc.local
#
# By default this script does nothing.

# Print the IP address
_IP=$(hostname -I) || true
if [ "$_IP" ]; then
    printf "My IP address is %s\n" "$_IP"
fi

sudo ifconfig eth0 down
sudo ifconfig eth0 hw ether 00:00:00:00:00:00
sudo ifconfig eth0 up
#
exit 0

[ Wrote 26 lines ]
^G Get Help ^O WriteOut ^R Read File ^Y Prev Page ^K Cut Text ^C Cur Pos
^X Exit ^J Justify ^W Where Is ^V Next Page ^U UnCut Text ^T To Spell
```

可以看到我修改了 mac 地址。



```
GNU nano 2.2.6 File: /etc/network/interfaces
auto lo

iface lo inet loopback
iface eth0 inet static

address 192.168.137.2
netmask 255.255.255.0
gateway 10.110.91.1

#address 192.168.137.2
#netmask 255.255.255.0
#gateway 192.168.137.1

allow-hotplug wlan0
iface wlan0 inet manual
wpa-roam /etc/wpa_supplicant/wpa_supplicant.conf
iface default inet dhcp

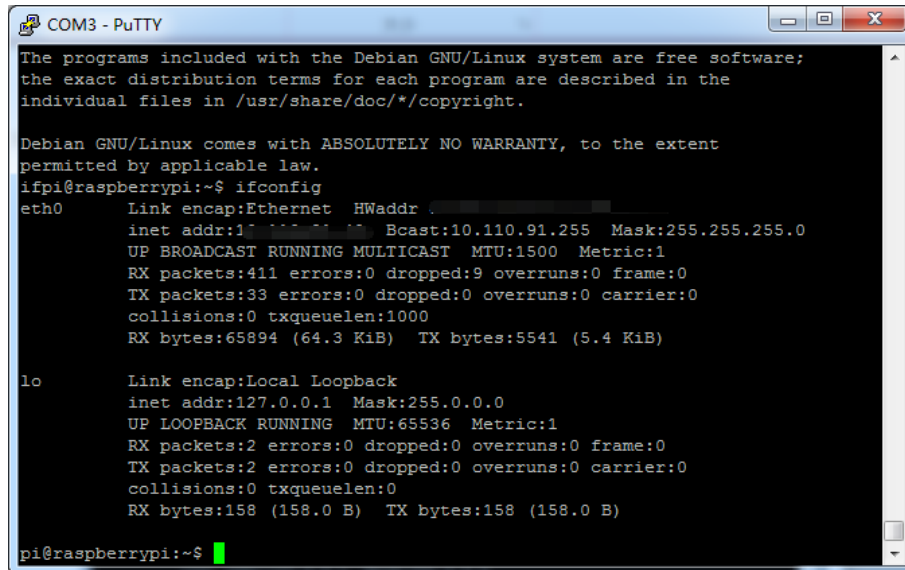
[ Read 18 lines ]
^G Get Help ^O WriteOut ^R Read File ^Y Prev Page ^K Cut Text ^C Cur Pos
^X Exit ^J Justify ^W Where Is ^V Next Page ^U UnCut Text ^T To Spell
```

ip 和网关的修改则放在 `etc/network/interface` 中。

### 3. 启动 ZJUVPN

#### a) 重启 RPi 并运行 zjuvpn

Sudo reboot 后, ifconfig 可以看到 ip 和 mac 均发生了变化(虽然马赛克掉了)。



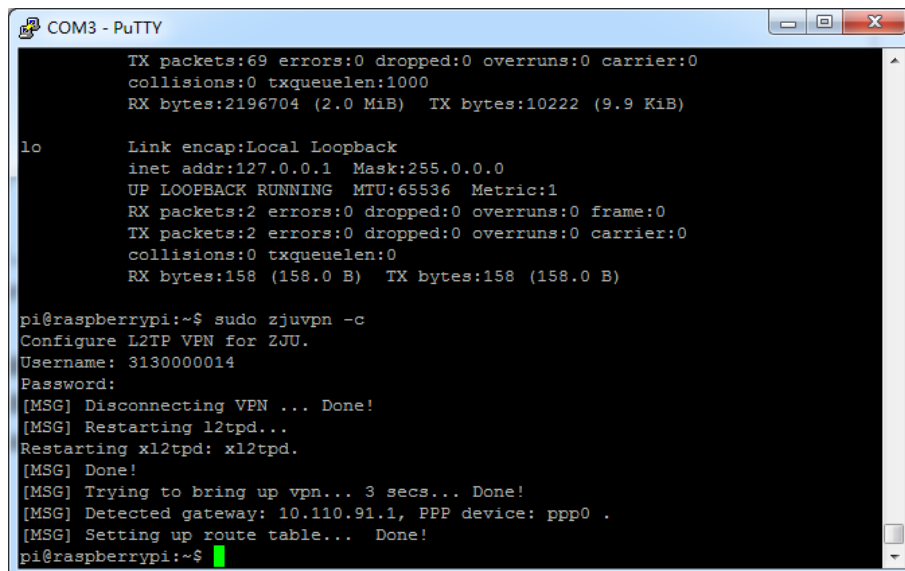
```
COM3 - PuTTY
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
ifpi@raspberrypi:~$ ifconfig
eth0      Link encap:Ethernet  HWaddr 08:00:00:00:00:00
          inet addr:10.110.91.255  Bcast:10.110.91.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:411 errors:0 dropped:9 overruns:0 frame:0
          TX packets:33 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:65894 (64.3 KiB)  TX bytes:5541 (5.4 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:2 errors:0 dropped:0 overruns:0 frame:0
          TX packets:2 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:158 (158.0 B)  TX bytes:158 (158.0 B)

pi@raspberrypi:~$
```

执行 `zjuvpn -c`, 输入用户名密码后, 可以看到连接信息。



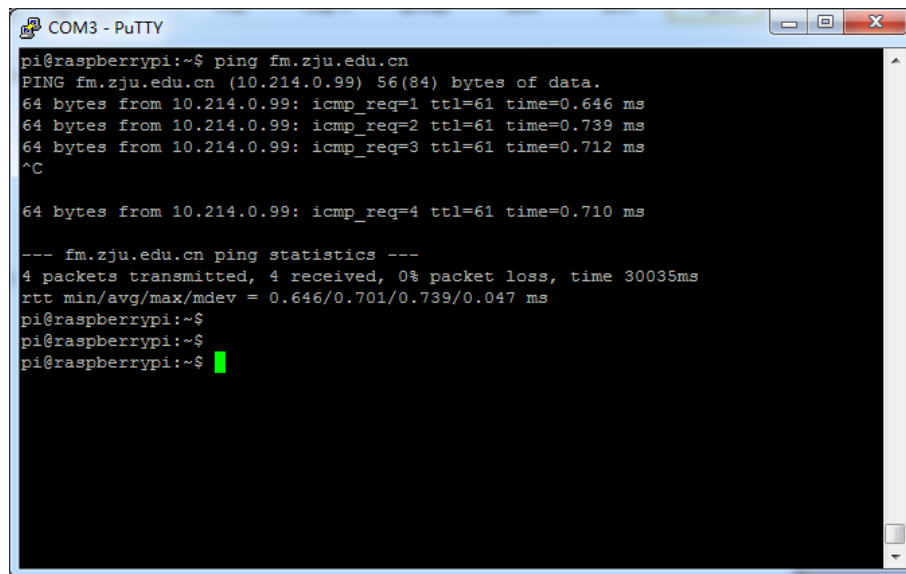
```
COM3 - PuTTY
TX packets:69 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:2196704 (2.0 MiB)  TX bytes:10222 (9.9 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:2 errors:0 dropped:0 overruns:0 frame:0
          TX packets:2 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:158 (158.0 B)  TX bytes:158 (158.0 B)

pi@raspberrypi:~$ sudo zjuvpn -c
Configure L2TP VPN for ZJU.
Username: 3130000014
Password:
[MSG] Disconnecting VPN ... Done!
[MSG] Restarting l2tpd...
Restarting xl2tpd: xl2tpd.
[MSG] Done!
[MSG] Trying to bring up vpn... 3 secs... Done!
[MSG] Detected gateway: 10.110.91.1, PPP device: ppp0 .
[MSG] Setting up route table... Done!
pi@raspberrypi:~$
```

#### b) Ping 通内外网

Ping `fm.zju.edu.cn`

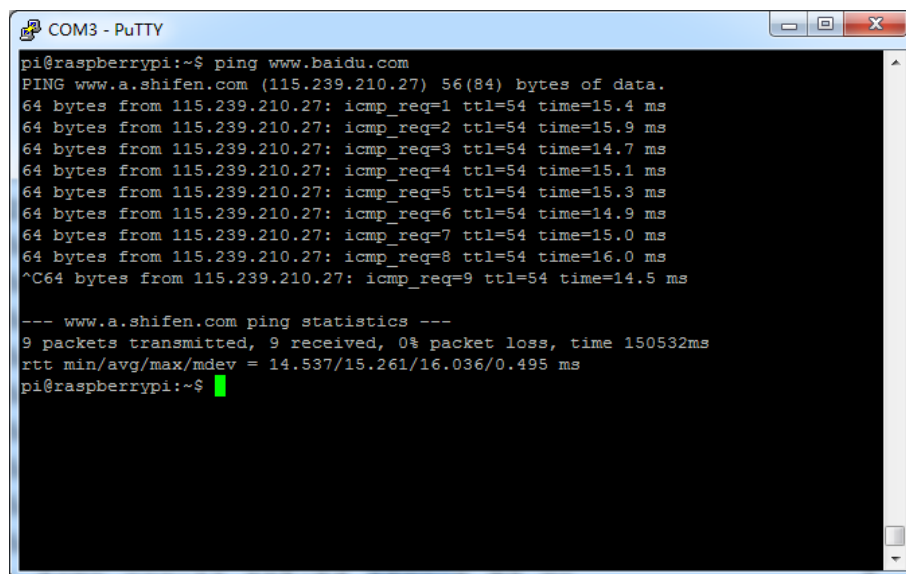


```
pi@raspberrypi:~$ ping fm.zju.edu.cn
PING fm.zju.edu.cn (10.214.0.99) 56(84) bytes of data.
64 bytes from 10.214.0.99: icmp_req=1 ttl=61 time=0.646 ms
64 bytes from 10.214.0.99: icmp_req=2 ttl=61 time=0.739 ms
64 bytes from 10.214.0.99: icmp_req=3 ttl=61 time=0.712 ms
^C
64 bytes from 10.214.0.99: icmp_req=4 ttl=61 time=0.710 ms

--- fm.zju.edu.cn ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 30035ms
rtt min/avg/max/mdev = 0.646/0.701/0.739/0.047 ms
pi@raspberrypi:~$
pi@raspberrypi:~$
pi@raspberrypi:~$
```

可以看到成功 Ping 通。

Ping [www.baidu.com](http://www.baidu.com)



```
pi@raspberrypi:~$ ping www.baidu.com
PING www.a.shifen.com (115.239.210.27) 56(84) bytes of data.
64 bytes from 115.239.210.27: icmp_req=1 ttl=54 time=15.4 ms
64 bytes from 115.239.210.27: icmp_req=2 ttl=54 time=15.9 ms
64 bytes from 115.239.210.27: icmp_req=3 ttl=54 time=14.7 ms
64 bytes from 115.239.210.27: icmp_req=4 ttl=54 time=15.1 ms
64 bytes from 115.239.210.27: icmp_req=5 ttl=54 time=15.3 ms
64 bytes from 115.239.210.27: icmp_req=6 ttl=54 time=14.9 ms
64 bytes from 115.239.210.27: icmp_req=7 ttl=54 time=15.0 ms
64 bytes from 115.239.210.27: icmp_req=8 ttl=54 time=16.0 ms
^C64 bytes from 115.239.210.27: icmp_req=9 ttl=54 time=14.5 ms

--- www.a.shifen.com ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 150532ms
rtt min/avg/max/mdev = 14.537/15.261/16.036/0.495 ms
pi@raspberrypi:~$
```

可以看到成功 Ping 通。

#### 四、 讨论与心得

本次实验中大量涉及了 IP、MAC 地址、网关等数据的修改和设置，让我对这些数据的查看和设置熟练了不少。另外，实验中还涉及了 x12tpd 等软件，对这些协议的学习和使用也让我受益匪浅。