

APRICOT 2010 wifi network tuning

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Three steps for wifi happiness

- Wifi for high density users can be very difficult
- You could spend much time on design, equipment, and testing - but there's just four things you really need to make happy wifi:
 - Use professional grade APs, NOT consumer grade
 - Consumer: 1-10 associations, Professional: 70-100 associations
 - Site survey, think about antenna types
 - Use non-overlapping channels
 - Turn power levels right down

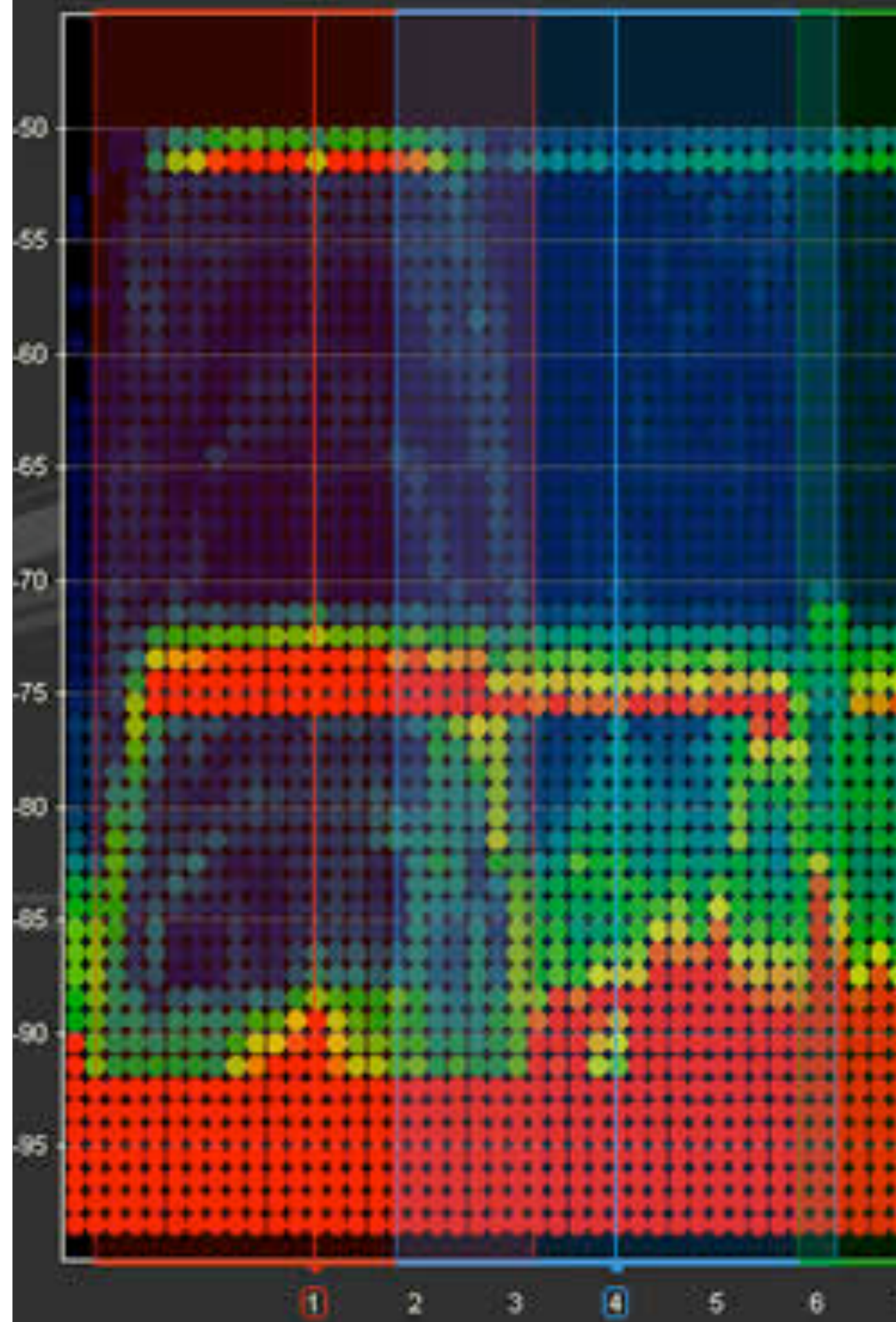
1. Site Survey

- Look at each room
- Place APs as far apart from each other as possible
- Low/medium density - place them high
- High density - place them low so people block the RF between APs
- Check for existing APs in the building. Turn them off if possible



2. Use Non-Overlapping Channels

- 802.11b/g - use ONLY channels 1,6,11
- 802.11a - provides an additional 19 non-overlapping channels. Regulations in most Asian countries limit to just four or five :(
- Use lots of 802.11a (even four or five is better than three)
- Try to prevent any locations from seeing multiple APs on the same channel



3. Turn power down!

- Only need 2 - 5dBm tx power
- That's not much!
- Reduces RF noise in the room

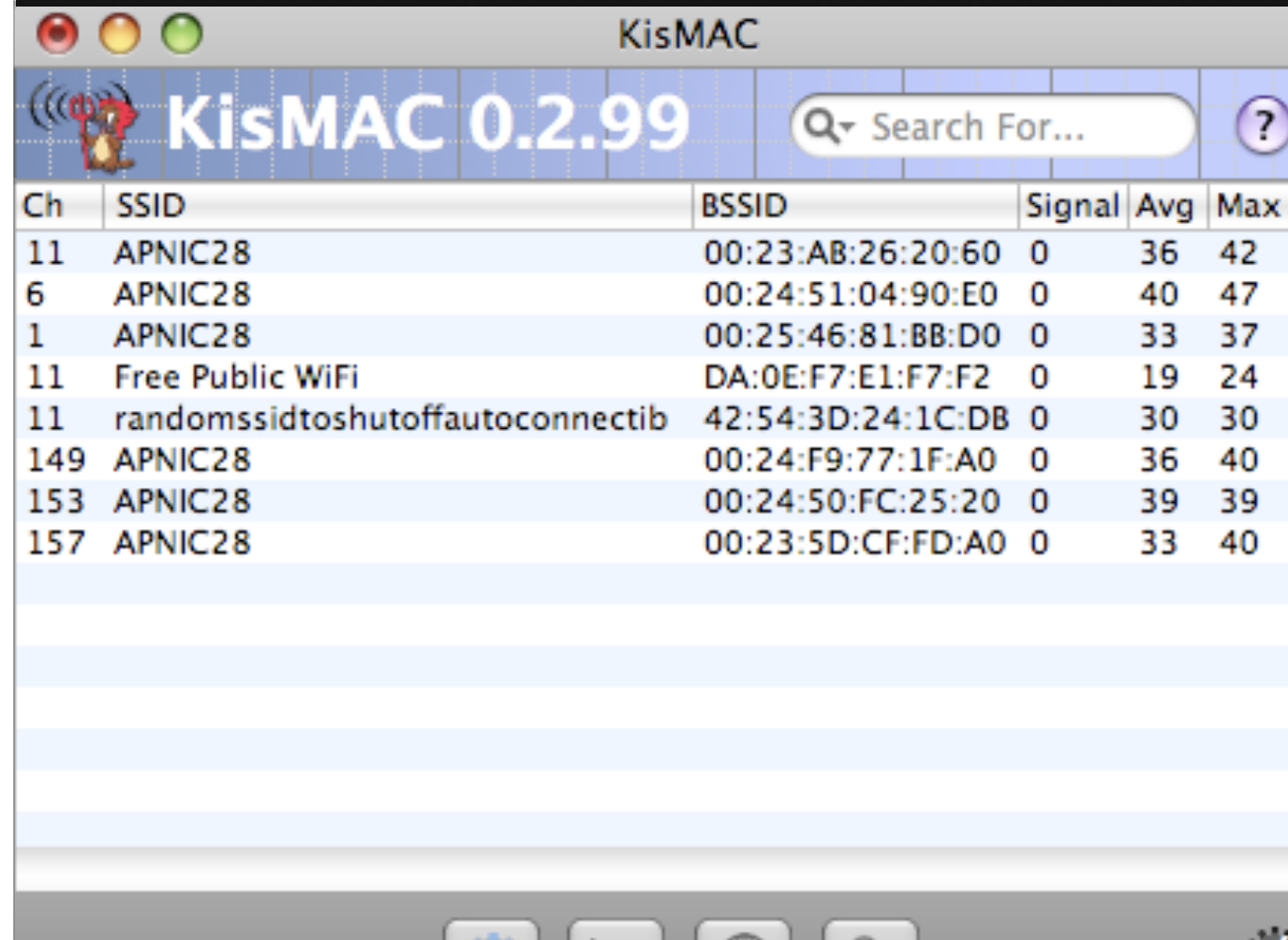


Simple Tests

- Ping across the local LAN - look for consistent and low RTT
- Use wireless scanner to check APs and their power levels
- Check all around the venue
- Confirm things are good when people and their wireless devices are present

```
Terminal — bash — 80x24
57:~ jonny$ sudo ping -s 1400 -i 0.1 -c 15 169.223.7.254
PING 169.223.7.254 (169.223.7.254): 1400 data bytes
1408 bytes from 169.223.7.254: icmp_seq=0 ttl=255 time=2.897 ms
1408 bytes from 169.223.7.254: icmp_seq=1 ttl=255 time=5.191 ms
1408 bytes from 169.223.7.254: icmp_seq=2 ttl=255 time=2.209 ms
1408 bytes from 169.223.7.254: icmp_seq=3 ttl=255 time=3.455 ms
1408 bytes from 169.223.7.254: icmp_seq=4 ttl=255 time=2.451 ms
1408 bytes from 169.223.7.254: icmp_seq=5 ttl=255 time=3.162 ms
1408 bytes from 169.223.7.254: icmp_seq=6 ttl=255 time=3.742 ms
1408 bytes from 169.223.7.254: icmp_seq=7 ttl=255 time=2.318 ms
1408 bytes from 169.223.7.254: icmp_seq=8 ttl=255 time=6.400 ms
1408 bytes from 169.223.7.254: icmp_seq=9 ttl=255 time=2.447 ms
1408 bytes from 169.223.7.254: icmp_seq=10 ttl=255 time=6.999 ms
1408 bytes from 169.223.7.254: icmp_seq=11 ttl=255 time=2.340 ms
1408 bytes from 169.223.7.254: icmp_seq=12 ttl=255 time=6.662 ms
1408 bytes from 169.223.7.254: icmp_seq=13 ttl=255 time=2.228 ms
1408 bytes from 169.223.7.254: icmp_seq=14 ttl=255 time=3.838 ms

--- 169.223.7.254 ping statistics ---
15 packets transmitted, 15 packets received, 0% packet loss
round-trip min/avg/max/stddev = 2.209/3.756/6.999/1.662 ms
57:~ jonny$
```



KisMAC 0.2.99

Ch	SSID	BSSID	Signal	Avg	Max
11	APNIC28	00:23:AB:26:20:60	0	36	42
6	APNIC28	00:24:51:04:90:E0	0	40	47
1	APNIC28	00:25:46:81:BB:D0	0	33	37
11	Free Public WiFi	DA:0E:F7:E1:F7:F2	0	19	24
11	randomssidtoshutoffautoconnectib	42:54:3D:24:1C:DB	0	30	30
149	APNIC28	00:24:F9:77:1F:A0	0	36	40
153	APNIC28	00:24:50:FC:25:20	0	39	39
157	APNIC28	00:23:5D:CF:FD:A0	0	33	40

Here in the KLCC

- The antennas didn't arrive in time so we had a mix of antenna types
- Mark and his team decided on AP locations primarily based on cabling availability. Number of APs based on room capacity
 - My rule of thumb: 50 *seats* per radio
- Best guess at power levels and channels
 - Most 802.11bg radios at 2dBm power
 - Most 802.11a radios at 5dBm power
- Tune via trial and error



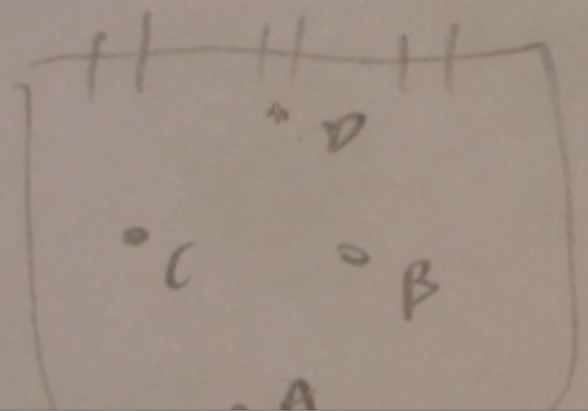
Antennas and AP types

802.116 ⇒ 1, 6, 11
 802.11 a ⇒ 36 (5180)
 149 40 (5200)
 153 44 (5220)
 157 48 (5240)
 161 52 (5260)
 56 (5280) 60 (5300)
 64 (5320)

executive suite		
vip suite		
boardroom		45.09 m ²
lounge		33.20 m ²
vip lounges		
1		22.62 m ²
2		23.05 m ²
3		24.72 m ²
4		25.79 m ²
business centre		
boardroom		
1		24.34 m ²
2		25.41 m ²
teleconferencing room		
		13.96 m ²
press room		
		85.83 m ²
business centre foyer with private computer workstations and pantry		
		100 m ²

- meeting room
- catering outlet
- concierge & luggage room
- medical room
- plenary hall
- dressing room suites
- dressing room
- passenger lift
- freight lift
- green room
- toilet
- surau
- AP Points

odios 2d Bm power
 power
 ⇒ 5d Bm
 2d Bm 3/2 hall
 5d Bm elsewhere



Initial 'best guess' layout, Level 3 KLCC

100 m²

AP-0

161

pre-function concourse (west)

153

44

3
153

109
105

6

2

11
104

1

104
157

1

306

305

304

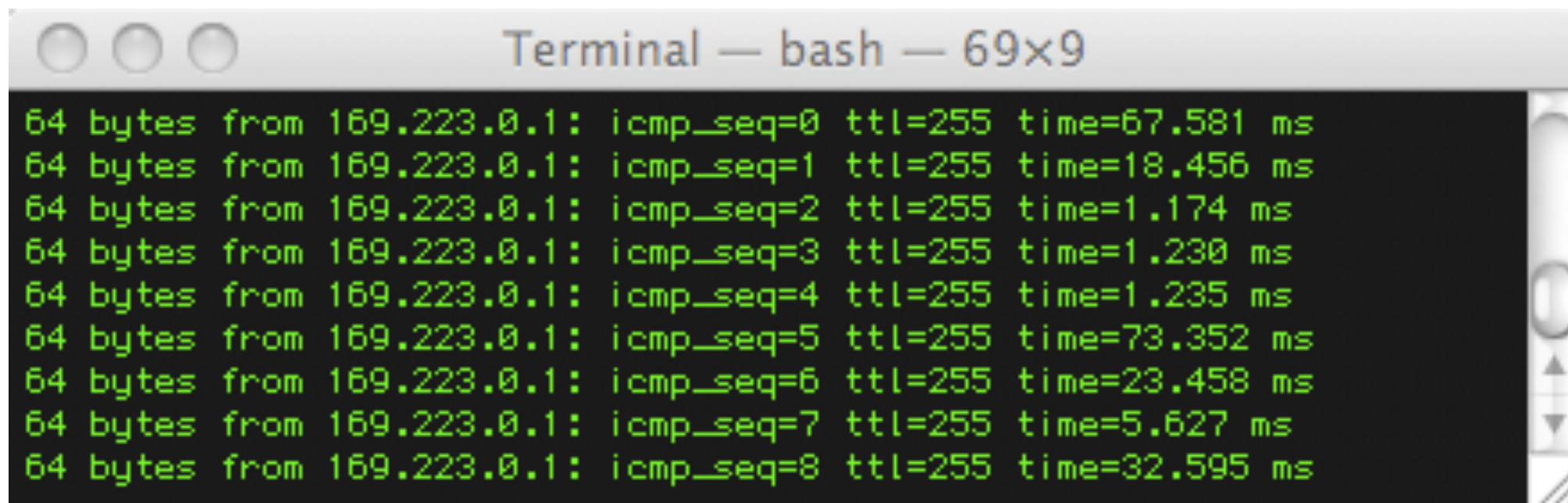
6

11

A

149

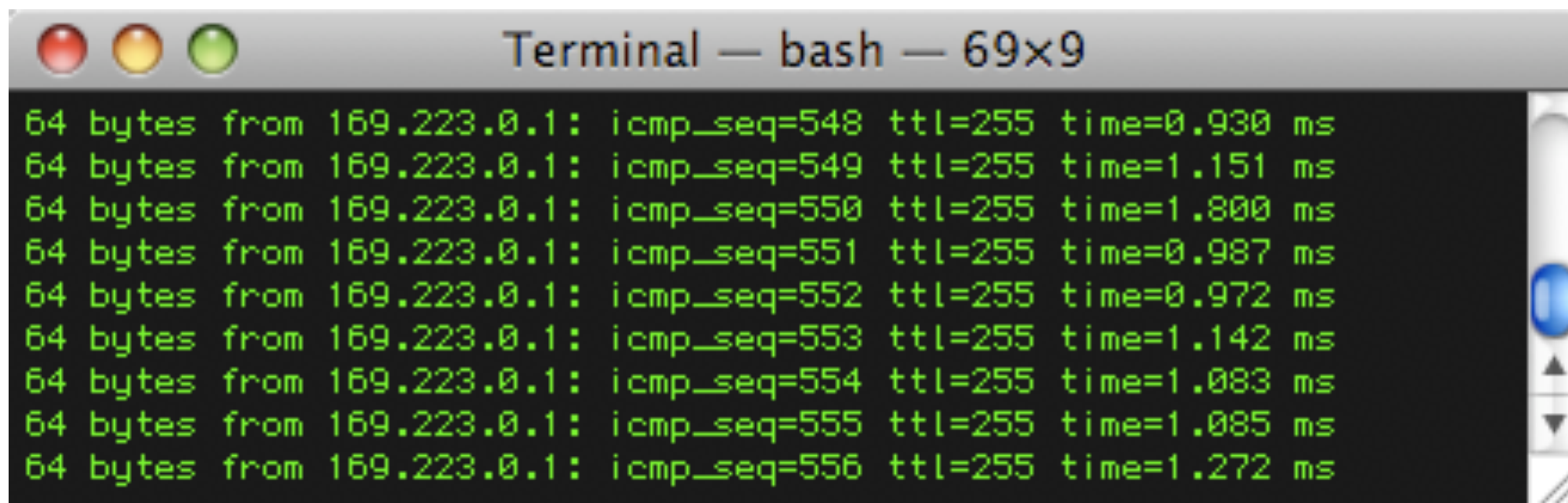
1



A terminal window titled "Terminal — bash — 69x9" showing the output of a ping command. The output consists of nine lines, each representing a ping attempt. The first line shows a significantly higher round-trip time (67.581 ms) compared to the subsequent lines, which are much lower (ranging from 1.174 ms to 32.595 ms). This indicates a network issue, likely a bad wireless connection.

```
64 bytes from 169.223.0.1: icmp_seq=0 ttl=255 time=67.581 ms
64 bytes from 169.223.0.1: icmp_seq=1 ttl=255 time=18.456 ms
64 bytes from 169.223.0.1: icmp_seq=2 ttl=255 time=1.174 ms
64 bytes from 169.223.0.1: icmp_seq=3 ttl=255 time=1.230 ms
64 bytes from 169.223.0.1: icmp_seq=4 ttl=255 time=1.235 ms
64 bytes from 169.223.0.1: icmp_seq=5 ttl=255 time=73.352 ms
64 bytes from 169.223.0.1: icmp_seq=6 ttl=255 time=23.458 ms
64 bytes from 169.223.0.1: icmp_seq=7 ttl=255 time=5.627 ms
64 bytes from 169.223.0.1: icmp_seq=8 ttl=255 time=32.595 ms
```

bad wireless



A terminal window titled "Terminal — bash — 69x9" showing the output of a ping command. The output consists of nine lines, each representing a ping attempt. All lines show very low and consistent round-trip times (ranging from 0.930 ms to 1.800 ms), indicating a stable and good wireless connection.

```
64 bytes from 169.223.0.1: icmp_seq=548 ttl=255 time=0.930 ms
64 bytes from 169.223.0.1: icmp_seq=549 ttl=255 time=1.151 ms
64 bytes from 169.223.0.1: icmp_seq=550 ttl=255 time=1.800 ms
64 bytes from 169.223.0.1: icmp_seq=551 ttl=255 time=0.987 ms
64 bytes from 169.223.0.1: icmp_seq=552 ttl=255 time=0.972 ms
64 bytes from 169.223.0.1: icmp_seq=553 ttl=255 time=1.142 ms
64 bytes from 169.223.0.1: icmp_seq=554 ttl=255 time=1.083 ms
64 bytes from 169.223.0.1: icmp_seq=555 ttl=255 time=1.085 ms
64 bytes from 169.223.0.1: icmp_seq=556 ttl=255 time=1.272 ms
```

good wireless


```
19:~ jonny$ while true; do sudo airport -s; echo ; sleep 1; done
```

SSID	BSSID	RSSI	CHANNEL	SECURITY (auth/unicast/group)
APRICOT-2010-b	00:26:99:a1:89:90	-86	6	NONE
Guest	00:11:93:1f:01:20	-84	10	NONE
APRICOT-2010-b	00:26:99:90:fe:d0	-74	11	NONE
Guest	00:11:93:1f:05:21	-67	10	NONE
FREE-INTERNET	00:11:93:1e:fc:20	-87	7	WEP
APRICOT-2010-b	00:3a:98:0b:44:d0	-79	1	NONE
APRICOT-2010	00:26:99:8f:52:40	-80	149	NONE
APRICOT-2010	00:3a:98:0a:a5:b0	-69	161	NONE

^C

```
19:~ jonny$ █
```

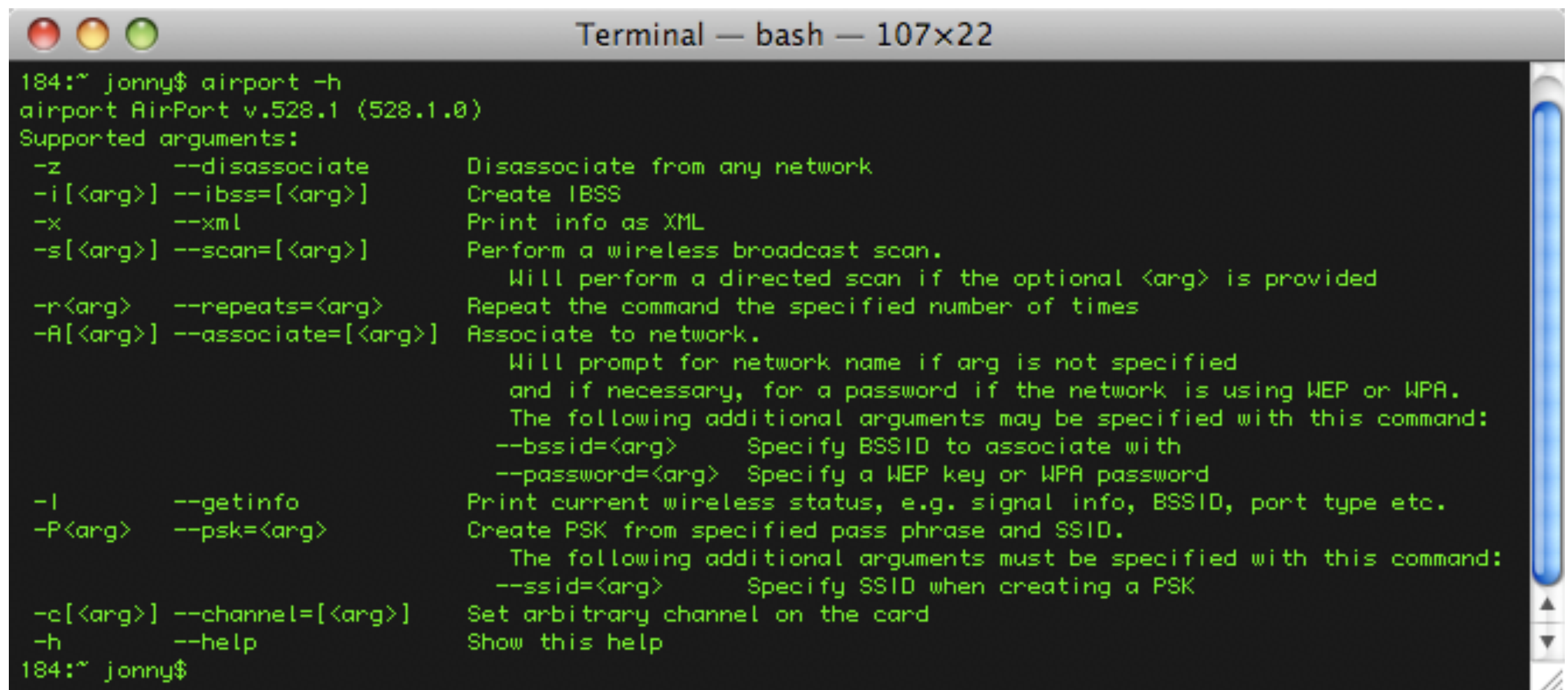
SSID	BSSID	RSSI	CHANNEL	SECURITY (auth/unicast/group)
Guest	00:11:93:1e:ff:d0	-90	4	NONE
Guest	00:11:93:1e:fe:20	-86	11	NONE
APRICOT-2010	00:24:97:c3:27:10	-73	165	NONE
APRICOT-2010-b	00:24:97:b7:7b:90	-71	11	NONE
Guest	00:11:93:1f:12:40	-66	8	NONE
Guest	00:11:93:1f:0c:d1	-74	7	NONE
APRICOT-2010-b	00:24:97:b7:96:c0	-72	6	NONE
mobile	00:11:93:1e:ff:d3	-88	4	WEP
Guest	00:11:93:1e:ff:11	-85	5	NONE
APRICOT-2010-b	00:24:97:b7:7c:20	-84	1	NONE
Guest	00:11:93:1f:0c:81	-93	1	NONE
Guest	00:11:93:1e:fd:90	-60	2	NONE
APRICOT-2010-b	00:24:97:b7:8e:a0	-69	1	NONE
APRICOT-2010	00:24:97:c2:e6:30	-76	157	NONE
APRICOT-2010	00:24:c4:85:eb:20	-73	153	NONE
APRICOT-2010	00:24:97:c3:19:f0	-71	149	NONE

```
1 IBSS network found:
```

SSID	BSSID	RSSI	CHANNEL	SECURITY (auth/unicast/group)
Free Public WiFi	aa:0c:a6:05:9c:e4	-79	10	NONE

Useful but hidden Airport tool on Macs

- For me it's in /System/Library/PrivateFrameworks/Apple80211.framework/ Versions/Current/Resources/airport
- Not well documented and may be dangerous, so be careful



```
Terminal — bash — 107x22
184:~ jonny$ airport -h
airport AirPort v.528.1 (528.1.0)
Supported arguments:
-z          --disassociate      Disassociate from any network
-i[<arg>]  --ibss=[<arg>]       Create IBSS
-x          --xml                Print info as XML
-s[<arg>]  --scan=[<arg>]      Perform a wireless broadcast scan.
                               Will perform a directed scan if the optional <arg> is provided
-r<arg>    --repeats=<arg>     Repeat the command the specified number of times
-A[<arg>]  --associate=[<arg>] Associate to network.
                               Will prompt for network name if arg is not specified
                               and if necessary, for a password if the network is using WEP or WPA.
                               The following additional arguments may be specified with this command:
                               --bssid=<arg>      Specify BSSID to associate with
                               --password=<arg>   Specify a WEP key or WPA password
-l          --getinfo           Print current wireless status, e.g. signal info, BSSID, port type etc.
-P<arg>    --psk=<arg>         Create PSK from specified pass phrase and SSID.
                               The following additional arguments must be specified with this command:
                               --ssid=<arg>       Specify SSID when creating a PSK
-c[<arg>]  --channel=[<arg>]   Set arbitrary channel on the card
-h          --help              Show this help
184:~ jonny$
```