

利用 MadWiFi 實作 WDS

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WDS

Q：什麼是WDS (Wireless Distribution System)？

A：WDS 就是一台AP(a)透過另一台AP(b)連到原來(a)所不能連到的地方。

一般的無線AP都號稱距離可達50-100公尺，但是會受到建築物的影響而有所減少，如果使用者位於超過AP的發射距離而連外只有一條ADSL又不想另外拉線，WDS就可以派上用場。

達成WDS的必要條件

1. 兩個具有WDS功能的AP
2. 兩個AP的SSID要相同
3. 兩個AP使用的無線網路頻道必須相同
4. 兩個AP啟動WDS，並互設對方wireless
MAC address
5. 兩個AP的安全機制必須相同

實驗環境

- 硬體：

(1) 4台NB - Acer 4830TG * 1 - STA1

Acer 4720 * 2 - AP1 & AP2

Asus A8FM * 1 - STA2

(2) 2張D-Link DWL-G650無線網卡

- 作業系統：

Acer 4830TG(STA1) - Ubuntu 10.04

Acer 4720(AP1) & (AP2) - Fedora core 6

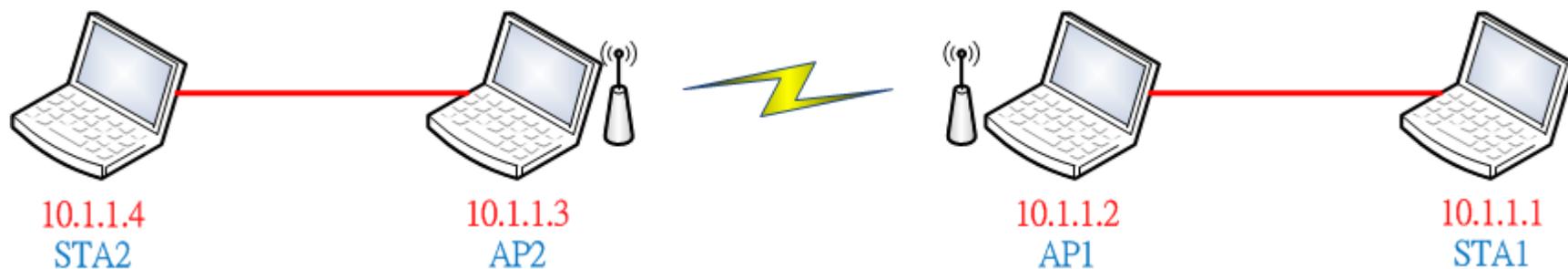
AP1 MAC : 00:0f:3d:de:1d:d7

AP2 MAC : 00:0f:3d:de:1d:d0

Asus A8FM(STA2) - WinXP(只是為了證明任何系統都可成功)

實驗目標

- 在WDS裡，橋接兩端的AP，藉由無線傳輸連接，即是從兩邊有線的乙太網路(802.3)，透過中間的無線傳輸(802.11)來進行溝通使得雙方能夠互ping。
- 實驗拓樸



實際實驗拓撲



10.1.1.4
STA2

10.1.1.3
AP2

10.1.1.2
AP1

10.1.1.1
STA1

實作WDS

要安裝Bridge控制套件

如果一開始安裝時沒點選到此套件，

Fedora core 6光碟有

在->Fedora->RPMS->bridge-utils-1.1-

2.i386(依你的系統版本而定，我是灌i386)

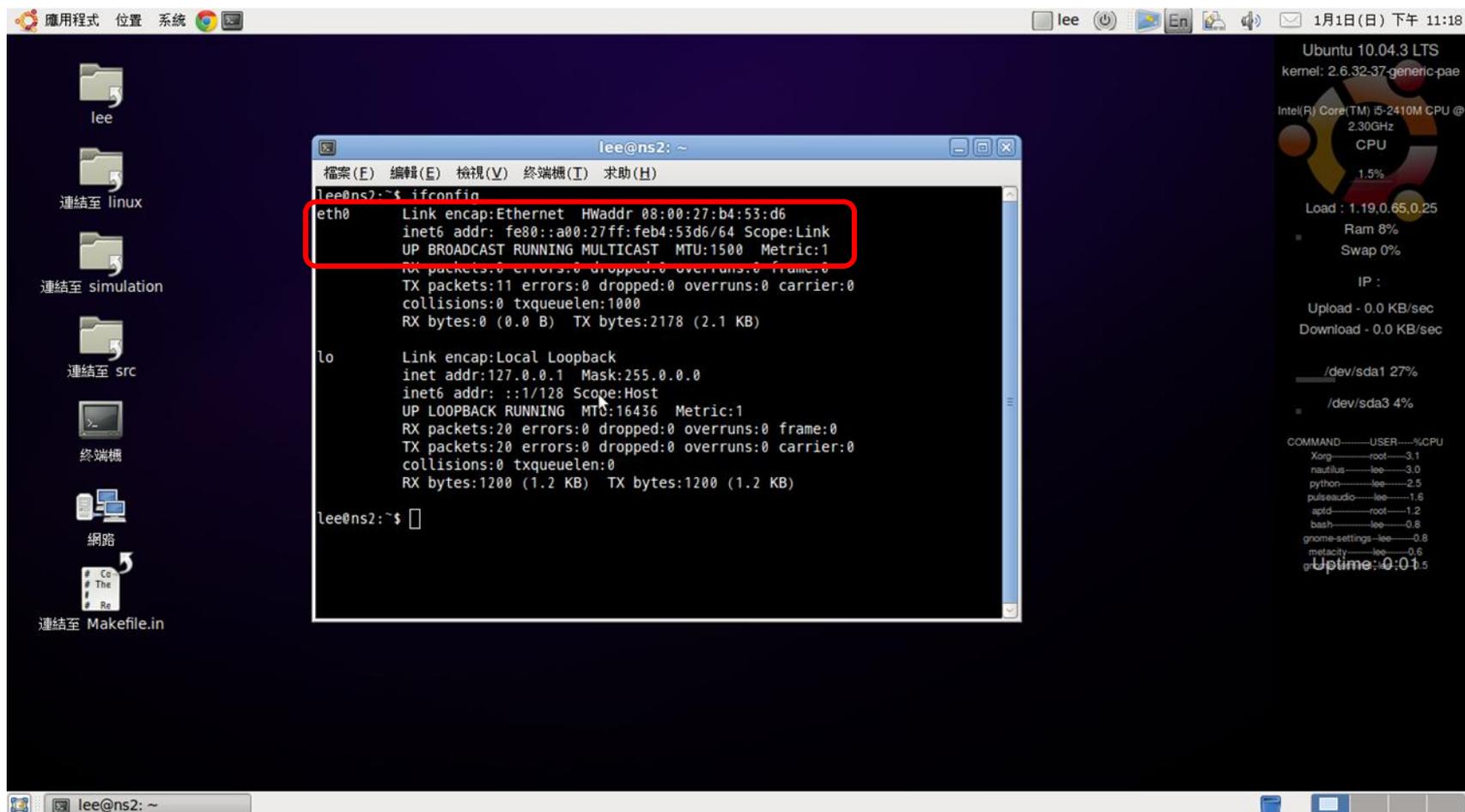
抓出來之後，執行安裝

```
#rpm -ivh bridge-utils-1.1-2.i386
```

必須安裝此套件才能使用brctl command

STA1的設定與運作情形

- 初始狀態，eth0無任何IP設定

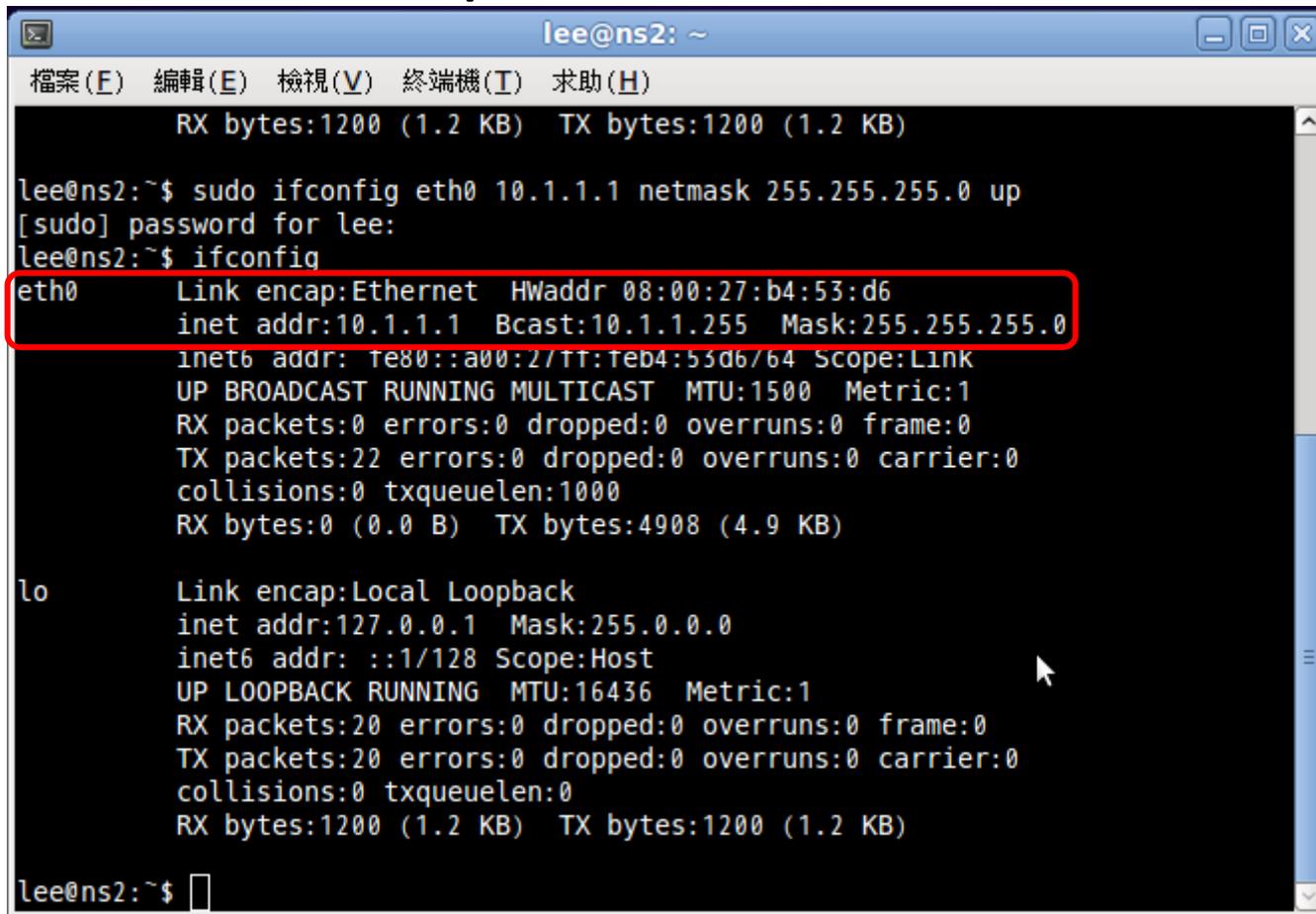


The screenshot shows a Linux desktop environment with a terminal window open. The terminal displays the output of the `ifconfig` command. The `eth0` interface is highlighted with a red box, showing its configuration details. The `lo` interface is also visible, showing its configuration details. The desktop background is dark blue, and the system tray at the bottom shows the user `lee` and the time `1月1日(日) 下午 11:18`.

```
lee@ns2: ~  
lee@ns2:~$ ifconfig  
eth0      Link encap:Ethernet HWaddr 08:00:27:b4:53:d6  
          inet6 addr: fe80::a00:27ff:feb4:53d6/64 Scope:Link  
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1  
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0  
          TX packets:11 errors:0 dropped:0 overruns:0 carrier:0  
          collisions:0 txqueuelen:1000  
          RX bytes:0 (0.0 B) TX bytes:2178 (2.1 KB)  
  
lo        Link encap:Local Loopback  
          inet addr:127.0.0.1 Mask:255.0.0.0  
          inet6 addr: ::1/128 Scope:Host  
          UP LOOPBACK RUNNING MTU:16436 Metric:1  
          RX packets:20 errors:0 dropped:0 overruns:0 frame:0  
          TX packets:20 errors:0 dropped:0 overruns:0 carrier:0  
          collisions:0 txqueuelen:0  
          RX bytes:1200 (1.2 KB) TX bytes:1200 (1.2 KB)  
  
lee@ns2:~$
```

STA1的設定與運作情形

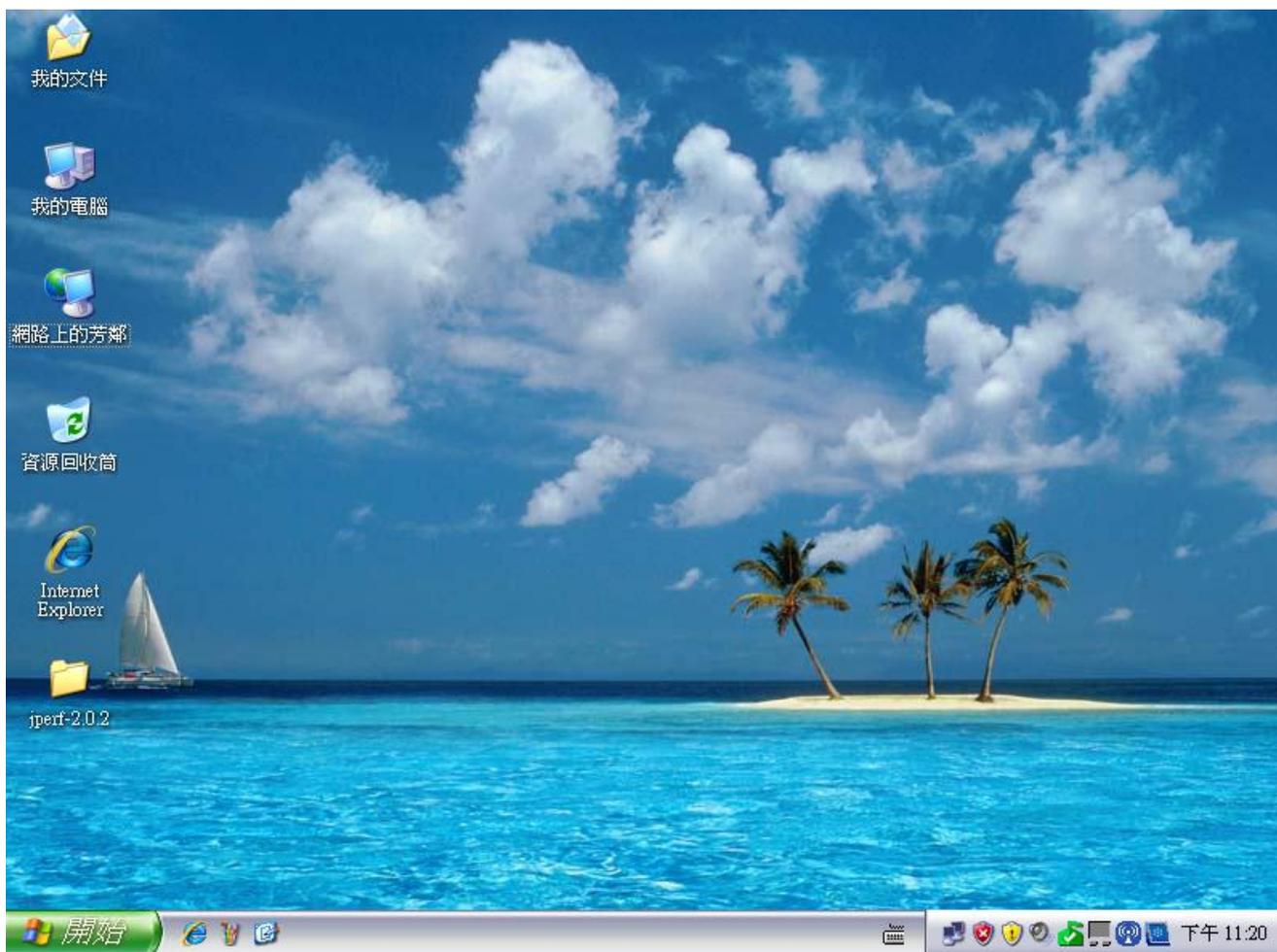
- #sudo ifconfig eth0 10.1.1.1 netmask 255.255.255.0 up



```
lee@ns2: ~  
檔案(E) 編輯(E) 檢視(V) 終端機(T) 求助(H)  
RX bytes:1200 (1.2 KB) TX bytes:1200 (1.2 KB)  
lee@ns2:~$ sudo ifconfig eth0 10.1.1.1 netmask 255.255.255.0 up  
[sudo] password for lee:  
lee@ns2:~$ ifconfig  
eth0      Link encap:Ethernet  HWaddr 08:00:27:b4:53:d6  
          inet addr:10.1.1.1  Bcast:10.1.1.255  Mask:255.255.255.0  
          inet6 addr: fe80::a00:27ff:feb4:53d6/64  Scope:Link  
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1  
          RX packets:0  errors:0  dropped:0  overruns:0  frame:0  
          TX packets:22  errors:0  dropped:0  overruns:0  carrier:0  
          collisions:0  txqueuelen:1000  
          RX bytes:0 (0.0 B)  TX bytes:4908 (4.9 KB)  
  
lo        Link encap:Local Loopback  
          inet addr:127.0.0.1  Mask:255.0.0.0  
          inet6 addr: ::1/128  Scope:Host  
          UP LOOPBACK RUNNING  MTU:16436  Metric:1  
          RX packets:20  errors:0  dropped:0  overruns:0  frame:0  
          TX packets:20  errors:0  dropped:0  overruns:0  carrier:0  
          collisions:0  txqueuelen:0  
          RX bytes:1200 (1.2 KB)  TX bytes:1200 (1.2 KB)  
  
lee@ns2:~$
```

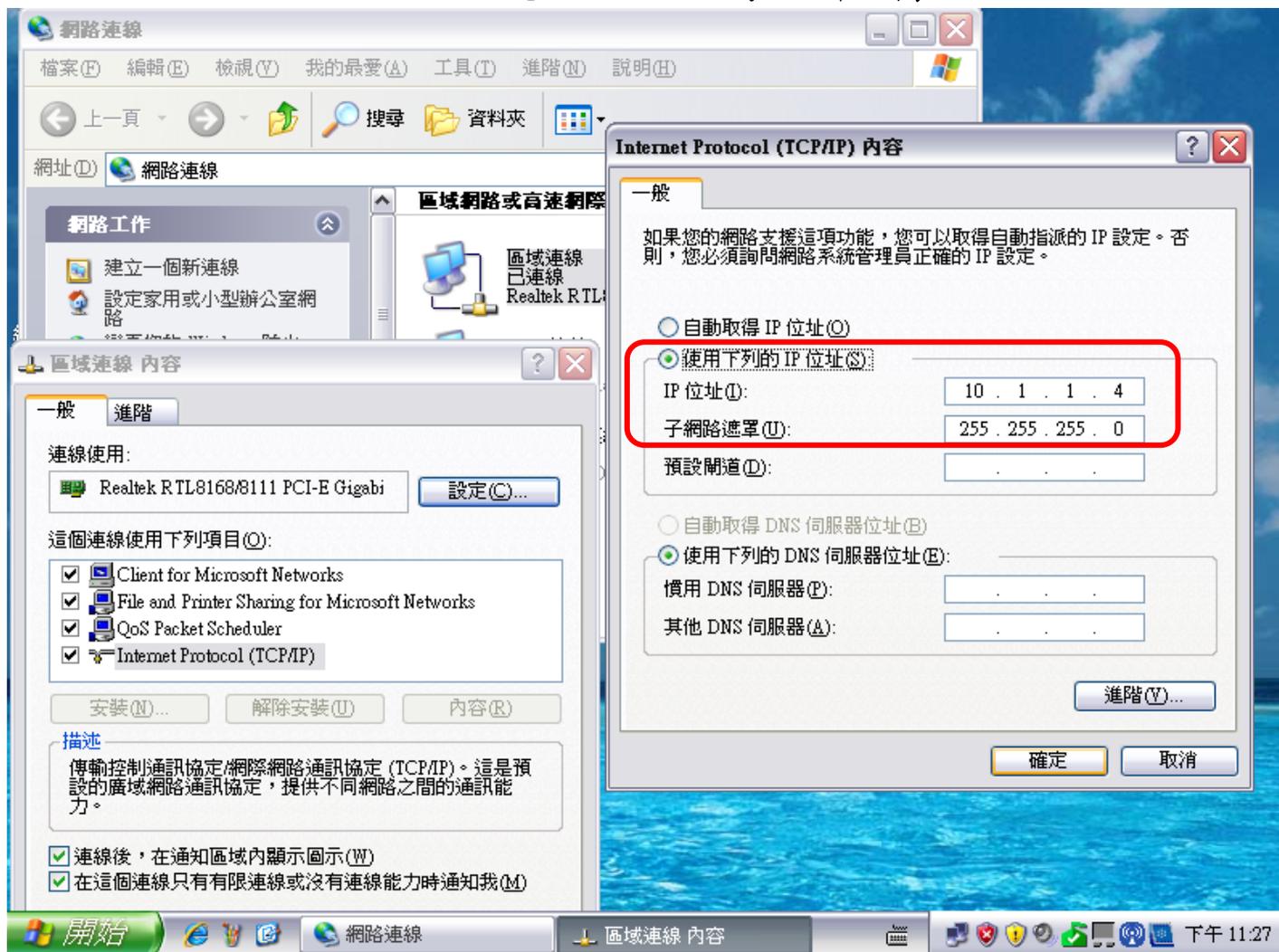
STA2的設定與運作情形

- 初始狀態



STA2的設定與運作情形

- 設定WinXP IP，想必大家都會



AP1的設定與運作情形(1/12)

編寫設定檔

```
#vim final_ap1.sh or #gedit final_ap1.sh
echo "br0 down "
ifconfig br0 down
sleep 3
echo "ath0 down "
ifconfig ath0 down
sleep 3
echo "wdsath0 down "
ifconfig wdsath0 down
sleep 3
echo "wlanconfig ath0 destroy "
wlanconfig ath0 destroy
sleep 3
echo "wlanconfig wdsath0 destroy "
```

API的設定與運作情形(2/12)

```
wlanconfig wdsath0 destroy
```

```
sleep 3
```

```
echo "delbr br0 "
```

```
brctl delbr br0
```

```
sleep 3
```

```
echo "rmmod -w ath_pci "
```

```
rmmod -w ath_pci
```

```
sleep 3
```

//以上為執行第二次以上才有作用，為device重置的意思，初次執行會無此裝置是沒關係的

#設定ath0無線相關設定

```
echo "modprobe ath_pci "
```

```
modprobe ath_pci
```

```
sleep 3
```

```
echo "wlanconfig ath0 destroy "
```

AP1 的設定與運作情形(3/12)

```
wlanconfig ath0 destroy
sleep 3
echo "wlanconfig ath0 create wlandev wifi0 wlanmode ap "
wlanconfig ath0 create wlandev wifi0 wlanmode ap
sleep 3
echo "ifconfig ath0 down "
ifconfig ath0 down
sleep 3
echo "iwconfig ath0 essid honjie "
iwconfig ath0 essid honjie
sleep 3
echo "iwconfig ath0 channel 10 "
iwconfig ath0 channel 10
sleep 3
echo "wlanconfig wdsath0 create wlandev wifi0 wlanmode wds "
```

AP1 的設定與運作情形(4/12)

```
wlanconfig wdsath0 create wlandev wifi0 wlanmode wds
sleep 3
echo "ifconfig wdsath0 down "
ifconfig wdsath0 down
sleep 3
echo "iwpriv wdsath0 wds_add 00:0f:3d:de:1d:d0 "
iwpriv wdsath0 wds_add 00:0f:3d:de:1d:d0
sleep 3
echo "iwpriv wdsath0 wds 1 "
iwpriv wdsath0 wds 1
sleep 3
echo "ifconfig ath0 0.0.0.0 up "
ifconfig ath0 0.0.0.0 up
sleep 3
echo "ifconfig wdsath0 0.0.0.0 up "
```

API的設定與運作情形(5/12)

```
ifconfig wdsath0 0.0.0.0 up
sleep 3
echo "ifconfig eth0 0.0.0.0 up "
ifconfig eth0 0.0.0.0 up
sleep 3
# 建立虛擬的br0—Bridge介面
echo "brctl addbr br0 "
brctl addbr br0
sleep 3
echo "brctl addif br0 ath0 "
brctl addif br0 ath0
sleep 3
echo "brctl addif br0 wdsath0 "
brctl addif br0 wdsath0
sleep 3
```

AP1的設定與運作情形(6/12)

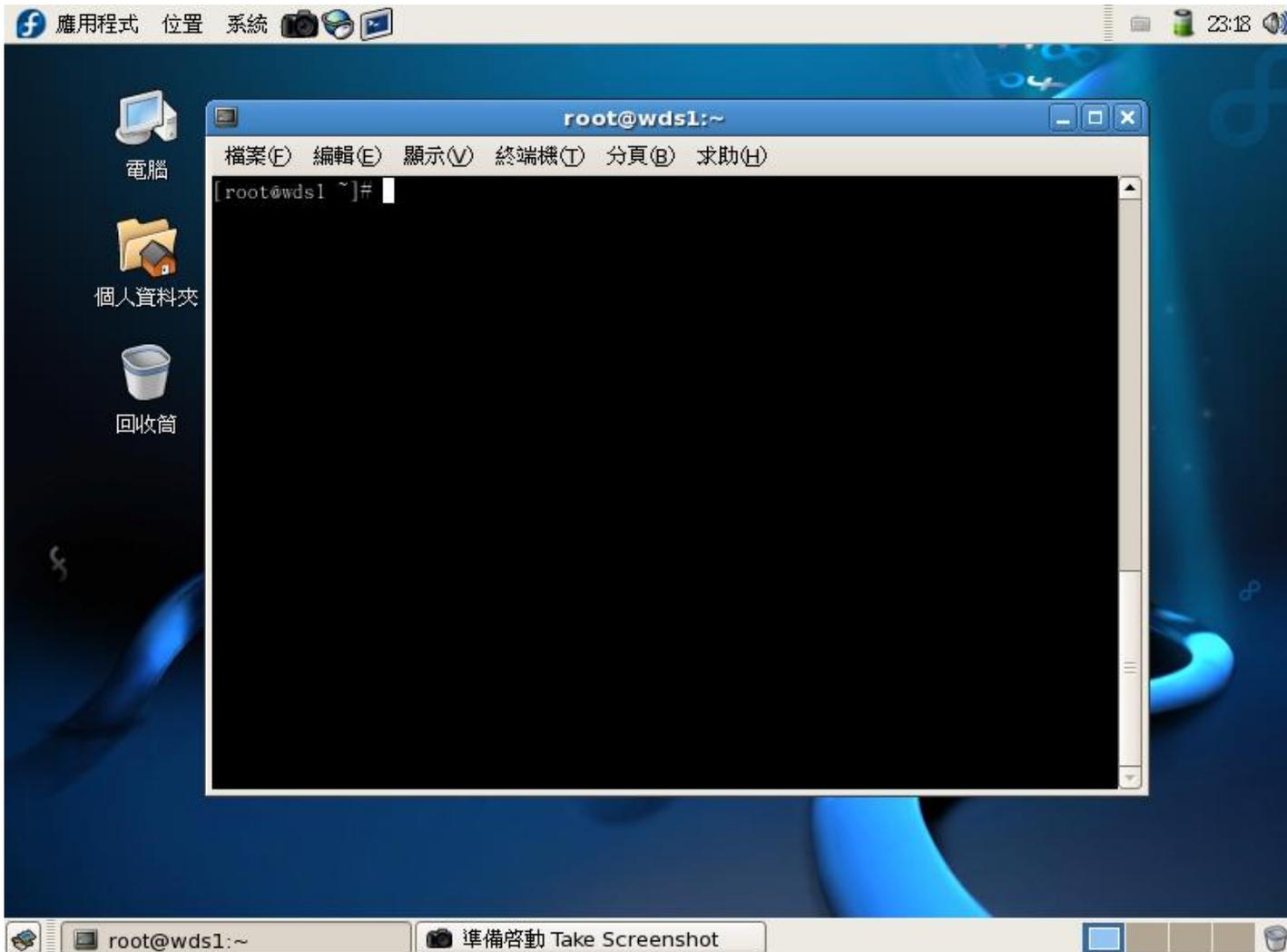
```
echo "brctl addif br0 eth0 "  
brctl addif br0 eth0  
sleep 3  
echo "echo 1 > /proc/sys/net/ipv4/ip_forward "  
echo 1 > /proc/sys/net/ipv4/ip_forward  
sleep 3  
#設定bridge的Network資訊，並將此bridge啟動  
echo "ifconfig br0 10.1.1.2 netmask 255.255.255.0 up "  
ifconfig br0 10.1.1.2 netmask 255.255.255.0 up  
//以上WDS之相關設定與bridge橋接均完成
```

存檔並執行

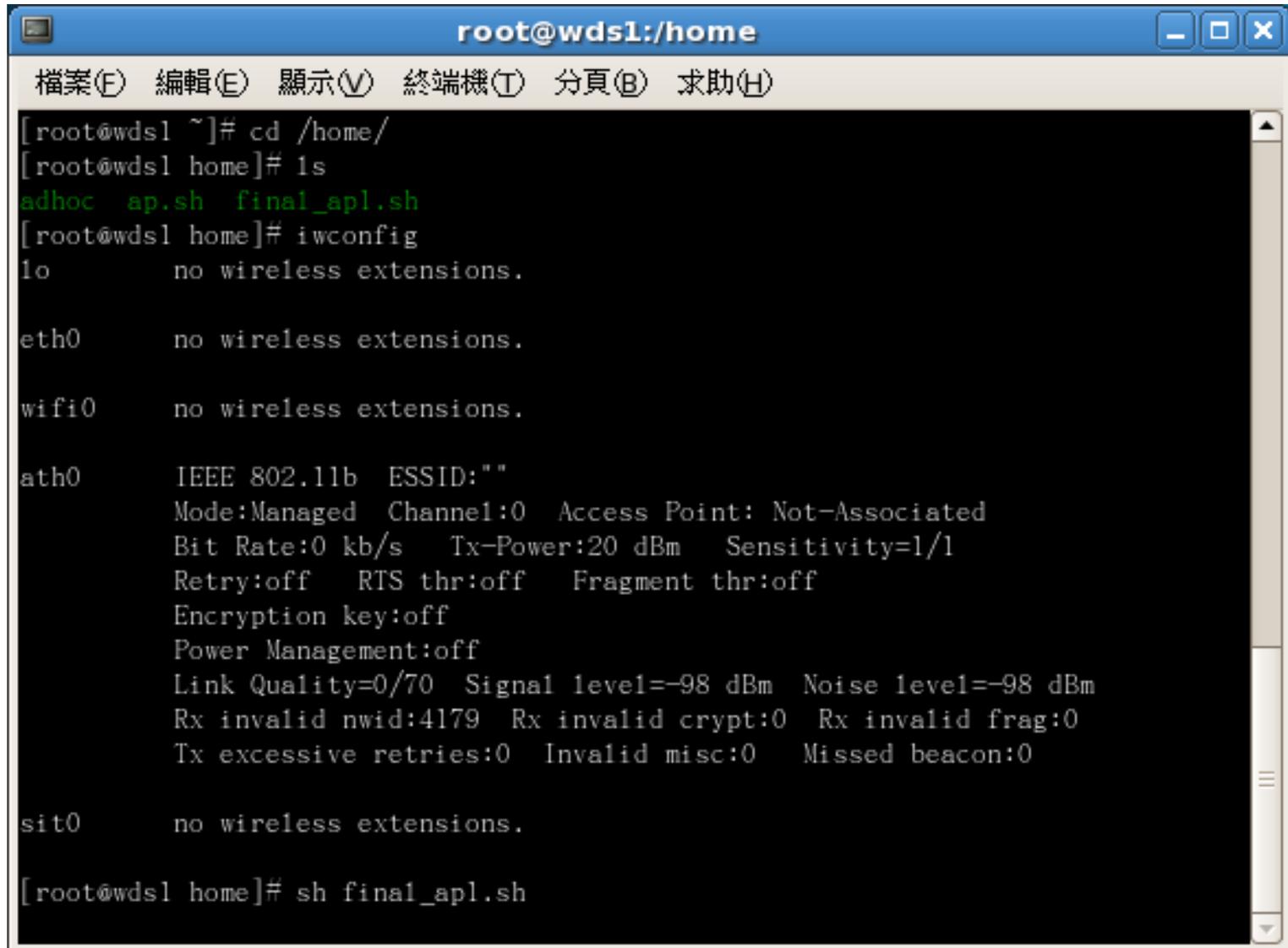
```
#chmod 755 final_ap1.sh  
#sh final_ap1.sh
```

API的設定與運作情形(7/12)

- 初始狀態



AP1 的設定與運作情形(8/12)



A terminal window titled "root@wds1:/home" with a menu bar containing "檔案(F)", "編輯(E)", "顯示(V)", "終端機(T)", "分頁(B)", and "求助(H)". The terminal output shows the following commands and results:

```
[root@wds1 ~]# cd /home/
[root@wds1 home]# ls
adhoc ap.sh final_ap1.sh
[root@wds1 home]# iwconfig
lo          no wireless extensions.

eth0       no wireless extensions.

wifi0     no wireless extensions.

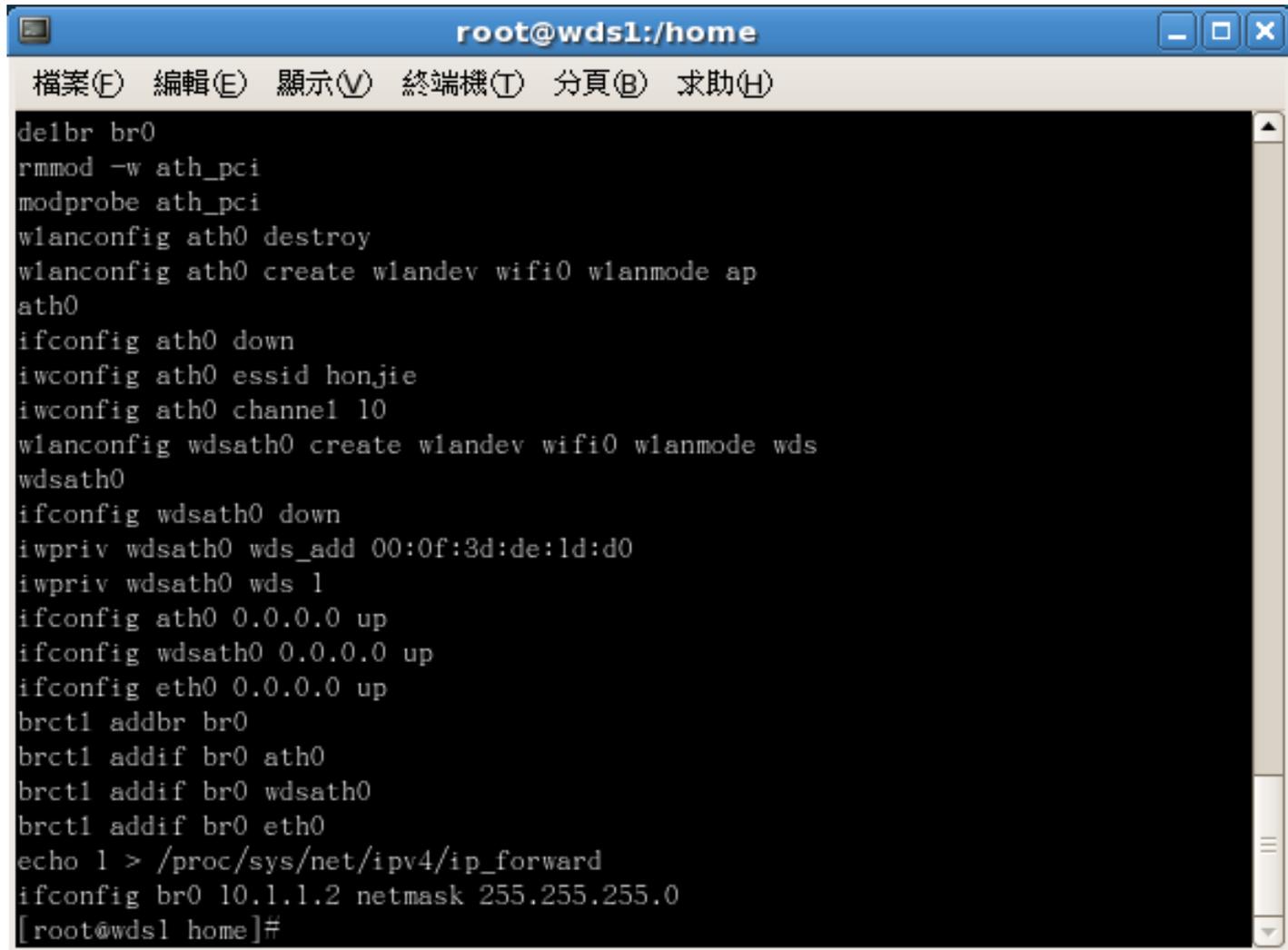
ath0      IEEE 802.11b  ESSID:""
          Mode:Managed  Channel:0  Access Point: Not-Associated
          Bit Rate:0 kb/s  Tx-Power:20 dBm  Sensitivity=1/1
          Retry:off  RTS thr:off  Fragment thr:off
          Encryption key:off
          Power Management:off
          Link Quality=0/70  Signal level=-98 dBm  Noise level=-98 dBm
          Rx invalid nwid:4179  Rx invalid crypt:0  Rx invalid frag:0
          Tx excessive retries:0  Invalid misc:0  Missed beacon:0

sit0      no wireless extensions.

[root@wds1 home]# sh final_ap1.sh
```

AP1 的設定與運作情形(9/12)

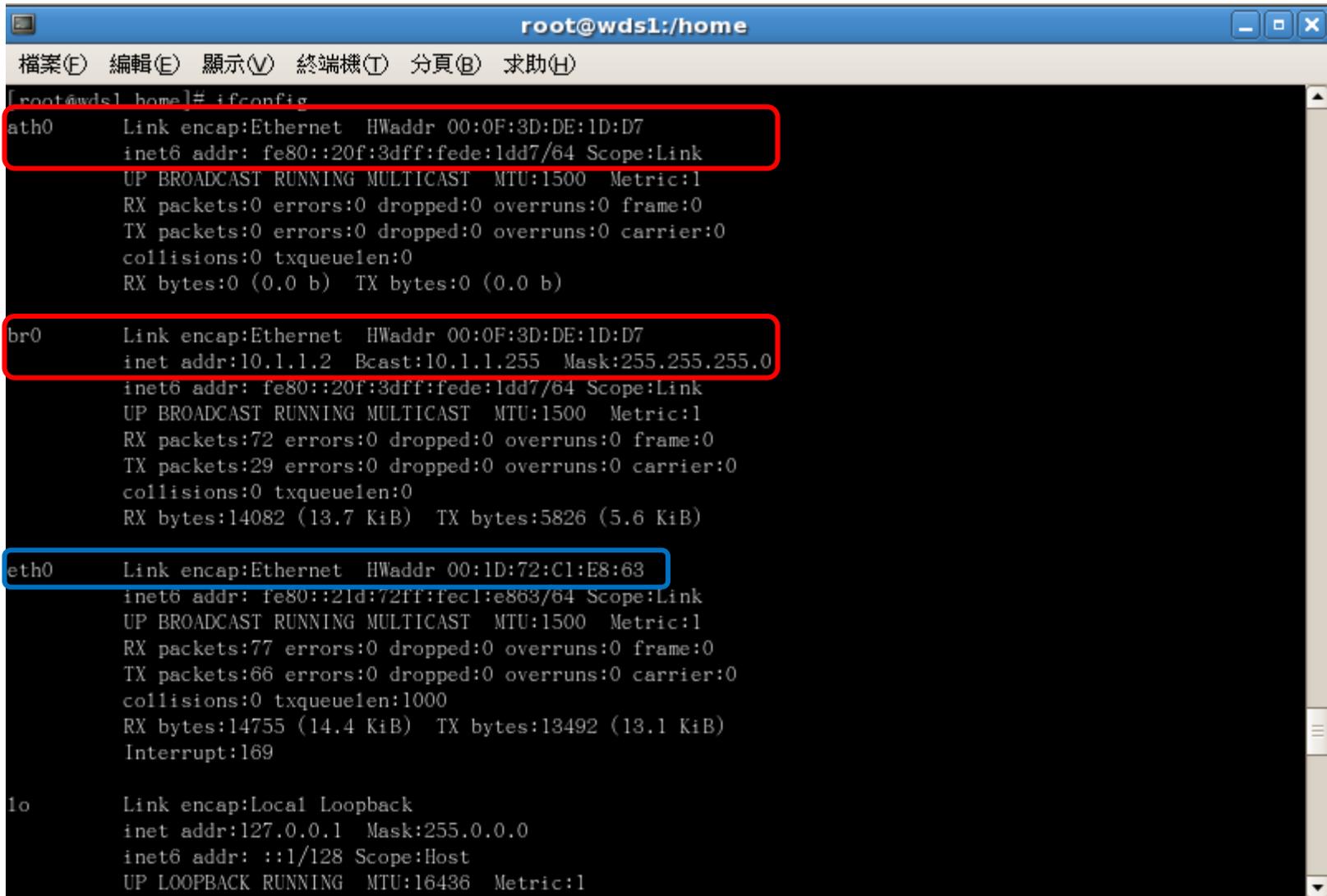
執行後結果



```
root@wds1:/home
檔案(E) 編輯(E) 顯示(V) 終端機(T) 分頁(B) 求助(H)
delbr br0
rmmod -w ath_pci
modprobe ath_pci
wlanconfig ath0 destroy
wlanconfig ath0 create wlandev wifi0 wlanmode ap
ath0
ifconfig ath0 down
iwconfig ath0 essid honjie
iwconfig ath0 channel 10
wlanconfig wdsath0 create wlandev wifi0 wlanmode wds
wdsath0
ifconfig wdsath0 down
iwpriv wdsath0 wds_add 00:0f:3d:de:ld:d0
iwpriv wdsath0 wds 1
ifconfig ath0 0.0.0.0 up
ifconfig wdsath0 0.0.0.0 up
ifconfig eth0 0.0.0.0 up
brctl addbr br0
brctl addif br0 ath0
brctl addif br0 wdsath0
brctl addif br0 eth0
echo 1 > /proc/sys/net/ipv4/ip_forward
ifconfig br0 10.1.1.2 netmask 255.255.255.0
[root@wds1 home]#
```

AP1 的設定與運作情形(10/12)

觀看網路相關設定，#ifconfig



```
root@wds1:/home
檔案(F) 編輯(E) 顯示(V) 終端機(T) 分頁(B) 求助(H)
[root@wds1 home]# ifconfig
ath0      Link encap:Ethernet  HWaddr 00:0F:3D:DE:1D:D7
          inet6 addr: fe80::20f:3dff:fede:1dd7/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

br0       Link encap:Ethernet  HWaddr 00:0F:3D:DE:1D:D7
          inet addr:10.1.1.2 Bcast:10.1.1.255  Mask:255.255.255.0
          inet6 addr: fe80::20f:3dff:fede:1dd7/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:72 errors:0 dropped:0 overruns:0 frame:0
          TX packets:29 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:14082 (13.7 KiB)  TX bytes:5826 (5.6 KiB)

eth0     Link encap:Ethernet  HWaddr 00:1D:72:C1:E8:63
          inet6 addr: fe80::21d:72ff:fecl:e863/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:77 errors:0 dropped:0 overruns:0 frame:0
          TX packets:66 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:14755 (14.4 KiB)  TX bytes:13492 (13.1 KiB)
          Interrupt:169

lo       Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
```

AP1的設定與運作情形(11/12)

```
root@wds1:/home
檔案(F) 編輯(E) 顯示(V) 終端機(T) 分頁(B) 求助(H)

TX packets:66 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:17632 (17.2 KiB) TX bytes:13492 (13.1 KiB)
Interrupt:169

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:4817 errors:0 dropped:0 overruns:0 frame:0
          TX packets:4817 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:6964292 (6.6 MiB)  TX bytes:6964292 (6.6 MiB)

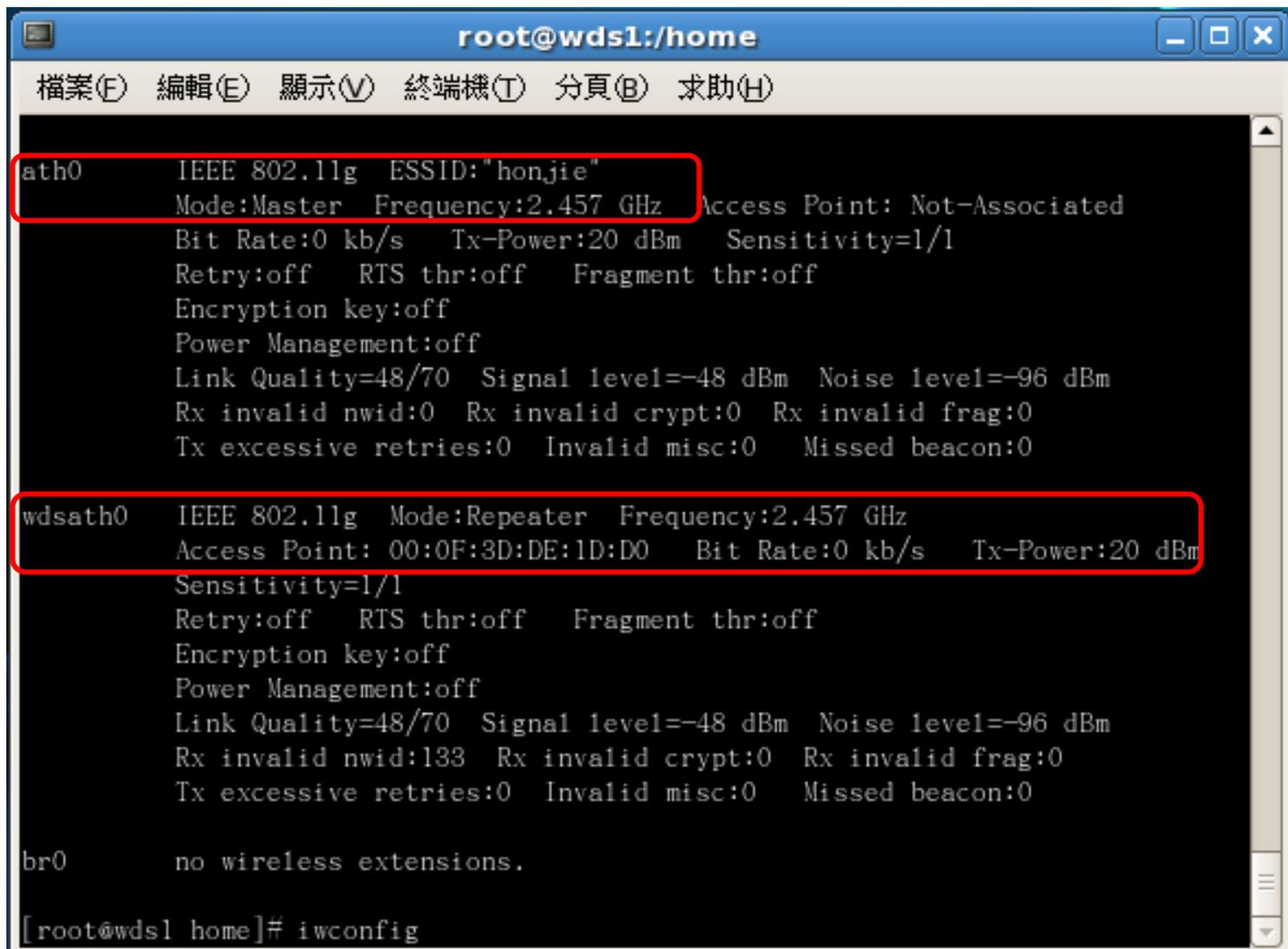
wdsath0   Link encap:Ethernet  HWaddr 00:0F:3D:DE:1D:D7
          inet6 addr: fe80::20f:3dff:fedc:1dd7/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:50 errors:0 dropped:0 overruns:0 frame:0
          TX packets:53 errors:0 dropped:1 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:9956 (9.7 KiB)  TX bytes:11402 (11.1 KiB)

wifi0     Link encap:UNSPEC  HWaddr 00-0F-3D-DE-1D-D7-98-22-00-00-00-00-00-00-00
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:207 errors:0 dropped:0 overruns:0 frame:333
          TX packets:53 errors:22 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:199
          RX bytes:28203 (27.5 KiB)  TX bytes:12886 (12.5 KiB)
          Interrupt:193

[root@wds1 home]#
```

AP1 的設定與運作情形(12/12)

觀看無線網卡相關設定， #iwconfig



```
root@wds1:/home
檔案(E) 編輯(E) 顯示(V) 終端機(T) 分頁(B) 求助(H)
ath0 IEEE 802.11g ESSID:"honjie"
Mode:Master Frequency:2.457 GHz Access Point: Not-Associated
Bit Rate:0 kb/s Tx-Power:20 dBm Sensitivity=1/1
Retry:off RTS thr:off Fragment thr:off
Encryption key:off
Power Management:off
Link Quality=48/70 Signal level=-48 dBm Noise level=-96 dBm
Rx invalid nwid:0 Rx invalid crypt:0 Rx invalid frag:0
Tx excessive retries:0 Invalid misc:0 Missed beacon:0

wdsath0 IEEE 802.11g Mode:Repeater Frequency:2.457 GHz
Access Point: 00:0F:3D:DE:1D:D0 Bit Rate:0 kb/s Tx-Power:20 dBm
Sensitivity=1/1
Retry:off RTS thr:off Fragment thr:off
Encryption key:off
Power Management:off
Link Quality=48/70 Signal level=-48 dBm Noise level=-96 dBm
Rx invalid nwid:133 Rx invalid crypt:0 Rx invalid frag:0
Tx excessive retries:0 Invalid misc:0 Missed beacon:0

br0 no wireless extensions.

[root@wds1 home]# iwconfig
```

AP2的設定與運作情形(1/7)

編寫設定檔，大致上都跟AP1一樣，只須改綠色部分，將

```
echo "iwpriv wdsath0 wds_add 00:0f:3d:de:1d:d0 "  
iwpriv wdsath0 wds_add 00:0f:3d:de:1d:d0
```

改成

```
echo "iwpriv wdsath0 wds_add 00:0f:3d:de:1d:d7 "  
iwpriv wdsath0 wds_add 00:0f:3d:de:1d:d7
```

並將

```
echo "ifconfig br0 10.1.1.2 netmask 255.255.255.0 up "  
ifconfig br0 10.1.1.2 netmask 255.255.255.0 up
```

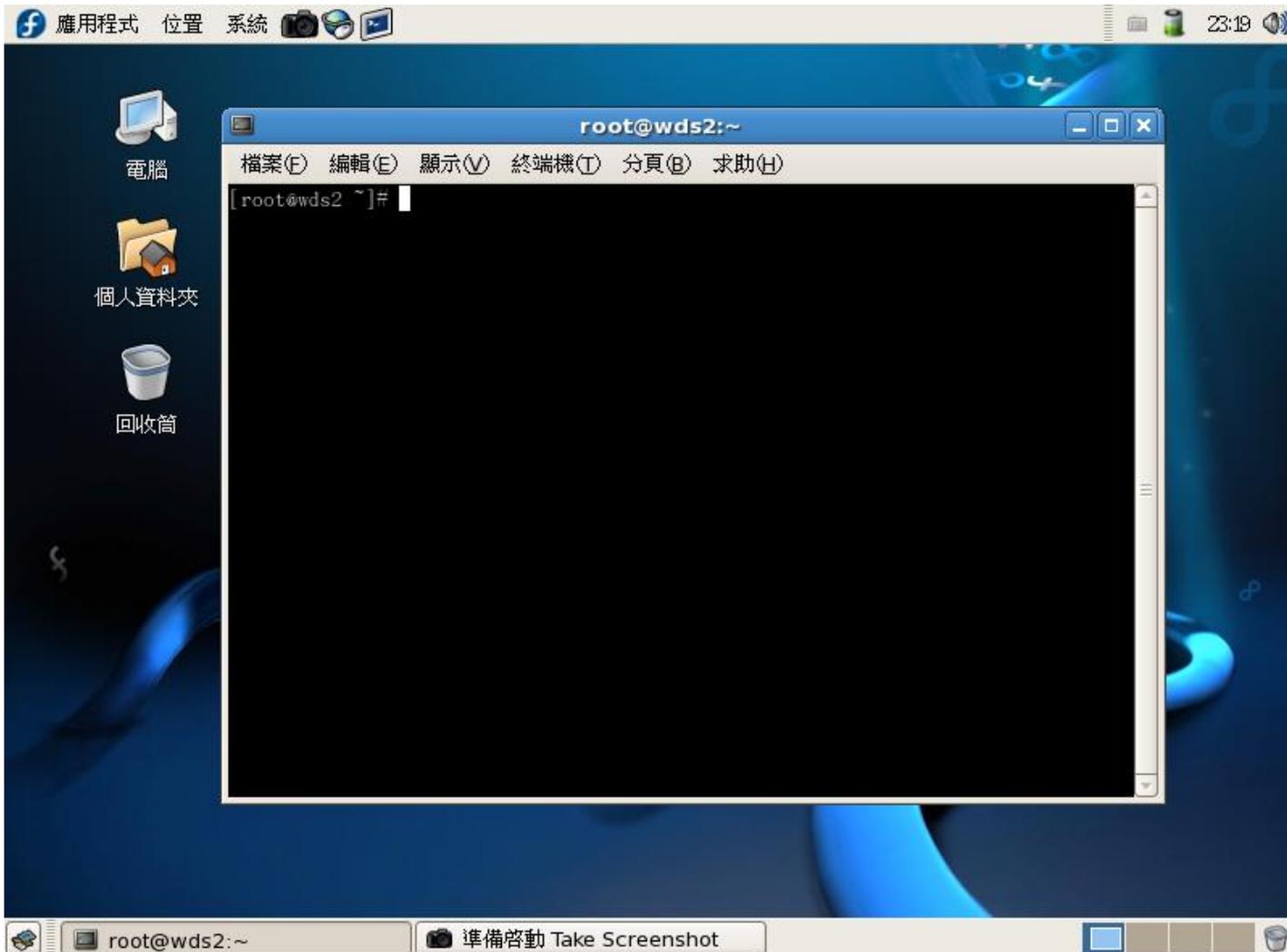
改成

```
echo "ifconfig br0 10.1.1.3 netmask 255.255.255.0 up "  
ifconfig br0 10.1.1.3 netmask 255.255.255.0 up
```

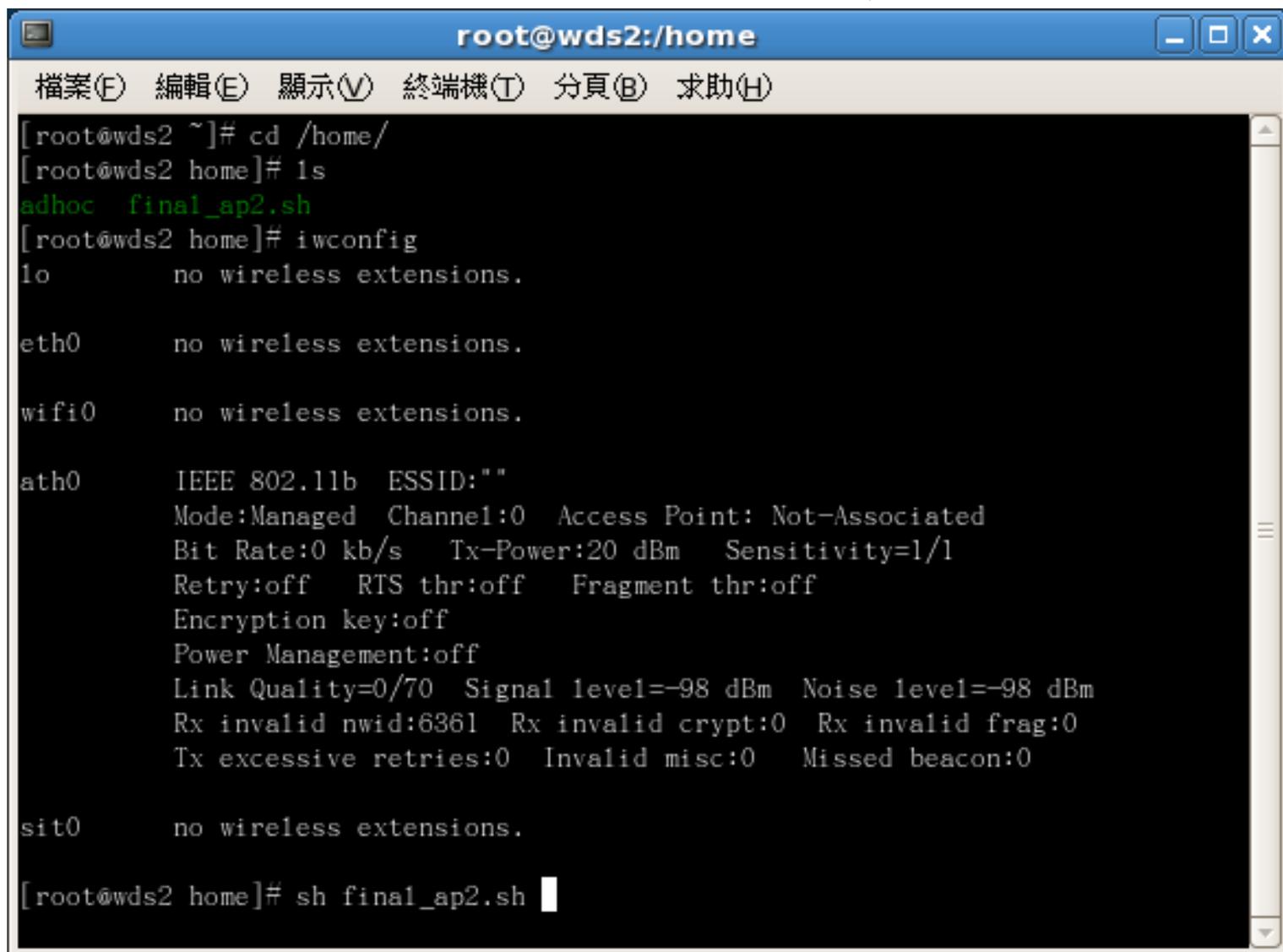
改藍字部分之後存檔執行。

AP2的設定與運作情形(2/7)

- 初始狀態



AP2的設定與運作情形(3/7)



```
root@wds2:/home
檔案(F) 編輯(E) 顯示(V) 終端機(T) 分頁(B) 求助(H)
[root@wds2 ~]# cd /home/
[root@wds2 home]# ls
adhoc final_ap2.sh
[root@wds2 home]# iwconfig
lo          no wireless extensions.

eth0       no wireless extensions.

wifi0      no wireless extensions.

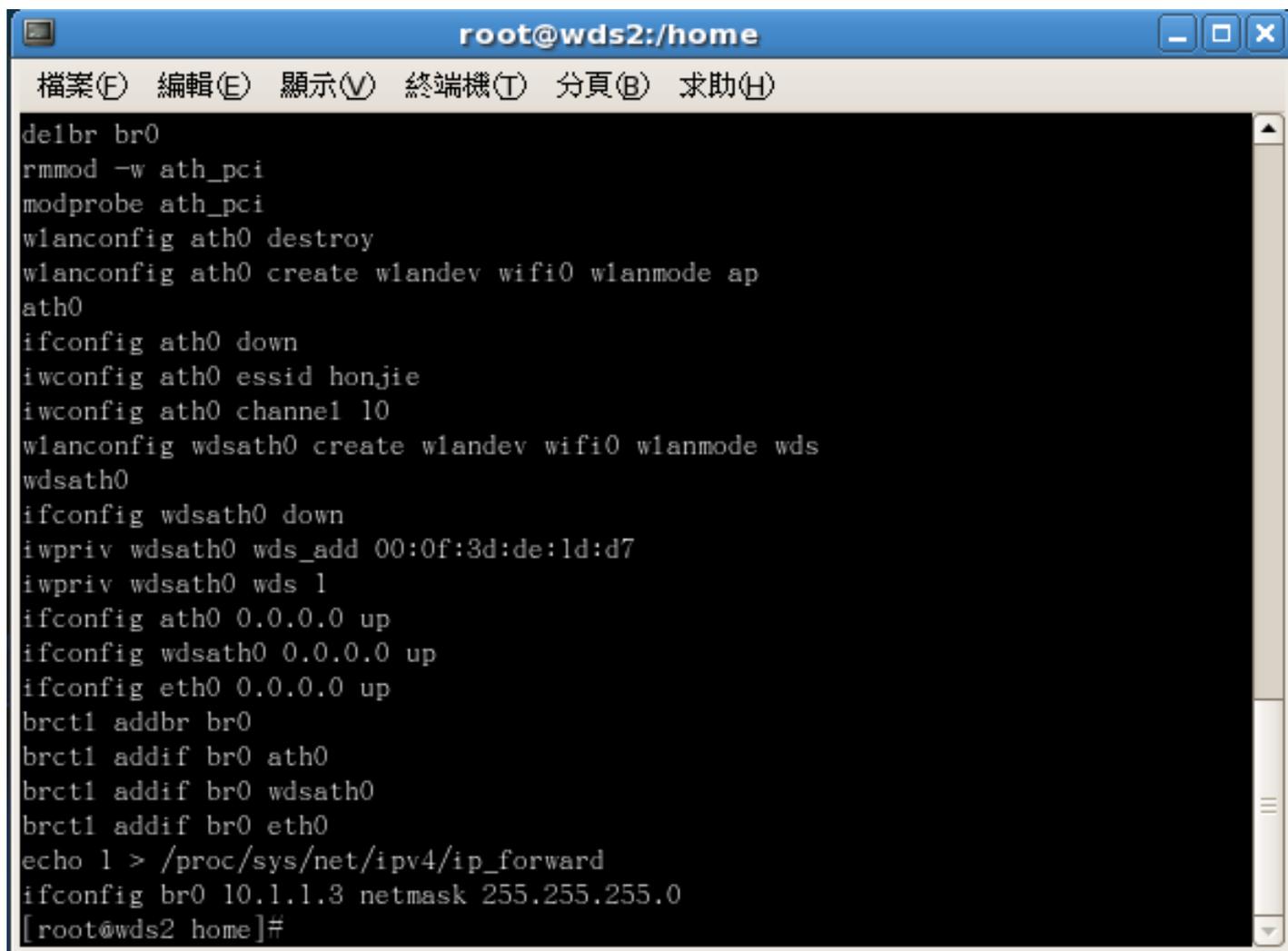
ath0       IEEE 802.11b  ESSID:""
           Mode:Managed  Channel:0  Access Point: Not-Associated
           Bit Rate:0 kb/s  Tx-Power:20 dBm  Sensitivity=1/1
           Retry:off  RTS thr:off  Fragment thr:off
           Encryption key:off
           Power Management:off
           Link Quality=0/70  Signal level=-98 dBm  Noise level=-98 dBm
           Rx invalid nwid:6361  Rx invalid crypt:0  Rx invalid frag:0
           Tx excessive retries:0  Invalid misc:0  Missed beacon:0

sit0       no wireless extensions.

[root@wds2 home]# sh final_ap2.sh
```

AP2的設定與運作情形(4/7)

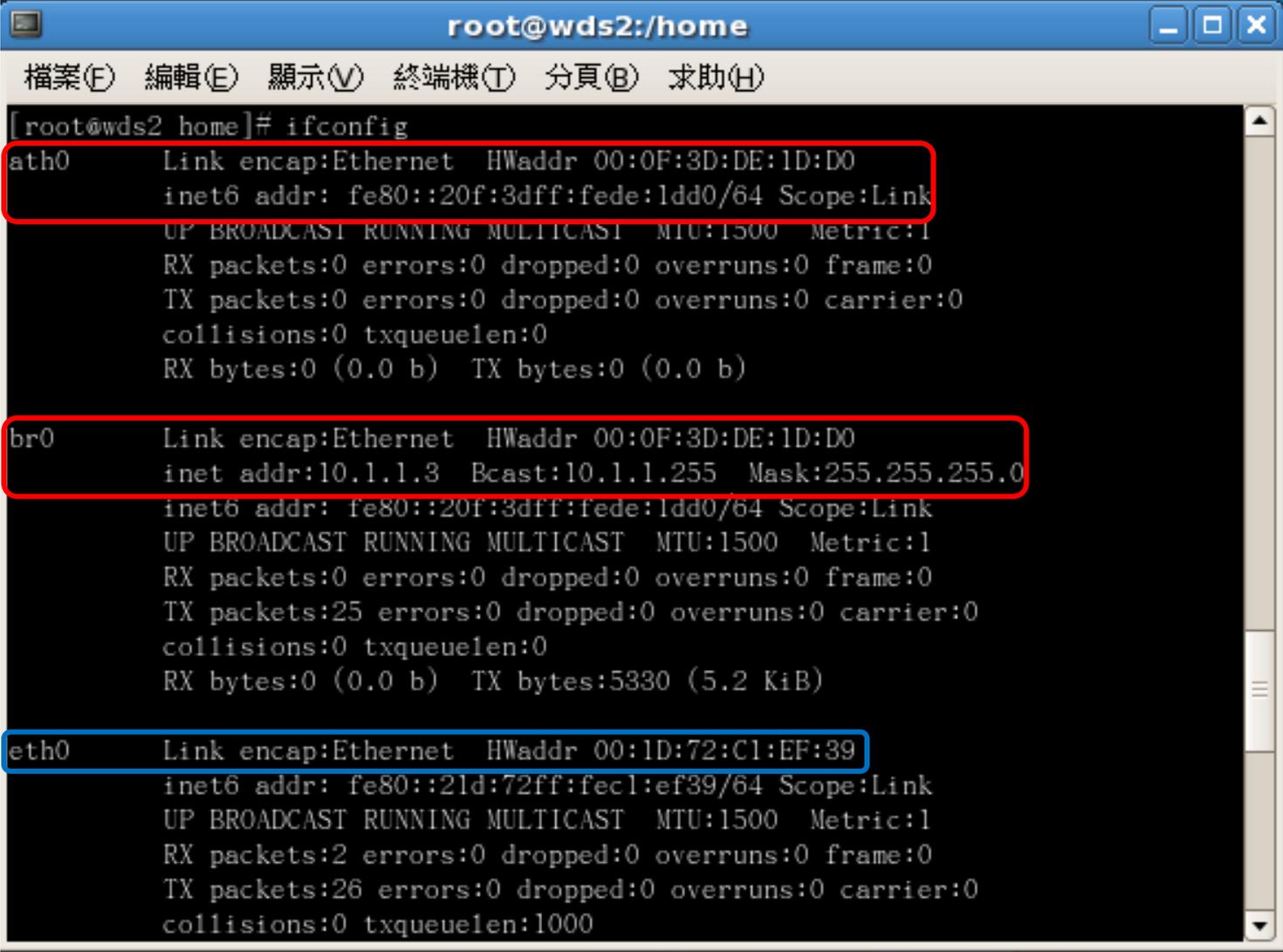
執行後結果



```
root@wds2:/home
檔案(F) 編輯(E) 顯示(V) 終端機(T) 分頁(B) 求助(H)
delbr br0
rmmod -w ath_pci
modprobe ath_pci
wlanconfig ath0 destroy
wlanconfig ath0 create wlandev wifi0 wlanmode ap
ath0
ifconfig ath0 down
iwconfig ath0 essid honjie
iwconfig ath0 channel 10
wlanconfig wdsath0 create wlandev wifi0 wlanmode wds
wdsath0
ifconfig wdsath0 down
iwpriv wdsath0 wds_add 00:0f:3d:de:1d:d7
iwpriv wdsath0 wds 1
ifconfig ath0 0.0.0.0 up
ifconfig wdsath0 0.0.0.0 up
ifconfig eth0 0.0.0.0 up
brctl addbr br0
brctl addif br0 ath0
brctl addif br0 wdsath0
brctl addif br0 eth0
echo 1 > /proc/sys/net/ipv4/ip_forward
ifconfig br0 10.1.1.3 netmask 255.255.255.0
[root@wds2 home]#
```

AP2的設定與運作情形(5/7)

觀看網路相關設定，#ifconfig



```
root@wds2:/home
檔案(F) 編輯(E) 顯示(V) 終端機(T) 分頁(B) 求助(H)
[root@wds2 home]# ifconfig
ath0    Link encap:Ethernet  HWaddr 00:0F:3D:DE:1D:D0
        inet6 addr: fe80::20f:3dff:fede:1dd0/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
        RX packets:0 errors:0 dropped:0 overruns:0 frame:0
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:0
        RX bytes:0 (0.0 b)  TX bytes:0 (0.0 b)

br0     Link encap:Ethernet  HWaddr 00:0F:3D:DE:1D:D0
        inet addr:10.1.1.3  Bcast:10.1.1.255  Mask:255.255.255.0
        inet6 addr: fe80::20f:3dff:fede:1dd0/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
        RX packets:0 errors:0 dropped:0 overruns:0 frame:0
        TX packets:25 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:0
        RX bytes:0 (0.0 b)  TX bytes:5330 (5.2 KiB)

eth0    Link encap:Ethernet  HWaddr 00:1D:72:C1:EF:39
        inet6 addr: fe80::21d:72ff:fecl:ef39/64 Scope:Link
        UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
        RX packets:2 errors:0 dropped:0 overruns:0 frame:0
        TX packets:26 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
```

AP2的設定與運作情形(6/7)

```
root@wds2:/home
檔案(F) 編輯(E) 顯示(V) 終端機(T) 分頁(B) 求助(H)

UP LOOPBACK RUNNING MTU:16436 Metric:1
RX packets:4345 errors:0 dropped:0 overruns:0 frame:0
TX packets:4345 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:6299612 (6.0 MiB) TX bytes:6299612 (6.0 MiB)

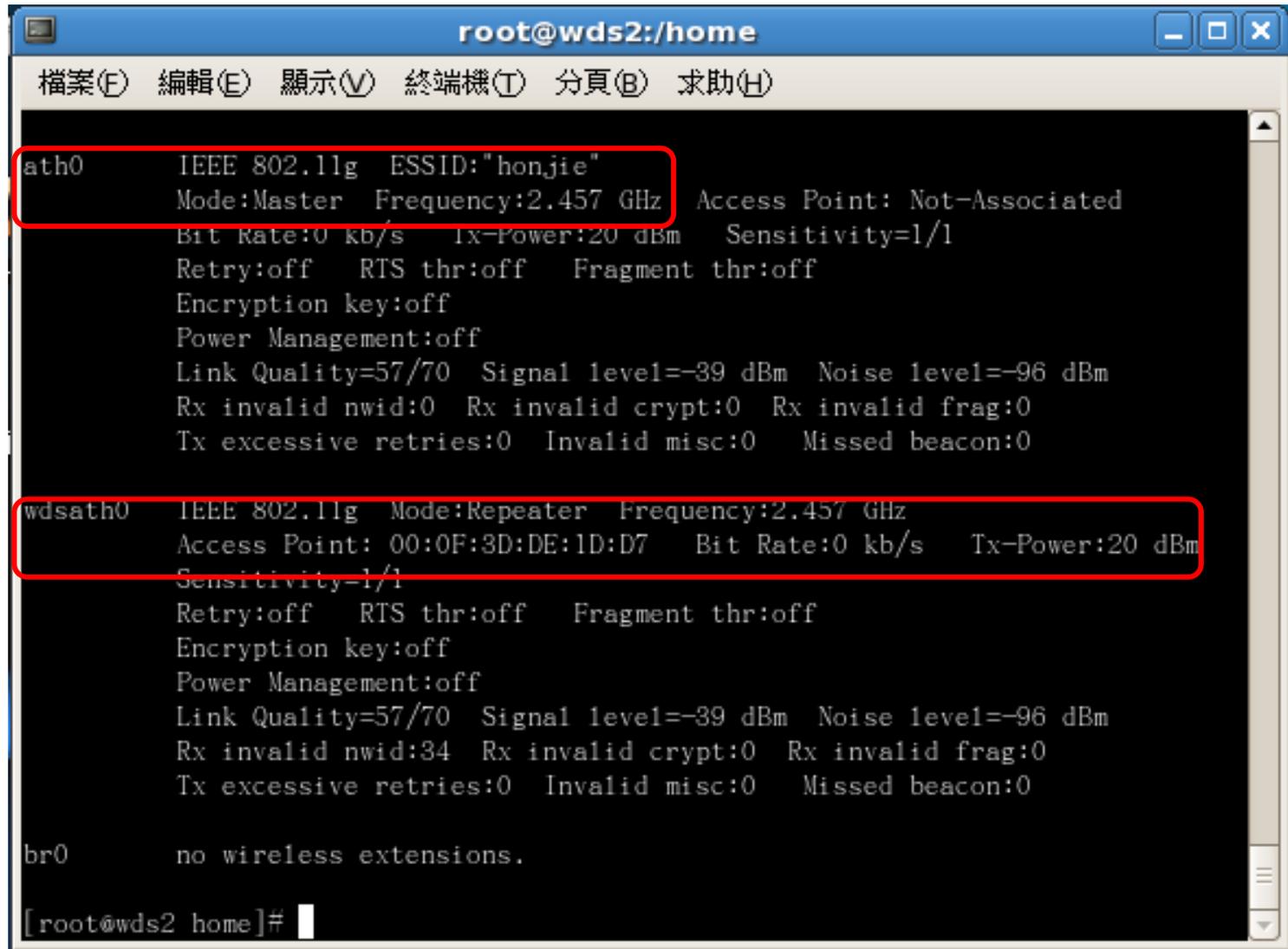
wdsath0 Link encap:Ethernet HWaddr 00:0F:3D:DE:1D:D0
inet6 addr: fe80::20f:3dff:fede:1dd0/64 Scope:Link
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:3 errors:0 dropped:0 overruns:0 frame:0
TX packets:17 errors:0 dropped:1 overruns:0 carrier:0
collisions:0 txqueuelen:0
RX bytes:1026 (1.0 KiB) TX bytes:3439 (3.3 KiB)

wifi0 Link encap:UNSPEC HWaddr 00-0F-3D-DE-1D-D0-98-D0-00-00-00-00-00-00-00-00
-00
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:71 errors:0 dropped:0 overruns:0 frame:0
TX packets:17 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:199
RX bytes:13758 (13.4 KiB) TX bytes:3915 (3.8 KiB)
Interrupt:193

[root@wds2 home]#
```

AP2的設定與運作情形(7/7)

觀看無線網卡相關設定， #iwconfig



```
root@wds2:/home
檔案(F) 編輯(E) 顯示(V) 終端機(T) 分頁(B) 求助(H)
ath0 IEEE 802.11g ESSID:"honjie"
Mode:Master Frequency:2.457 GHz Access Point: Not-Associated
Bit Rate:0 kb/s Tx-Power:20 dbm Sensitivity=1/1
Retry:off RTS thr:off Fragment thr:off
Encryption key:off
Power Management:off
Link Quality=57/70 Signal level=-39 dBm Noise level=-96 dBm
Rx invalid nwid:0 Rx invalid crypt:0 Rx invalid frag:0
Tx excessive retries:0 Invalid misc:0 Missed beacon:0

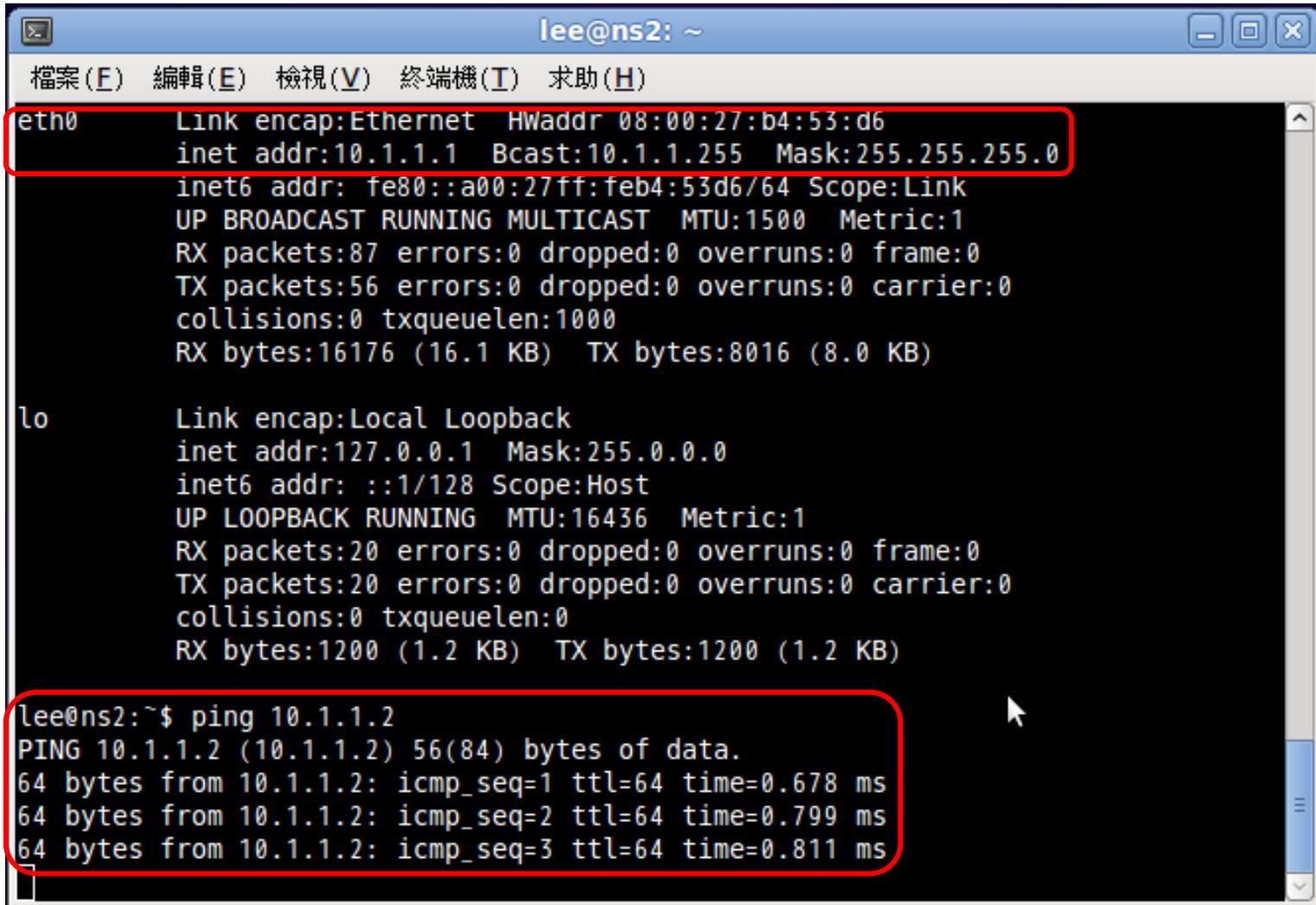
wdsath0 IEEE 802.11g Mode:Repeater Frequency:2.457 GHz
Access Point: 00:0F:3D:DE:1D:D7 Bit Rate:0 kb/s Tx-Power:20 dBm
Sensitivity=1/1
Retry:off RTS thr:off Fragment thr:off
Encryption key:off
Power Management:off
Link Quality=57/70 Signal level=-39 dBm Noise level=-96 dBm
Rx invalid nwid:34 Rx invalid crypt:0 Rx invalid frag:0
Tx excessive retries:0 Invalid misc:0 Missed beacon:0

br0 no wireless extensions.

[root@wds2 home]#
```

實驗結果(1/13)

- STA1(10.1.1.1) ping AP1(10.1.1.2)



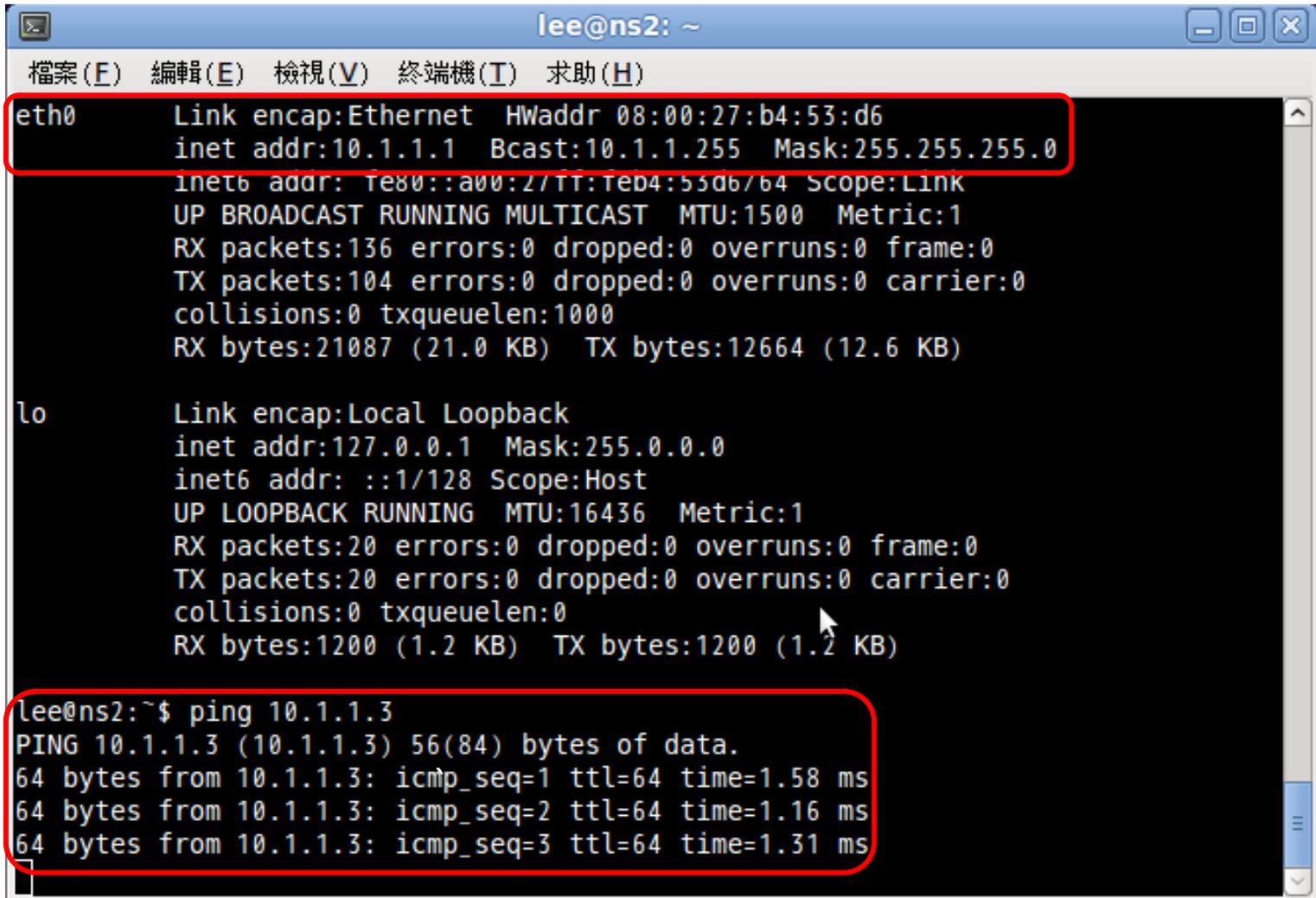
```
lee@ns2: ~
檔案(E) 編輯(E) 檢視(V) 終端機(I) 求助(H)
eth0  Link encap:Ethernet  HWaddr 08:00:27:b4:53:d6
      inet addr:10.1.1.1  Bcast:10.1.1.255  Mask:255.255.255.0
      inet6 addr: fe80::a00:27ff:feb4:53d6/64  Scope:Link
      UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
      RX packets:87  errors:0  dropped:0  overruns:0  frame:0
      TX packets:56  errors:0  dropped:0  overruns:0  carrier:0
      collisions:0 txqueuelen:1000
      RX bytes:16176 (16.1 KB)  TX bytes:8016 (8.0 KB)

lo    Link encap:Local Loopback
      inet addr:127.0.0.1  Mask:255.0.0.0
      inet6 addr: ::1/128  Scope:Host
      UP LOOPBACK RUNNING  MTU:16436  Metric:1
      RX packets:20  errors:0  dropped:0  overruns:0  frame:0
      TX packets:20  errors:0  dropped:0  overruns:0  carrier:0
      collisions:0 txqueuelen:0
      RX bytes:1200 (1.2 KB)  TX bytes:1200 (1.2 KB)

lee@ns2:~$ ping 10.1.1.2
PING 10.1.1.2 (10.1.1.2) 56(84) bytes of data.
64 bytes from 10.1.1.2: icmp_seq=1 ttl=64 time=0.678 ms
64 bytes from 10.1.1.2: icmp_seq=2 ttl=64 time=0.799 ms
64 bytes from 10.1.1.2: icmp_seq=3 ttl=64 time=0.811 ms
```

實驗結果(2/13)

- STA1(10.1.1.1) ping AP2(10.1.1.3)



```
lee@ns2: ~
檔案(E) 編輯(E) 檢視(V) 終端機(T) 求助(H)
eth0    Link encap:Ethernet  HWaddr 08:00:27:b4:53:d6
        inet addr:10.1.1.1  Bcast:10.1.1.255  Mask:255.255.255.0
        inet6 addr: fe80::a00:27ff:feb4:53d6/64 Scope:LINK
        UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
        RX packets:136 errors:0 dropped:0 overruns:0 frame:0
        TX packets:104 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:21087 (21.0 KB)  TX bytes:12664 (12.6 KB)

lo      Link encap:Local Loopback
        inet addr:127.0.0.1  Mask:255.0.0.0
        inet6 addr: ::1/128 Scope:Host
        UP LOOPBACK RUNNING  MTU:16436  Metric:1
        RX packets:20 errors:0 dropped:0 overruns:0 frame:0
        TX packets:20 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:0
        RX bytes:1200 (1.2 KB)  TX bytes:1200 (1.2 KB)

lee@ns2:~$ ping 10.1.1.3
PING 10.1.1.3 (10.1.1.3) 56(84) bytes of data:
64 bytes from 10.1.1.3: icmp_seq=1 ttl=64 time=1.58 ms
64 bytes from 10.1.1.3: icmp_seq=2 ttl=64 time=1.16 ms
64 bytes from 10.1.1.3: icmp_seq=3 ttl=64 time=1.31 ms
```

實驗結果(3/13)

- STA1(10.1.1.1) ping STA2(10.1.1.4)

```
lee@ns2: ~  
檔案(E) 編輯(E) 檢視(V) 終端機(T) 求助(H)  
eth0  Link encap:Ethernet  HWaddr 08:00:27:b4:53:d6  
      inet addr:10.1.1.1  Bcast:10.1.1.255  Mask:255.255.255.0  
      inet6 addr: fe80::a00:27ff:feb4:53d6/64  Scope:Link  
      UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1  
      RX packets:183 errors:0 dropped:0 overruns:0 frame:0  
      TX packets:149 errors:0 dropped:0 overruns:0 carrier:0  
      collisions:0 txqueuelen:1000  
      RX bytes:26006 (26.0 KB)  TX bytes:16962 (16.9 KB)  
  
lo    Link encap:Local Loopback  
      inet addr:127.0.0.1  Mask:255.0.0.0  
      inet6 addr: ::1/128  Scope:Host  
      UP LOOPBACK RUNNING  MTU:16436  Metric:1  
      RX packets:20 errors:0 dropped:0 overruns:0 frame:0  
      TX packets:20 errors:0 dropped:0 overruns:0 carrier:0  
      collisions:0 txqueuelen:0  
      RX bytes:1200 (1.2 KB)  TX bytes:1200 (1.2 KB)  
  
lee@ns2:~$ ping 10.1.1.4  
PING 10.1.1.4 (10.1.1.4) 56(84) bytes of data:  
64 bytes from 10.1.1.4: icmp_seq=1 ttl=128 time=4.80 ms  
64 bytes from 10.1.1.4: icmp_seq=2 ttl=128 time=1.69 ms  
64 bytes from 10.1.1.4: icmp_seq=3 ttl=128 time=1.66 ms
```

實驗結果(4/13)

- STA1(10.1.1.1) arp 與 route table

```
lee@ns2: ~  
檔案(E) 編輯(E) 檢視(V) 終端機(T) 求助(H)  
lee@ns2:~$ arp -n  
Address          HWtype  HWaddress      Flags Mask    Iface  
10.1.1.4         ether   00:18:f3:5f:43:3a  C           eth0  
10.1.1.2         ether   00:0f:3d:de:1d:d7  C           eth0  
10.1.1.3         ether   00:0f:3d:de:1d:d0  C           eth0  
lee@ns2:~$ route -n  
Kernel IP routing table  
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface  
0.0.0.0         0.0.0.0        255.255.255.0  U         0      0      0 eth0  
lee@ns2:~$
```

實驗結果(5/13)

- AP1(10.1.1.2) ping STA1(10.1.1.1)
- AP1(10.1.1.2) ping AP2(10.1.1.3)
- AP1(10.1.1.2) ping STA2(10.1.1.4)

```
root@wds1:~  
檔案(F) 編輯(E) 顯示(V) 終端機(T) 分頁(B) 求助(H)  
[root@wds1 ~]# ping 10.1.1.1  
PING 10.1.1.1 (10.1.1.1) 56(84) bytes of data.  
64 bytes from 10.1.1.1: icmp_seq=1 ttl=64 time=0.889 ms  
64 bytes from 10.1.1.1: icmp_seq=2 ttl=64 time=0.745 ms  
  
--- 10.1.1.1 ping statistics ---  
2 packets transmitted, 2 received, 0% packet loss, time 999ms  
rtt min/avg/max/mdev = 0.745/0.817/0.889/0.072 ms  
[root@wds1 ~]# ping 10.1.1.3  
PING 10.1.1.3 (10.1.1.3) 56(84) bytes of data.  
64 bytes from 10.1.1.3: icmp_seq=1 ttl=64 time=0.508 ms  
64 bytes from 10.1.1.3: icmp_seq=2 ttl=64 time=0.518 ms  
  
--- 10.1.1.3 ping statistics ---  
2 packets transmitted, 2 received, 0% packet loss, time 999ms  
rtt min/avg/max/mdev = 0.508/0.513/0.518/0.005 ms  
[root@wds1 ~]# ping 10.1.1.4  
PING 10.1.1.4 (10.1.1.4) 56(84) bytes of data.  
64 bytes from 10.1.1.4: icmp_seq=1 ttl=128 time=0.733 ms  
64 bytes from 10.1.1.4: icmp_seq=2 ttl=128 time=0.790 ms  
  
--- 10.1.1.4 ping statistics ---  
2 packets transmitted, 2 received, 0% packet loss, time 999ms  
rtt min/avg/max/mdev = 0.733/0.761/0.790/0.039 ms  
[root@wds1 ~]# arp -n  
Address HWtype HWaddress Flags Mask Iface  
10.1.1.4 ether 00:18:F3:5F:43:3A C br0  
10.1.1.1 ether 08:00:27:B4:53:D6 C br0  
10.1.1.3 ether 00:0F:3D:DE:1D:D0 C br0  
[root@wds1 ~]#
```

實驗結果(6/13)

- AP1(10.1.1.2) arp 與 route table

```
root@wds1:~  
檔案(F) 編輯(E) 顯示(V) 終端機(T) 分頁(B) 求助(H)  
64 bytes from 10.1.1.1: icmp_seq=2 ttl=64 time=0.745 ms  
  
— 10.1.1.1 ping statistics —  
2 packets transmitted, 2 received, 0% packet loss, time 999ms  
rtt min/avg/max/mdev = 0.745/0.817/0.889/0.072 ms  
[root@wds1 ~]# ping 10.1.1.3  
PING 10.1.1.3 (10.1.1.3) 56(84) bytes of data.  
64 bytes from 10.1.1.3: icmp_seq=1 ttl=64 time=0.508 ms  
64 bytes from 10.1.1.3: icmp_seq=2 ttl=64 time=0.518 ms  
  
— 10.1.1.3 ping statistics —  
2 packets transmitted, 2 received, 0% packet loss, time 999ms  
rtt min/avg/max/mdev = 0.508/0.513/0.518/0.005 ms  
[root@wds1 ~]# ping 10.1.1.4  
PING 10.1.1.4 (10.1.1.4) 56(84) bytes of data.  
64 bytes from 10.1.1.4: icmp_seq=1 ttl=128 time=0.733 ms  
64 bytes from 10.1.1.4: icmp_seq=2 ttl=128 time=0.790 ms  
  
— 10.1.1.4 ping statistics —  
2 packets transmitted, 2 received, 0% packet loss, time 999ms  
rtt min/avg/max/mdev = 0.733/0.761/0.790/0.039 ms  
[root@wds1 ~]# arp -n  
Address HWtype HWaddress Flags Mask Iface  
10.1.1.4 ether 00:18:F3:5F:43:3A C br0  
10.1.1.1 ether 08:00:27:B4:53:D6 C br0  
10.1.1.3 ether 00:0F:3D:DE:1D:D0 C br0  
[root@wds1 ~]# route -n  
Kernel IP routing table  
Destination Gateway Genmask Flags Metric Ref Use Iface  
10.1.1.0 0.0.0.0 255.255.255.0 U 0 0 0 br0  
[root@wds1 ~]#
```

實驗結果(7/13)

- AP2(10.1.1.3) ping STA1(10.1.1.1)
- AP2(10.1.1.3) ping AP1(10.1.1.2)
- AP2(10.1.1.3) ping STA2(10.1.1.4)

```
root@wds2:/home
檔案(F) 編輯(E) 顯示(V) 終端機(T) 分頁(B) 求助(H)
[root@wds2 home]# ping 10.1.1.1
PING 10.1.1.1 (10.1.1.1) 56(84) bytes of data.
64 bytes from 10.1.1.1: icmp_seq=1 ttl=64 time=1.38 ms
64 bytes from 10.1.1.1: icmp_seq=2 ttl=64 time=1.34 ms

--- 10.1.1.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 999ms
rtt min/avg/max/mdev = 1.346/1.363/1.380/0.017 ms
[root@wds2 home]# ping 10.1.1.2
PING 10.1.1.2 (10.1.1.2) 56(84) bytes of data.
64 bytes from 10.1.1.2: icmp_seq=1 ttl=64 time=0.512 ms
64 bytes from 10.1.1.2: icmp_seq=2 ttl=64 time=0.578 ms

--- 10.1.1.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 999ms
rtt min/avg/max/mdev = 0.512/0.545/0.578/0.033 ms
[root@wds2 home]# ping 10.1.1.4
PING 10.1.1.4 (10.1.1.4) 56(84) bytes of data.
64 bytes from 10.1.1.4: icmp_seq=1 ttl=128 time=2.80 ms
64 bytes from 10.1.1.4: icmp_seq=2 ttl=128 time=0.268 ms

--- 10.1.1.4 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 0.268/1.534/2.801/1.267 ms
[root@wds2 home]# arp -n

```

Address	HWtype	HWaddress	Flags	Mask	Iface
10.1.1.2	ether	00:0F:3D:DE:1D:D7	C		br0
10.1.1.1	ether	08:00:27:B4:53:D6	C		br0
10.1.1.4	ether	00:18:F3:5F:43:3A	C		br0

```
[root@wds2 home]#
```

實驗結果(8/13)

- AP2(10.1.1.3) arp 與 route table

```
root@wds2:/home
檔案(F) 編輯(E) 顯示(V) 終端機(T) 分頁(B) 求助(H)
64 bytes from 10.1.1.1: icmp_seq=2 ttl=64 time=1.34 ms

--- 10.1.1.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 999ms
rtt min/avg/max/mdev = 1.346/1.363/1.380/0.017 ms
[root@wds2 home]# ping 10.1.1.2
PING 10.1.1.2 (10.1.1.2) 56(84) bytes of data.
64 bytes from 10.1.1.2: icmp_seq=1 ttl=64 time=0.512 ms
64 bytes from 10.1.1.2: icmp_seq=2 ttl=64 time=0.578 ms

--- 10.1.1.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 999ms
rtt min/avg/max/mdev = 0.512/0.545/0.578/0.033 ms
[root@wds2 home]# ping 10.1.1.4
PING 10.1.1.4 (10.1.1.4) 56(84) bytes of data.
64 bytes from 10.1.1.4: icmp_seq=1 ttl=128 time=2.80 ms
64 bytes from 10.1.1.4: icmp_seq=2 ttl=128 time=0.268 ms

--- 10.1.1.4 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 0.268/1.534/2.801/1.267 ms
[root@wds2 home]# arp -n
Address          HWtype  HWaddress           Flags Mask          Iface
10.1.1.2         ether   00:0F:3D:DE:1D:D7   C                   br0
10.1.1.1         ether   08:00:27:B4:53:D6   C                   br0
10.1.1.4         ether   00:18:F3:5F:43:3A   C                   br0
[root@wds2 home]# route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
10.1.1.0        0.0.0.0        255.255.255.0   U         0      0      0 br0
[root@wds2 home]#
```

實驗結果(9/13)

- STA2(10.1.1.4) ping STA1(10.1.1.1)

```
C:\WINDOWS\system32\cmd.exe

Connection-specific DNS Suffix . :
Description . . . . . : Realtek RTL8168/8111 PCI-E Gigabit Ethernet NIC
Physical Address. . . . . : 00-18-F3-5F-43-3A
Dhcp Enabled. . . . . : No
IP Address. . . . . : 10.1.1.4
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . :

C:\Documents and Settings\lin6>ping 10.1.1.1

Pinging 10.1.1.1 with 32 bytes of data:

Reply from 10.1.1.1: bytes=32 time=1ms TTL=64
Reply from 10.1.1.1: bytes=32 time=1ms TTL=64
Reply from 10.1.1.1: bytes=32 time=2ms TTL=64
Reply from 10.1.1.1: bytes=32 time=1ms TTL=64

Ping statistics for 10.1.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms

C:\Documents and Settings\lin6>
```

實驗結果(10/13)

- STA1(10.1.1.4) ping AP1(10.1.1.2)

```
C:\WINDOWS\system32\cmd.exe

Connection-specific DNS Suffix . :
Description . . . . . : Realtek RTL8168/8111 PCI-E Gigabit Ethernet NIC
Physical Address. . . . . : 00-18-F3-5F-43-3A
Dhcp Enabled. . . . . : No
IP Address. . . . . : 10.1.1.4
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . :

C:\Documents and Settings\lin6>ping 10.1.1.2

Pinging 10.1.1.2 with 32 bytes of data:

Reply from 10.1.1.2: bytes=32 time<1ms TTL=64
Reply from 10.1.1.2: bytes=32 time<1ms TTL=64
Reply from 10.1.1.2: bytes=32 time<1ms TTL=64
Reply from 10.1.1.2: bytes=32 time=1ms TTL=64

Ping statistics for 10.1.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Documents and Settings\lin6>
```

實驗結果(11/13)

- STA2(10.1.1.4) ping AP2(10.1.1.3)

```
C:\WINDOWS\system32\cmd.exe

Connection-specific DNS Suffix . :
Description . . . . . : Realtek RTL8168/8111 PCI-E Gigabit Ethernet NIC
Physical Address. . . . . : 00-18-F3-5F-43-3A
Dhcp Enabled. . . . . : No
IP Address. . . . . : 10.1.1.4
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . :

C:\Documents and Settings\lin6>ping 10.1.1.3

Pinging 10.1.1.3 with 32 bytes of data:

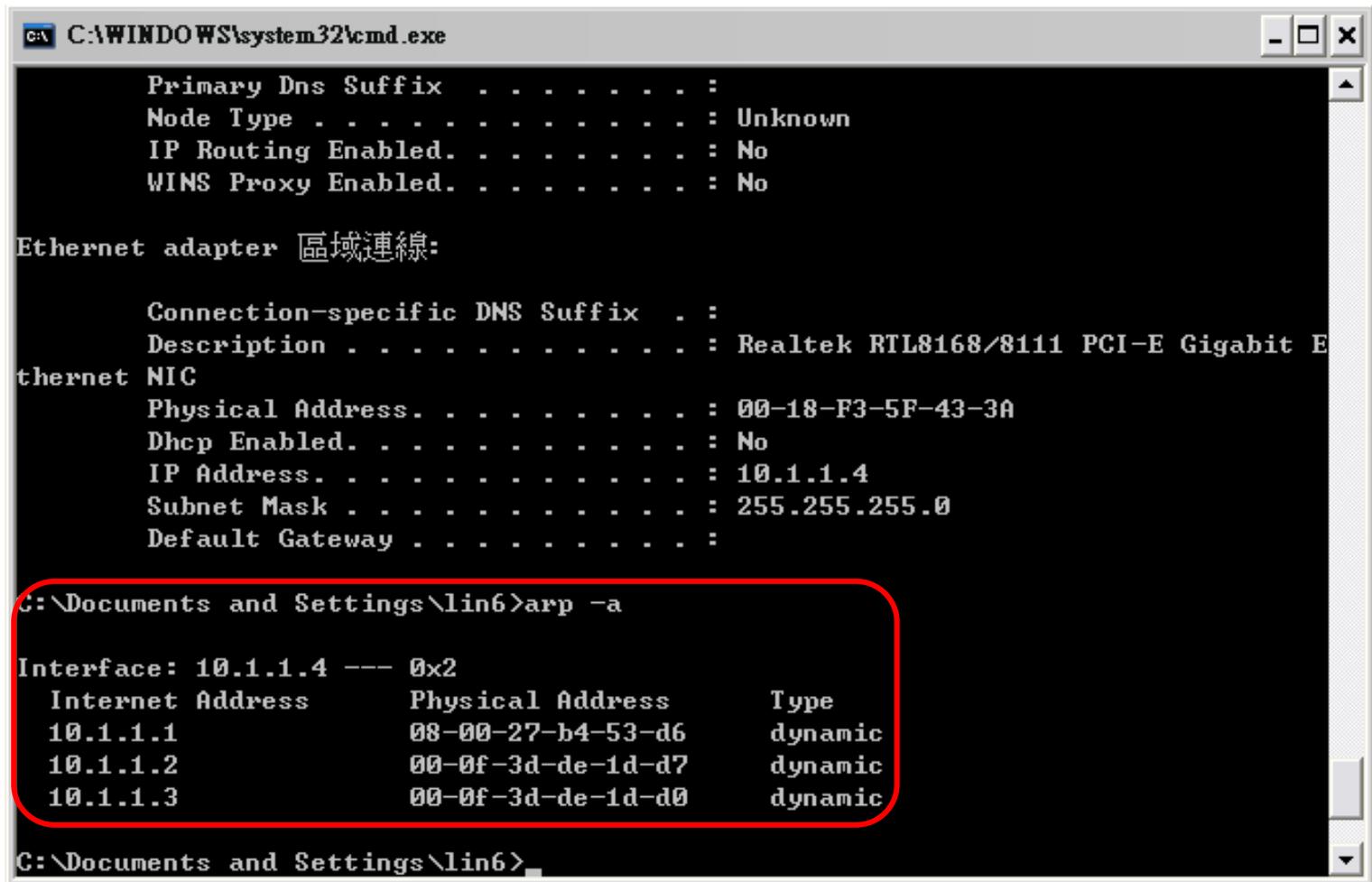
Reply from 10.1.1.3: bytes=32 time<1ms TTL=64

Ping statistics for 10.1.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Documents and Settings\lin6>
```

實驗結果(12/13)

- STA2(10.1.1.4) arp table



The screenshot shows a Windows command prompt window with the following content:

```
C:\WINDOWS\system32\cmd.exe

Primary Dns Suffix . . . . . :
Node Type . . . . . : Unknown
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No

Ethernet adapter 區域連線:

    Connection-specific DNS Suffix  . :
    Description . . . . . : Realtek RTL8168/8111 PCI-E Gigabit Ethernet NIC
    Physical Address. . . . . : 00-18-F3-5F-43-3A
    Dhcp Enabled. . . . . : No
    IP Address. . . . . : 10.1.1.4
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . :

C:\Documents and Settings\lin6>arp -a

Interface: 10.1.1.4 --- 0x2
    Internet Address      Physical Address      Type
    10.1.1.1              08-00-27-b4-53-d6    dynamic
    10.1.1.2              00-0f-3d-de-1d-d7    dynamic
    10.1.1.3              00-0f-3d-de-1d-d0    dynamic

C:\Documents and Settings\lin6>
```

The ARP table output is highlighted with a red rounded rectangle:

Internet Address	Physical Address	Type
10.1.1.1	08-00-27-b4-53-d6	dynamic
10.1.1.2	00-0f-3d-de-1d-d7	dynamic
10.1.1.3	00-0f-3d-de-1d-d0	dynamic

實驗結果(13/13)

- STA2(10.1.1.4) route table

```
C:\WINDOWS\system32\cmd.exe

10.1.1.1      08-00-27-b4-53-d6      dynamic
10.1.1.2      00-0f-3d-de-1d-d7      dynamic
10.1.1.3      00-0f-3d-de-1d-d0      dynamic

C:\Documents and Settings\lin6>route PRINT
=====
Interface List
0x1 ..... MS TCP Loopback interface
0x2 ...00 18 f3 5f 43 3a ..... Realtek RTL8168/8111 PCI-E Gigabit Ethernet NIC
- Packet Scheduler Miniport
=====

Active Routes:
Network Destination    Netmask          Gateway          Interface        Metric
-----
10.1.1.0                255.255.255.0    10.1.1.4         10.1.1.4         10
10.1.1.4                255.255.255.255  127.0.0.1       127.0.0.1       10
10.255.255.255         255.255.255.255  10.1.1.4         10.1.1.4         10
127.0.0.0              255.0.0.0        127.0.0.1       127.0.0.1       1
224.0.0.0              240.0.0.0        10.1.1.4         10.1.1.4         10
255.255.255.255       255.255.255.255  10.1.1.4         10.1.1.4         1
=====

Persistent Routes:
None

C:\Documents and Settings\lin6>
```

注意事項(1/4)

- AP1設定檔裡提到//以上為執行第二次以上才有作用，為device重置的意思，初次執行會無此裝置是沒關係的，因為不一定執行一次就會成功，故所以加入這一段，執行第二次以上後就會清除所有設定，重新寫入，也就是重置裝置的意思
- 基本上，本次實驗都是使用802.11g居多，WiFi(802.11b & 802.11g)有11個無線頻道(channel)，由1~11所組成，他們的頻段為ISM Band 2.4GHz。在同一個地方可能有許多台AP，由於11個channel的頻率其實蠻接近的，為了讓彼此AP降低干擾，而理想的頻道間隔應該為5，也就是在同一區域如果有3人各自架設自己的AP提供自己人上網使用，那麼最好的選擇將會是channel 1 & channel 6 & channel 11，此為最理想狀況(頻率間隔越大，彼此間干擾越低)，所以請盡量避免channel在2.4GHz的設備之間架設AP(ex:微波爐...等等)，除非你們是使用WiFi其他的規格(ex:802.11a就在5GHz...等等)

注意事項(2/4)

- 基於以上第2點，所以如果我們能避開相同或是鄰近的channel，那麼AP & WDS實驗的成功性必將提高許多，所以我們可以先使用無線網卡來掃描無線AP的channel與SSID跟一些相關訊息，利用這些訊息來避開實驗選擇相同或是鄰近的channel，以降低干擾，提升成功率。
- 插入無線網卡，輸入以下指令

```
#ifconfig ath0 up
```

```
#wlanconfig ath0 list scan
```

我在NETLAB scan，結果如下圖



```
root@wds1:~  
檔案(F) 編輯(E) 顯示(V) 終端機(T) 分頁(B) 求助(H)  
[root@wds1 ~]# ifconfig ath0 up  
[root@wds1 ~]# wlanconfig ath0 list scan  
SSID          BSSID          CHAN  RATE  S:N  INT  CAPS  
ncue          00:0b:85:7f:67:ff  1    54M  6:0  100  ESs  
ncue          00:0b:85:7f:3f:cf  11   54M  7:0  100  ESs  
Netlab       00:90:cc:e0:69:34   3    54M  32:0 100  EPs  
[root@wds1 ~]#
```

注意事項(3/4)

- 我檔案裡有寫echo ” ” ，此為print出目前執行到哪一個指令動作，不一定要寫，只是為了方便debug哪一行出錯。另外sleep 3-sleep功能是讓他執行程序後等待一段時間再度執行下一行指令，避免機器當機狀態，或是沒有執行指令就跳過。建議寫比較保險，不然當機就飽了(以上是我試多種Linux Distribution實作adhoc & AP實驗心得)，故我之後都會加 “sleep 3”
- 如果station一端是Windows用戶，建議關閉防火牆，不然無法ping到，先前實驗都是用Linux Distribution，所以無此問題(此為我這次實作所遇到的問題)
- 此次實驗STA1其實是使用我的NB Win7底下灌Virtualbox掛載Ubuntu，但是其實不影響結果，我試過了station端不管是WinXP、Win7、Fedora、CentOS、Ubuntu都可以成功互ping

注意事項(4/4)

- 先前WDS實驗是在Ubuntu底下架設成功，但是也是一直在try and error許久之後才革命成功，印象試了N次才成功1次，已記不得了。經由再次實做WDS實驗，我覺得也許在Fedora底下會比較容易成功，我執行1~2次就成功了，頂多3次，已驗證關機重開機再試，驗證10次的成功取樣
- 如果堅持要在Ubuntu底下實作WDS，他的ath0無線網卡mac開頭會改成06:XX:XX:XX:XX:XX，你要啟動WDS，要加入對方AP MAC時，也許改成06:XX:XX:XX:XX:XX，才會成功。
- 其實有興趣的同學也可以參考The MadWiFi project網站，有更多詳細的MadWiFi介紹，可以玩看看加密機制的AP…等等，經由實作adhoc & AP & WDS想必同學對網路運作觀念與原理更加確實了解，Good luck！

參考文獻

[1] **The MadWifi project**

<http://madwifi-project.org/wiki>