

task11

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课程名称: Embedded System

实验时间: 2015-3-26 实验地点: 曹西-501 指导老师: 翁恺

一、实验目的和要求

把 Acadia 或 RPi 或 WRTnode 变成一个 DHCP 服务器。

二、主要仪器设备

硬件

Acadia 或 RPi 或 WRTnode 板一块; (本实验采用树莓派 2 代)

5V/1A 电源一个;

microUSB 线一根;

USB-TTL 串口线一根 (FT232RL 芯片或 PL2303 芯片);

PC 一台;

以太网线一根

Micro SD 一张/两张

U 盘 一个

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, 如 minicom、picocom、putty 等;

PC 上的 SSH 软件, 如 putty 等。

三、操作方法与实验步骤

首先安装 **hostapd**:

```

root@raspberrypi:/# sudo apt-get install bridge-utils hostapd
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  bridge-utils hostapd
0 upgraded, 2 newly installed, 0 to remove and 25 not upgraded.
Need to get 456 kB of archives.
After this operation, 1,050 kB of additional disk space will be used.
Get:1 http://mirrordirector.raspbian.org/raspbian/ wheezy/main bridge-utils armhf 1.5-6 [35.9 kB]
Get:2 http://mirrordirector.raspbian.org/raspbian/ wheezy/main hostapd armhf 1:1.0-3+deb7u1 [420 kB]
Fetched 456 kB in 19s (23.5 kB/s)
Selecting previously unselected package bridge-utils.
(Reading database ... 77696 files and directories currently installed.)
Unpacking bridge-utils (from ../bridge-utils_1.5-6_armhf.deb) ...
Selecting previously unselected package hostapd.
Unpacking hostapd (from ../hostapd_1%3a1.0-3+deb7u1_armhf.deb) ...
Processing triggers for man-db ...
Setting up bridge-utils (1.5-6) ...
Setting up hostapd (1:1.0-3+deb7u1) ...
root@raspberrypi:/#

```

```

root@raspberrypi:/# sudo apt-get install udhcpd
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
  busybox
The following NEW packages will be installed:
  busybox udhcpd
0 upgraded, 2 newly installed, 0 to remove and 25 not upgraded.
Need to get 459 kB of archives.
After this operation, 843 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 busybox armhf 1:1.20.0-7 [438 kB]
Get:2 http://mirrordirector.raspbian.org/raspbian/ wheezy/main udhcpd armhf 1:1.

```

至此 hostapd 成功安装。然后为了实现路由功能，安装程序 udhcpd

```

pi@raspberrypi:~$ wget http://www.daveconroy.com/wp3/wp-content/uploads/2013/
hostapd.zip
--2015-03-27 16:52:56-- http://www.daveconroy.com/wp3/wp-content/uploads/201
7/hostapd.zip
Resolving www.daveconroy.com (www.daveconroy.com)... 173.236.224.34
Connecting to www.daveconroy.com (www.daveconroy.com)[173.236.224.34]:80... c
ected.
HTTP request sent, awaiting response... 200 OK
Length: 706800 (690K) [application/zip]
Saving to: 'hostapd.zip'

```

配置 udhcpd:

指定 dhcp 能够分配的 IP 范围

```

start          192.168.42.2      #default: 192.168.0.20
end            192.168.42.20    #default: 192.168.0.254

```

```

remaining      yes              #default: yes

```

```
#Examples
opt      dns      8.8.8.8 4.4.4.4
option   subnet    255.255.255.0
opt      router    192.168.42.1
opt      wins      192.168.10.10
option   dns      129.219.13.81 # appened to above D
option   domain    local
option   lease     864000 # 10 days of seconds
```

制定了主机的 IP 是 192.168.42.1，在后面的验证环节我们还会用到这个 IP。

```
COM4 - PuTTY
GNU nano 2.2.6      File: /etc/default/udhcpd

# Comment the following line to enable
#DHCPD_ENABLED="no"

# Options to pass to busybox' udhcpd.
#
# -S      Log to syslog
# -f      run in foreground

DHCPD_OPTS="-S"
```

编辑/etc/default/udhcpd，注释掉 DHCPD_ENABLED="no"

从而让 dhcp 不会被使能关闭。

```
root@raspberrypi:/#
root@raspberrypi:/#
root@raspberrypi:/# ifconfig wlan0 192.168.42.1
root@raspberrypi:/#
```

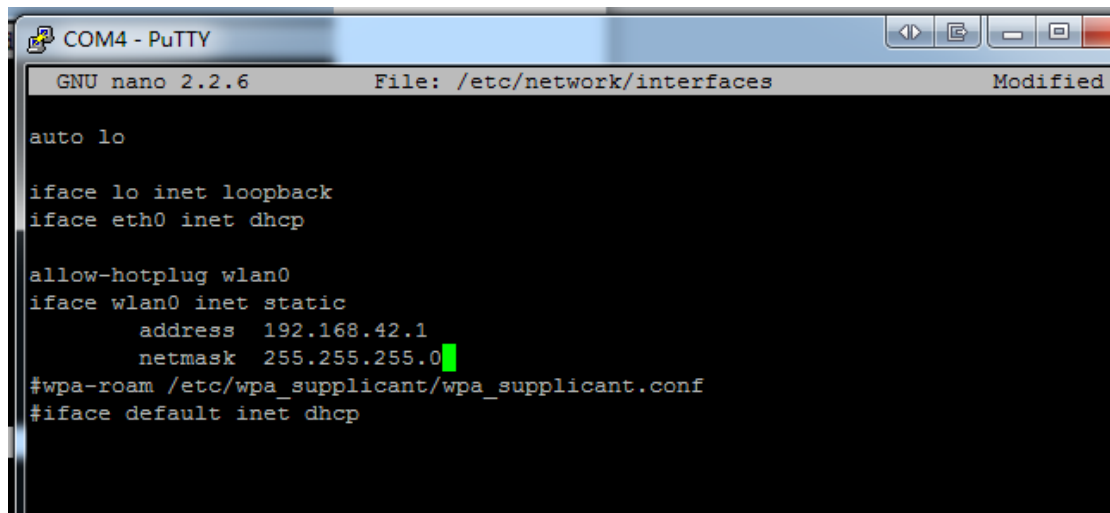
这一步是给无线网卡设置了 IP 地址 192.168.42.1

```
COM4 - PuTTY
GNU nano 2.2.6      File: /etc/network/interfaces      Modified

auto lo

iface lo inet loopback
iface eth0 inet dhcp

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



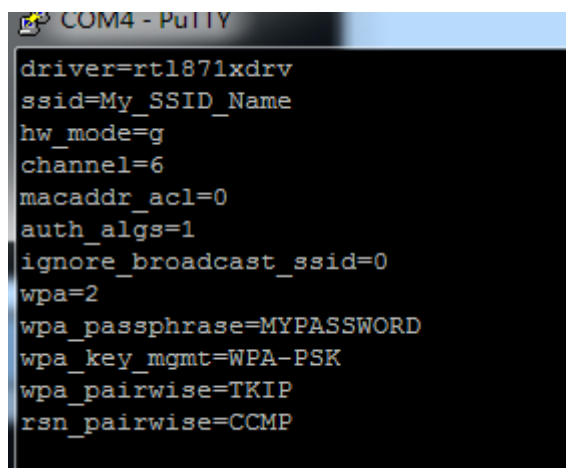
```
COM4 - PuTTY
GNU nano 2.2.6      File: /etc/network/interfaces      Modified

auto lo

iface lo inet loopback
iface eth0 inet dhcp

allow-hotplug wlan0
iface wlan0 inet static
    address 192.168.42.1
    netmask 255.255.255.0
#wpa-roam /etc/wpa_supplicant/wpa_supplicant.conf
#iface default inet dhcp
```

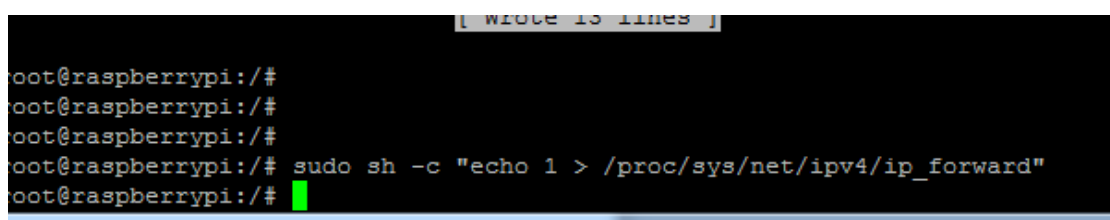
为了下次启动仍然有效，配置 `/etc/network/interfaces` 文件，具体修改如上图。



```
COM4 - PuTTY

driver=rtl871xdrv
ssid=My_SSID_Name
hw_mode=g
channel=6
macaddr_acl=0
auth_algs=1
ignore_broadcast_ssid=0
wpa=2
wpa_passphrase=MYPASSWORD
wpa_key_mgmt=WPA-PSK
wpa_pairwise=TKIP
rsn_pairwise=CCMP
```

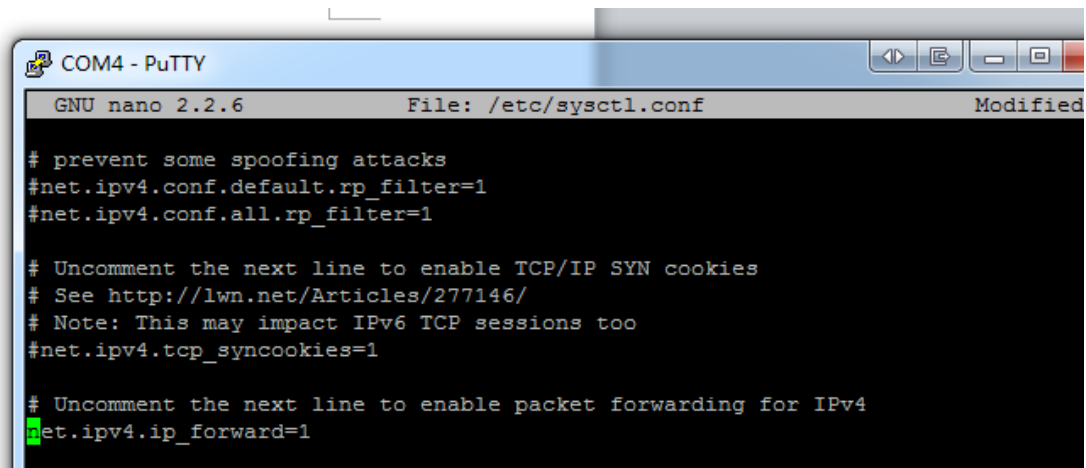
接下来编辑 `hostapd` 配置，将上述内容添加到 `/etc/hostapd/hostapd.conf` 制定了 AP 的名字是 `SSID_name`，密码是 `MYPASSWORD`（默认的我没有改，所以名字密码比较挫。。）



```
[ write 13 lines ]

oot@raspberrypi:/#
oot@raspberrypi:/#
oot@raspberrypi:/#
oot@raspberrypi:/# sudo sh -c "echo 1 > /proc/sys/net/ipv4/ip_forward"
oot@raspberrypi:/#
```

上图为启动 IP 转向功能。



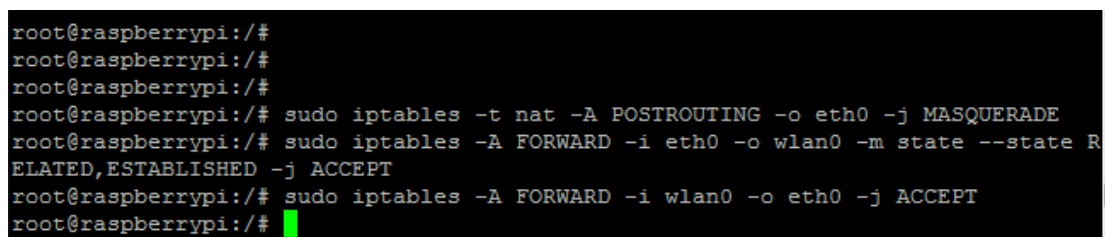
```
COM4 - PuTTY
GNU nano 2.2.6      File: /etc/sysctl.conf      Modified

# prevent some spoofing attacks
#net.ipv4.conf.default.rp_filter=1
#net.ipv4.conf.all.rp_filter=1

# Uncomment the next line to enable TCP/IP SYN cookies
# See http://lwn.net/Articles/277146/
# Note: This may impact IPv6 TCP sessions too
#net.ipv4.tcp_syncookies=1

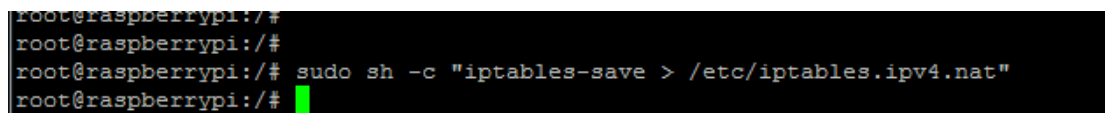
# Uncomment the next line to enable packet forwarding for IPv4
net.ipv4.ip_forward=1
```

编辑 sysctl.conf 改动 net.ipv4.ip_forward = 1;



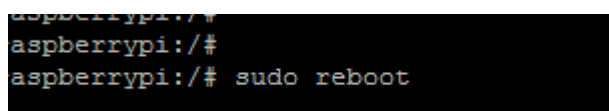
```
root@raspberrypi:/#
root@raspberrypi:/#
root@raspberrypi:/#
root@raspberrypi:/# sudo iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE
root@raspberrypi:/# sudo iptables -A FORWARD -i eth0 -o wlan0 -m state --state R
ELATED,ESTABLISHED -j ACCEPT
root@raspberrypi:/# sudo iptables -A FORWARD -i wlan0 -o eth0 -j ACCEPT
root@raspberrypi:/#
```

配置 iptables 防火墙，如上图所示。



```
root@raspberrypi:/#
root@raspberrypi:/#
root@raspberrypi:/# sudo sh -c "iptables-save > /etc/iptables.ipv4.nat"
root@raspberrypi:/#
```

将刚才配置的 iptables 保存下来以便于下次使用



```
root@raspberrypi:/#
root@raspberrypi:/#
root@raspberrypi:/# sudo reboot
```

至此设置完成，我们先重启一下树莓派然后进行测试：

重启完毕后输入命令

`sudo hostapd -dd /etc/hostapd/hostapd.conf`

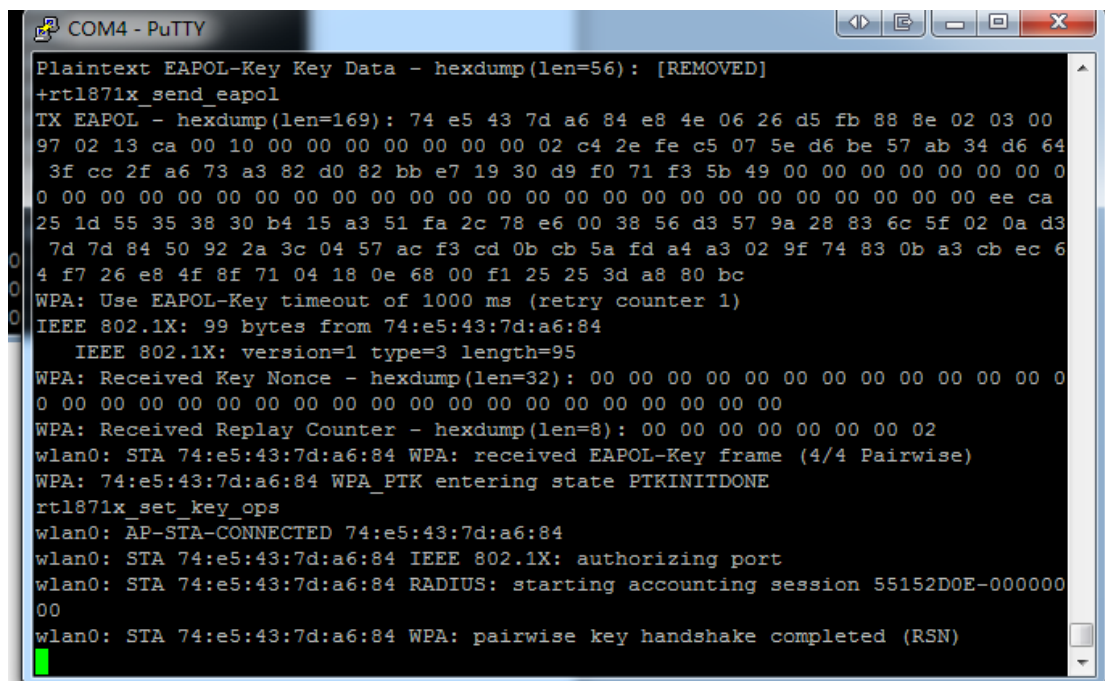
可以看到树莓派上面显示如下内容：

```

NOTICE: the software on this Raspberry Pi has not been fully configured. Please
run 'sudo raspi-config'

-bash: TZ: command not found
pi@raspberrypi:~$ sudo hostapd -dd /etc/hostapd/hostapd.conf
random: Trying to read entropy from /dev/random
Configuration file: /etc/hostapd/hostapd.conf
drv->ifindex=3
l2_sock_rcv==l2_sock_xmit=0x0xef8638
BSS count 1, BSSID mask 00:00:00:00:00:00 (0 bits)
Allowed channel: mode=1 chan=1 freq=2412 MHz max_tx_power=0 dBm
Allowed channel: mode=1 chan=2 freq=2417 MHz max_tx_power=0 dBm
Allowed channel: mode=1 chan=3 freq=2422 MHz max_tx_power=0 dBm
Allowed channel: mode=1 chan=4 freq=2427 MHz max_tx_power=0 dBm
Allowed channel: mode=1 chan=5 freq=2432 MHz max_tx_power=0 dBm
Allowed channel: mode=1 chan=6 freq=2437 MHz max_tx_power=0 dBm
Allowed channel: mode=1 chan=7 freq=2442 MHz max_tx_power=0 dBm
Allowed channel: mode=1 chan=8 freq=2447 MHz max_tx_power=0 dBm
Allowed channel: mode=1 chan=9 freq=2452 MHz max_tx_power=0 dBm
Allowed channel: mode=1 chan=10 freq=2457 MHz max_tx_power=0 dBm
Allowed channel: mode=1 chan=11 freq=2462 MHz max_tx_power=0 dBm
Allowed channel: mode=1 chan=12 freq=2467 MHz max_tx_power=0 dBm

```



```

COM4 - PuTTY
Plaintext EAPOL-Key Key Data - hexdump(len=56): [REMOVED]
+rtl871x_send_eapol
TX EAPOL - hexdump(len=169): 74 e5 43 7d a6 84 e8 4e 06 26 d5 fb 88 8e 02 03 00
97 02 13 ca 00 10 00 00 00 00 00 00 00 02 c4 2e fe c5 07 5e d6 be 57 ab 34 d6 64
3f cc 2f a6 73 a3 82 d0 82 bb e7 19 30 d9 f0 71 f3 5b 49 00 00 00 00 00 00 00 00
0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ee ca
25 1d 55 35 38 30 b4 15 a3 51 fa 2c 78 e6 00 38 56 d3 57 9a 28 83 6c 5f 02 0a d3
7d 7d 84 50 92 2a 3c 04 57 ac f3 cd 0b cb 5a fd a4 a3 02 9f 74 83 0b a3 cb ec 6
4 f7 26 e8 4f 8f 71 04 18 0e 68 00 f1 25 25 3d a8 80 bc
WPA: Use EAPOL-Key timeout of 1000 ms (retry counter 1)
IEEE 802.1X: 99 bytes from 74:e5:43:7d:a6:84
IEEE 802.1X: version=1 type=3 length=95
WPA: Received Key Nonce - hexdump(len=32): 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
WPA: Received Replay Counter - hexdump(len=8): 00 00 00 00 00 00 00 02
wlan0: STA 74:e5:43:7d:a6:84 WPA: received EAPOL-Key frame (4/4 Pairwise)
WPA: 74:e5:43:7d:a6:84 WPA_PTK entering state PTKINITDONE
rtl871x_set_key_ops
wlan0: AP-STA-CONNECTED 74:e5:43:7d:a6:84
wlan0: STA 74:e5:43:7d:a6:84 IEEE 802.1X: authorizing port
wlan0: STA 74:e5:43:7d:a6:84 RADIUS: starting accounting session 55152D0E-000000
00
wlan0: STA 74:e5:43:7d:a6:84 WPA: pairwise key handshake completed (RSN)

```

这时在我的 PC 上进行搜索，发现了对应的 wifi 并且使用 MYPASSWORD 登陆成功：



在 PC 上 ping 一下主机，成功：

```
管理员: C:\Windows\system32\cmd.exe
Microsoft Windows [版本 6.1.7600]
版权所有 (c) 2009 Microsoft Corporation。保留所有权利。

C:\Users\Lenovo>ping 192.168.42.1

正在 Ping 192.168.42.1 具有 32 字节的数据:
来自 192.168.42.1 的回复: 字节=32 时间=8ms TTL=64
来自 192.168.42.1 的回复: 字节=32 时间=5ms TTL=64
来自 192.168.42.1 的回复: 字节=32 时间=6ms TTL=64
来自 192.168.42.1 的回复: 字节=32 时间=10ms TTL=64

192.168.42.1 的 Ping 统计信息:
    数据包: 已发送 = 4, 已接收 = 4, 丢失 = 0 (0% 丢失),
    往返行程的估计时间(以毫秒为单位):
        最短 = 5ms, 最长 = 10ms, 平均 = 7ms

C:\Users\Lenovo>
```

证明 dhcp 服务器运转良好。实验结束。

四、实验结果与分析

实验成功，截图见第三部分。

五、讨论、心得

这次试验有点费工夫，我用的无线网卡一开始不兼容，后来使用了非官方的 `hostapd` 软件才成功实现了这个实验。这样树莓派就可以当成一个 AP 来用了~