# Wireless Tools

Training materials for wireless trainers

The Abdus Salam
International Centre
for Theoretical Physics

United Nations
Educational, Scientific and
Cultural Organization

This talk covers tools that will show you a great deal of information about wireless networks, including network discovery, data logging, security auditing, and spectrum analysis.
Version 1.4 by Rob, @2009-11-23
Version 1.5 by Rob, @2010-02-28
Version 1.6 by Rob, @2010-03-12

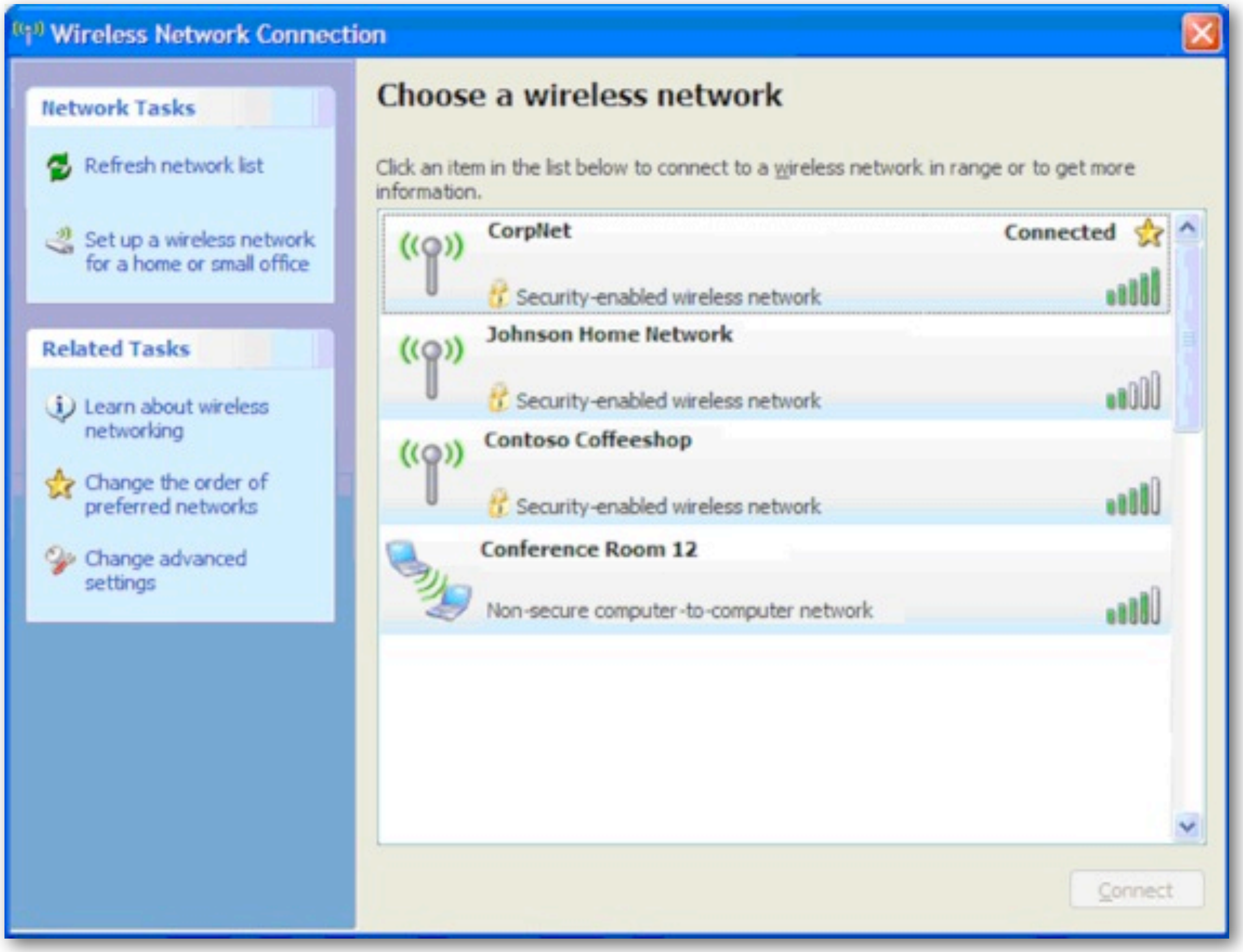
# Goals

- The goal of this talk is to provide an introduction to a few software tools that will help you to:
    - monitor your WiFi network to identify problems
    - perform security audits and prevent attacks
    - observe the ongoing performance of your network and plan for future needs
    - detect interference

# Types of wireless tools

- Network ESSID scanners
- Wireless protocol analyzers
- Encryption cracking tools
- Wireless device auditing and management
- “War driving” tools: network mapping
- Spectrum analysis

# Built-in wireless clients

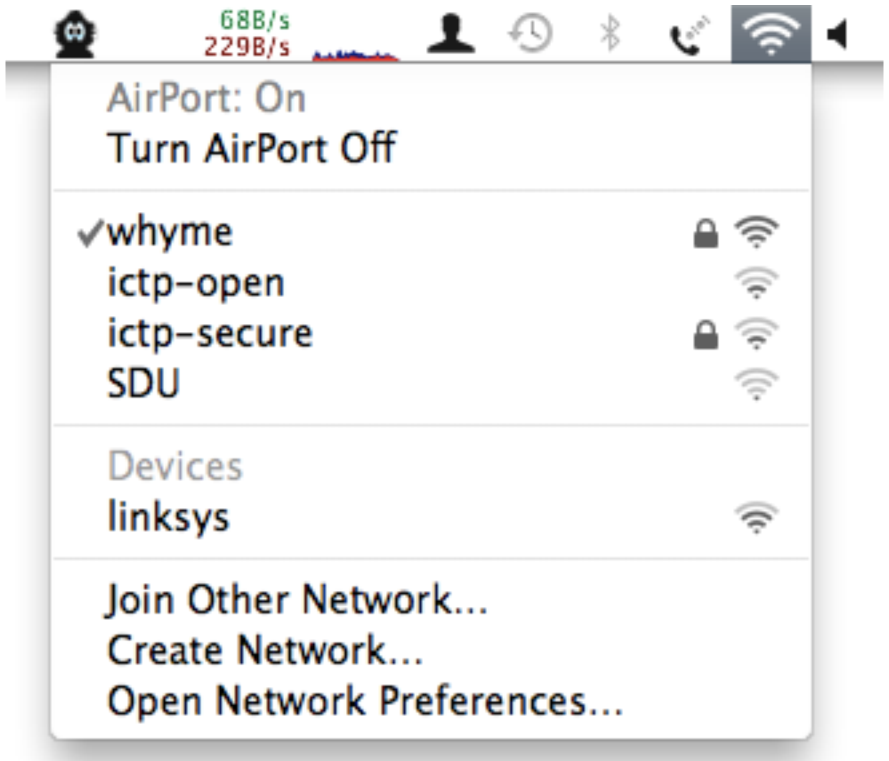


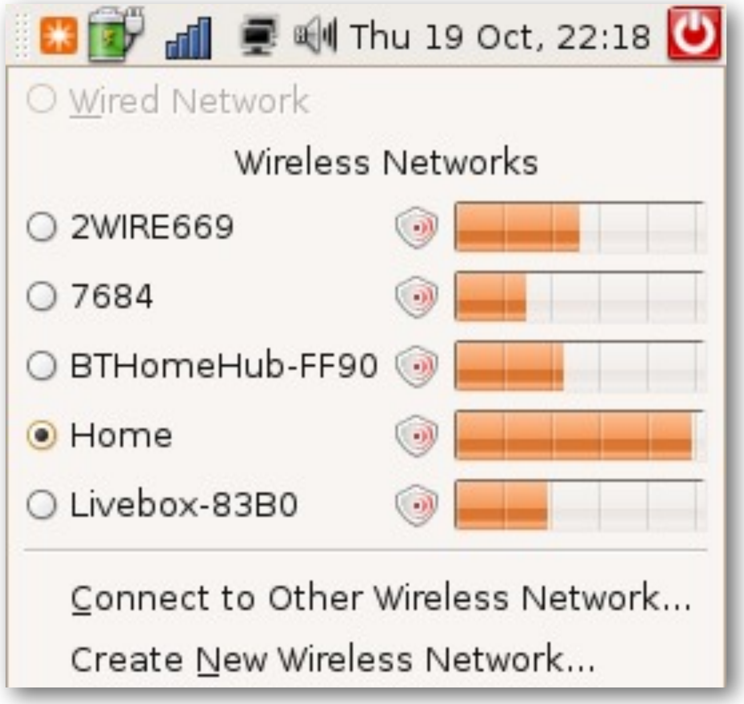
Wireless Network Connection

Choose a wireless network

Click an item in the list below to connect to a wireless network in range or to get more information.

Network Tasks
Refresh network list
Set up a wireless network for a home or small office
Related Tasks
Learn about wireless networking
Change the order of preferred networks
Change advanced settings
CorpNet
Connected
Security-enabled wireless network
Johnson Home Network
Security-enabled wireless network
Contoso Coffeeshop
Security-enabled wireless network
Conference Room 12
Non-secure computer-to-computer network
Connect

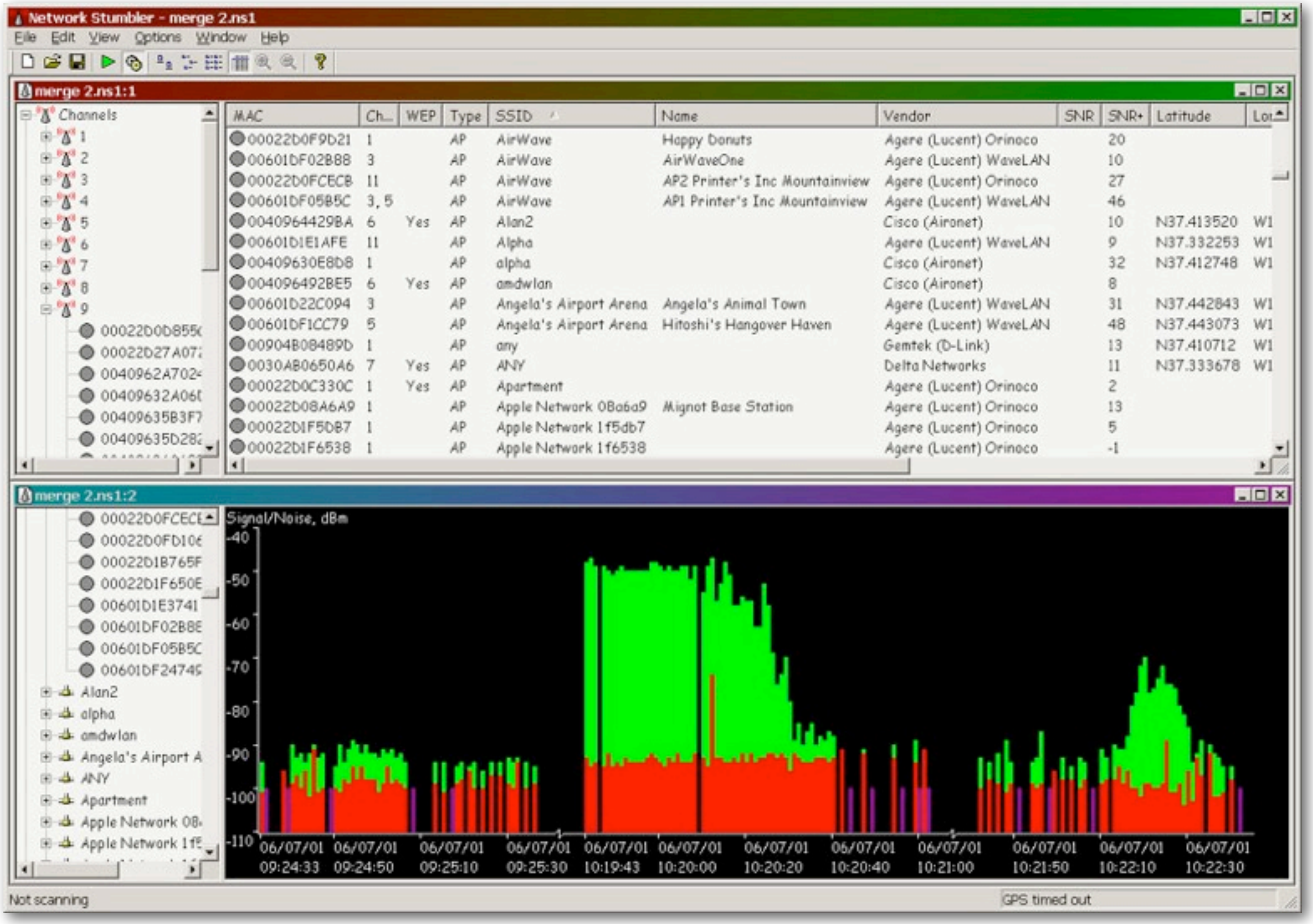




If a computer has a wireless card, it has a basic network scanner.

# NetStumbler

*http://www.stumbler.net/*

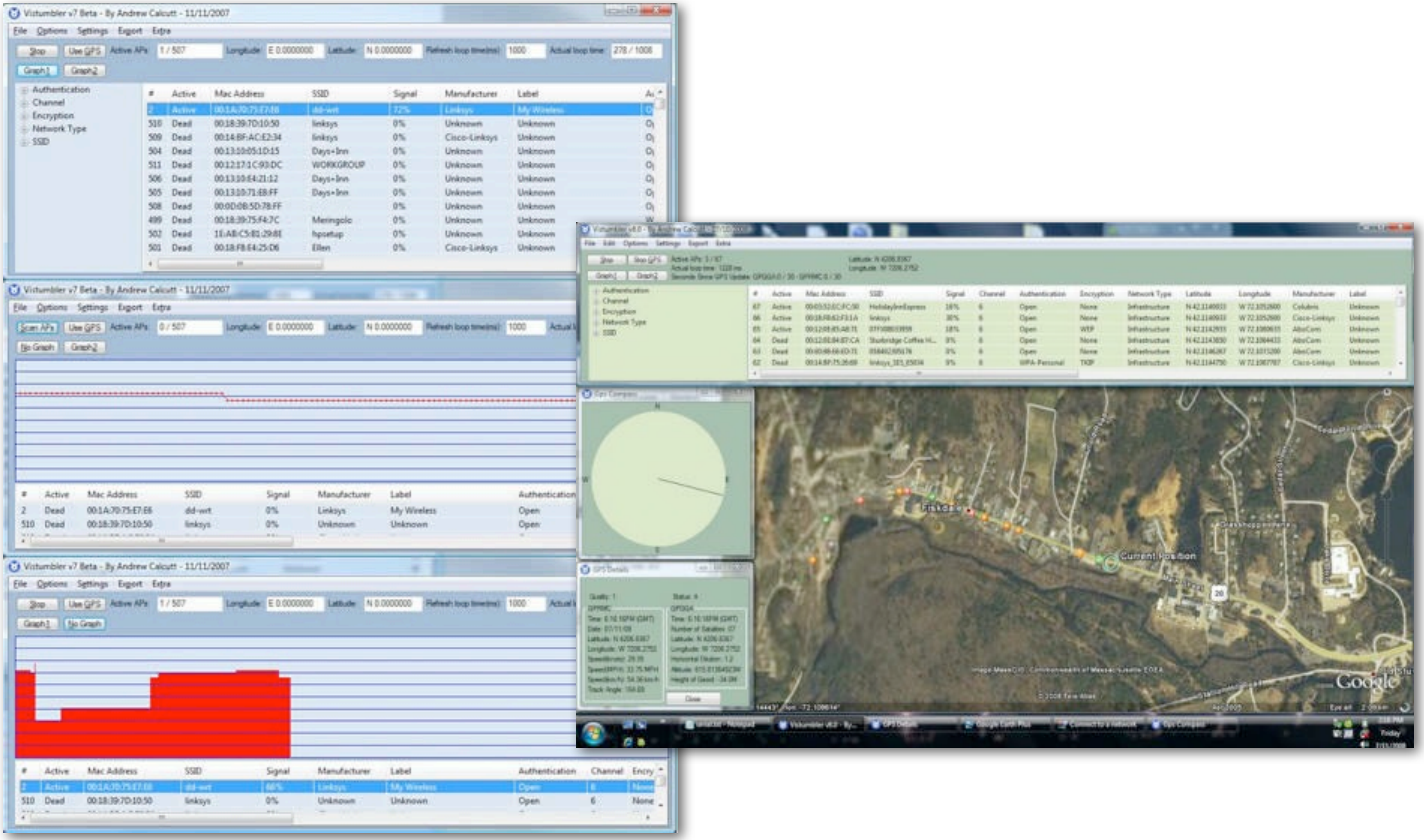


| MAC | Ch... | WEP | Type | SSID | Name | Vendor | SNR | SNR+ | Latitude | Lo |
|---|---|---|---|---|---|---|---|---|---|---|
| 00022D0F9D21 | 1 | | AP | AirWave | Happy Donuts | Agere (Lucent) Orinoco | | 20 | | |
| 00601DF02B88 | 3 | | AP | AirWave | AirWaveOne | Agere (Lucent) WaveLAN | | 10 | | |
| 00022D0FCECB | 11 | | AP | AirWave | AP2 Printer's Inc Mountainview | Agere (Lucent) Orinoco | | 27 | | |
| 00601DF05B5C | 3, 5 | | AP | AirWave | AP1 Printer's Inc Mountainview | Agere (Lucent) WaveLAN | | 46 | | |
| 0040964429BA | 6 | Yes | AP | Alan2 | | Cisco (Aironet) | | 10 | N37.413520 | W1 |
| 00601D1E1AFE | 11 | | AP | Alpha | | Agere (Lucent) WaveLAN | | 9 | N37.332253 | W1 |
| 00409630E8D8 | 1 | | AP | alpha | | Cisco (Aironet) | | 32 | N37.412748 | W1 |
| 004096492BE5 | 6 | Yes | AP | amdwlan | | Cisco (Aironet) | | 8 | | |
| 00601D22C094 | 3 | | AP | Angela's Airport Arena | Angela's Animal Town | Agere (Lucent) WaveLAN | | 31 | N37.442843 | W1 |
| 00601DF1CC79 | 5 | | AP | Angela's Airport Arena | Hitoshi's Hangover Haven | Agere (Lucent) WaveLAN | | 48 | N37.443073 | W1 |
| 00904B08489D | 1 | | AP | any | | Gemtek (D-Link) | | 13 | N37.410712 | W1 |
| 0030AB0650A6 | 7 | Yes | AP | ANY | | Delta Networks | | 11 | N37.333678 | W1 |
| 00022D0C330C | 1 | Yes | AP | Apartment | | Agere (Lucent) Orinoco | | 2 | | |
| 00022D08A6A9 | 1 | | AP | Apple Network 08a6a9 | Mignot Base Station | Agere (Lucent) Orinoco | | 13 | | |
| 00022D1F5DB7 | 1 | | AP | Apple Network 1f5db7 | | Agere (Lucent) Orinoco | | 5 | | |
| 00022D1F6538 | 1 | | AP | Apple Network 1f6538 | | Agere (Lucent) Orinoco | | -1 | | |

NetStumbler was one of the first and most widely used WiFi detection tools. It runs only in Windows XP or Windows 2000, and works with many (but not all) wireless cards. NetStumbler can be used for mapping the coverage of your WiFi network, War Driving, rogue AP detection, aligning antennas on a long distance link, and more. NetStumbler is not open source, and was last updated in 2004.

# Vistumbler

*http://www.vistumbler.net/*



Vistumbler v7 Beta - By Andrew Calcutt - 11/11/2007

Active APs: 1 / 507 Longitude: E 0.0000000 Latitude: N 0.0000000 Refresh loop time(ms): 1000 Actual loop time: 278 / 1008

| # | Active | Mac Address | SSID | Signal | Manufacturer | Label |
|---|---|---|---|---|---|---|
| 2 | Active | 00:1A:70:75:E7:E6 | dd-wrt | 72% | Linksys | My Wireless |
| 510 | Dead | 00:18:39:7D:10:50 | linksys | 0% | Unknown | Unknown |
| 509 | Dead | 00:14:BF:AC:E2:34 | linksys | 0% | Cisco-Linksys | Unknown |
| 504 | Dead | 00:13:10:05:1D:15 | Days+Inn | 0% | Unknown | Unknown |
| 511 | Dead | 00:12:17:1C:93:DC | WORKGROUP | 0% | Unknown | Unknown |
| 506 | Dead | 00:13:10:E4:21:12 | Days+Inn | 0% | Unknown | Unknown |
| 505 | Dead | 00:13:10:71:E8:FF | Days+Inn | 0% | Unknown | Unknown |
| 508 | Dead | 00:0D:0B:5D:78:FF | | 0% | Unknown | Unknown |
| 499 | Dead | 00:18:39:75:F4:7C | Meringolo | 0% | Unknown | Unknown |
| 502 | Dead | 1E:AB:C5:81:29:8E | hpsetup | 0% | Unknown | Unknown |
| 501 | Dead | 00:18:F8:E4:25:D6 | Ellen | 0% | Cisco-Linksys | Unknown |

Vistumbler v7 Beta - By Andrew Calcutt - 11/11/2007

Active APs: 0 / 507 Longitude: E 0.0000000 Latitude: N 0.0000000 Refresh loop time(ms): 1000

| # | Active | Mac Address | SSID | Signal | Manufacturer | Label | Authentication |
|---|---|---|---|---|---|---|---|
| 2 | Dead | 00:1A:70:75:E7:E6 | dd-wrt | 0% | Linksys | My Wireless | Open |
| 510 | Dead | 00:18:39:7D:10:50 | linksys | 0% | Unknown | Unknown | Open |

Vistumbler v7 Beta - By Andrew Calcutt - 11/11/2007

Active APs: 1 / 507 Longitude: E 0.0000000 Latitude: N 0.0000000 Refresh loop time(ms): 1000

| # | Active | Mac Address | SSID | Signal | Manufacturer | Label | Authentication | Channel | Encry |
|---|---|---|---|---|---|---|---|---|---|
| 2 | Active | 00:1A:70:75:E7:E6 | dd-wrt | 66% | Linksys | My Wireless | Open | 6 | None |
| 510 | Dead | 00:18:39:7D:10:50 | linksys | 0% | Unknown | Unknown | Open | 6 | None |

Vistumbler v8.0 - By Andrew Calcutt

Active APs: 3 / 67
Actual loop time: 1220 ms
Seconds Since GPS Update: GPGGA 0 / 30 - GPRMC 0 / 30
Latitude: N 4206.8367
Longitude: W 7206.2752

| # | Active | Mac Address | SSID | Signal | Channel | Authentication | Encryption | Network Type | Latitude | Longitude | Manufacturer | Label |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 67 | Active | 00:03:52:EC:FC:50 | HolidayInnExpress | 18% | 6 | Open | None | Infrastructure | N 42.1140933 | W 72.1052600 | Colubris | Unknown |
| 66 | Active | 00:18:F8:62:F3:1A | linksys | 30% | 6 | Open | None | Infrastructure | N 42.1140933 | W 72.1052600 | Cisco-Linksys | Unknown |
| 65 | Active | 00:12:0E:85:A8:71 | [illegible] | 18% | 6 | Open | WEP | Infrastructure | N 42.1142933 | W 72.1080633 | AboCom | Unknown |
| 64 | Dead | 00:12:0E:84:B7:CA | Sturbridge Coffee H... | 0% | 6 | Open | None | Infrastructure | N 42.1143830 | W 72.1084433 | AboCom | Unknown |
| 63 | Dead | 00:00:4B:66:6D:71 | [illegible] | 0% | 6 | Open | None | Infrastructure | N 42.1146267 | W 72.1015200 | AboCom | Unknown |
| 62 | Dead | 00:14:BF:75:26:69 | linksys_SES_65034 | 0% | 6 | WPA-Personal | TKIP | Infrastructure | N 42.1144750 | W 72.1087787 | Cisco-Linksys | Unknown |

GPS Details

Quality: 1
Status: A

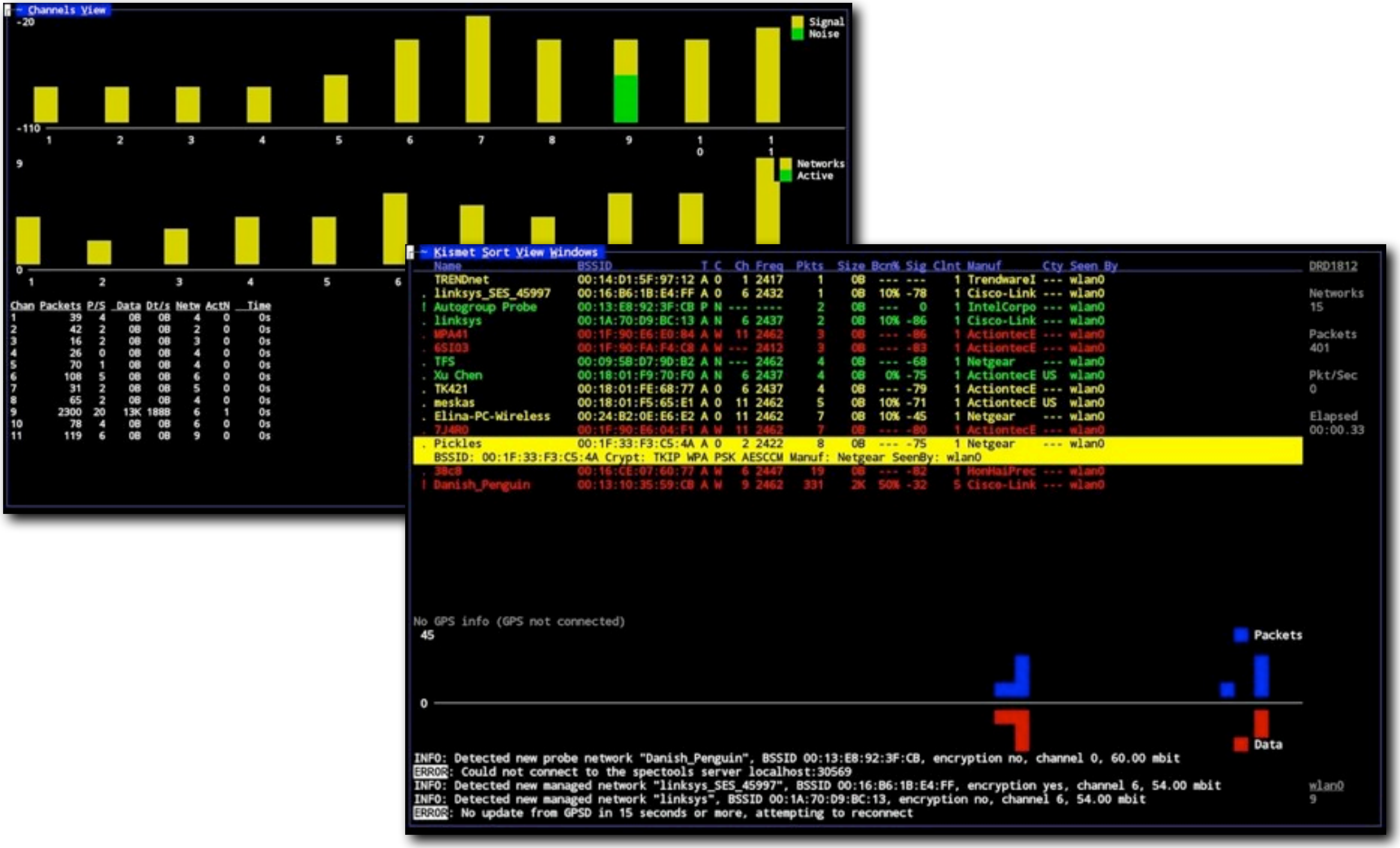
GPRMC
Time: 6:16:16PM (GMT)
Date: 07/11/08
Latitude: N 4206.8367
Longitude: W 7206.2752
SpeedKnots: 29.19
Speed(MPH): 33.75 MPH
Speed(km/h): 54.36 km/h
Track Angle: 164.85

GPGGA
Time: 6:16:16PM (GMT)
Number of Satalites: 07
Latitude: N 4206.8367
Longitude: W 7206.2752
Horizontal Dilution: 1.2
Altitude: 615.013845238
Height of Geoid: -34.0M

Vistumbler is an updated open source network detection tool for Windows Vista and Windows 7. It supports many of the same features as NetStumbler, including network detection and GPS integration. It also works with Google Earth to allow realtime WiFi mapping on a live map. Vistumbler does not run in Windows XP.

# Kismet

*http://www.kismetwireless.net/*



```
Chan Packets P/S  Data Dt/s Netw ActN   Time
1         39   4    0B   0B    4    0     0s
2         42   2    0B   0B    2    0     0s
3         16   2    0B   0B    3    0     0s
4         26   0    0B   0B    4    0     0s
5         70   1    0B   0B    4    0     0s
6        108   5    0B   0B    6    0     0s
7         31   2    0B   0B    5    0     0s
8         65   2    0B   0B    4    0     0s
9       2300  20   13K 188B    6    1     0s
10        78   4    0B   0B    6    0     0s
11       119   6    0B   0B    9    0     0s
```

```
~ Kismet Sort View Windows
  Name                 BSSID             T C  Ch Freq  Pkts  Size Bcn% Sig  Clnt Manuf      Cty Seen By      DRD1812
  TRENDnet             00:14:D1:5F:97:12 A 0   1 2417     1    0B  --- ---     1 TrendwareI --- wlan0
. linksys_SES_45997    00:16:B6:1B:E4:FF A 0   6 2432     1    0B  10% -78     1 Cisco-Link --- wlan0        Networks
! Autogroup Probe      00:13:E8:92:3F:CB P N --- ----     2    0B  ---   0     1 IntelCorpo --- wlan0        15
. linksys              00:1A:70:D9:BC:13 A N   6 2437     2    0B  10% -86     1 Cisco-Link --- wlan0
. WPA41                00:1F:90:E6:E0:84 A W  11 2462     3    0B  --- -86     1 ActiontecE --- wlan0        Packets
. 6SI03                00:1F:90:FA:F4:C8 A W --- 2412     3    0B  --- -83     1 ActiontecE --- wlan0        401
. TFS                  00:09:5B:D7:9D:B2 A N --- 2462     4    0B  --- -68     1 Netgear    --- wlan0
. Xu Chen              00:18:01:F9:70:F0 A N   6 2437     4    0B   0% -75     1 ActiontecE US  wlan0        Pkt/Sec
. TK421                00:18:01:FE:68:77 A 0   6 2437     4    0B  --- -79     1 ActiontecE --- wlan0        0
. meskas               00:18:01:F5:65:E1 A 0  11 2462     5    0B  10% -71     1 ActiontecE US  wlan0
. Elina-PC-Wireless    00:24:B2:0E:E6:E2 A 0  11 2462     7    0B  10% -45     1 Netgear    --- wlan0        Elapsed
. 7J4R0                00:1F:90:E6:04:F1 A W  11 2462     7    0B  --- -80     1 ActiontecE --- wlan0        00:00.33
. Pickles              00:1F:33:F3:C5:4A A 0   2 2422     8    0B  --- -75     1 Netgear    --- wlan0
  BSSID: 00:1F:33:F3:C5:4A Crypt: TKIP WPA PSK AESCCM Manuf: Netgear SeenBy: wlan0
. 38c8                 00:16:CE:07:60:77 A W   6 2447    19    0B  --- -82     1 HonHaiPrec --- wlan0
! Danish_Penguin       00:13:10:35:59:CB A W   9 2462   331    2K  50% -32     5 Cisco-Link --- wlan0
```

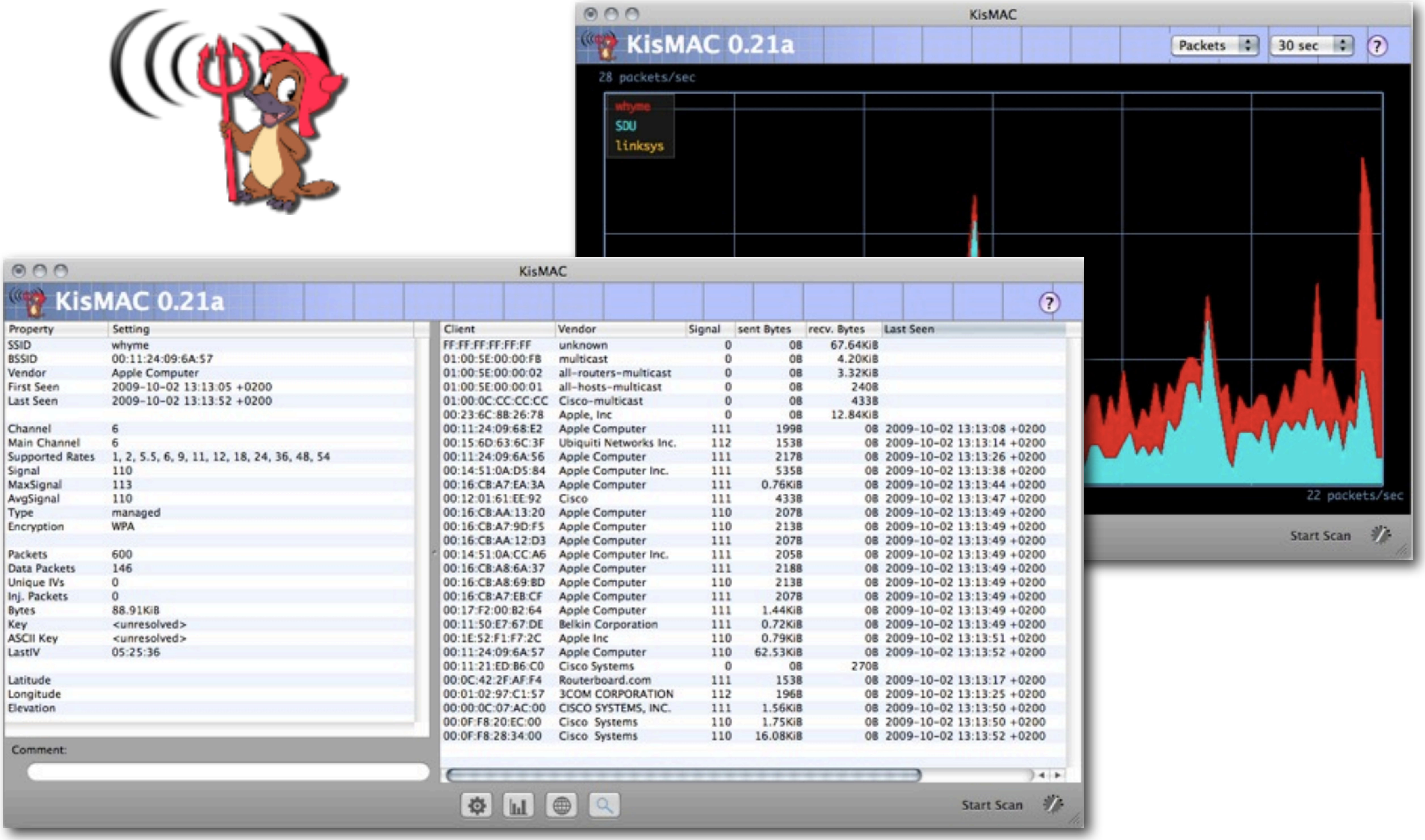
```
INFO: Detected new probe network "Danish_Penguin", BSSID 00:13:E8:92:3F:CB, encryption no, channel 0, 60.00 mbit
ERROR: Could not connect to the spectools server localhost:30569
INFO: Detected new managed network "linksys_SES_45997", BSSID 00:16:B6:1B:E4:FF, encryption yes, channel 6, 54.00 mbit      wlan0
INFO: Detected new managed network "linksys", BSSID 00:1A:70:D9:BC:13, encryption no, channel 6, 54.00 mbit                 9
ERROR: No update from GPSD in 15 seconds or more, attempting to reconnect
```

Kismet is the most widely used wireless network monitor and logging system. Kismet will work with any wireless card which supports raw monitoring mode, and can sniff 802.11b, 802.11a, and 802.11g traffic. Far from being a simple network detector, Kismet can log all 802.11 frames for later analysis. It supports multiple radio cards and a sophisticated network monitoring mode, which makes it possible to log and analyze all traffic on all channels in an arbitrarily large network simultaneously. It can identify the SSID of "closed" WiFi networks, identify associated clients (including relative traffic and hardware vendors), has GPS integration, and much more. Kismet is open source software.

While free and powerful, one downside to Kismet is its relative complexity. It works best on Linux or BSD, and also works on Windows when using the AirPcap packet capture hardware.

# KisMAC

*http://www.kismac-ng.org/*

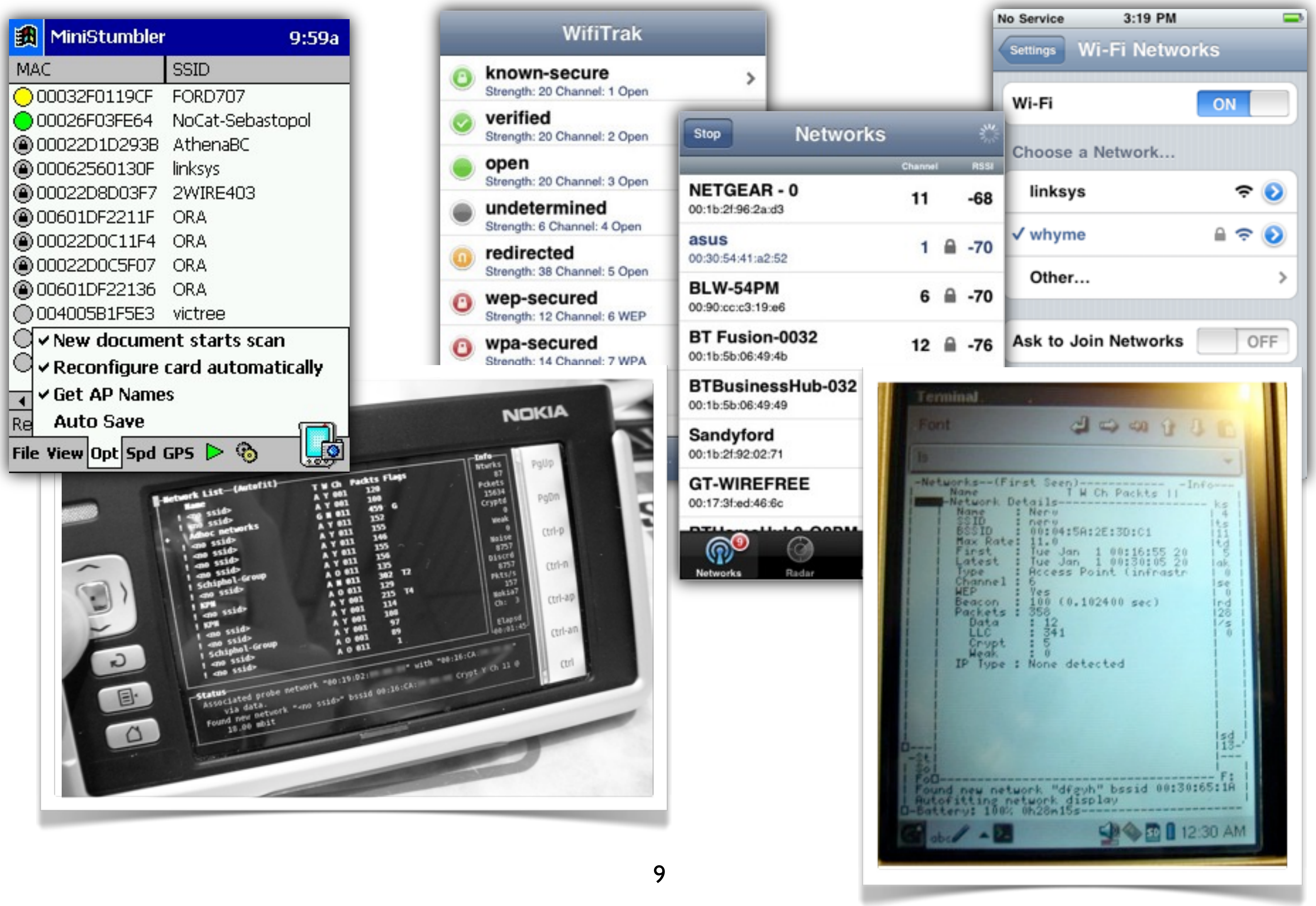


| Property | Setting |
|---|---|
| SSID | whyme |
| BSSID | 00:11:24:09:6A:57 |
| Vendor | Apple Computer |
| First Seen | 2009-10-02 13:13:05 +0200 |
| Last Seen | 2009-10-02 13:13:52 +0200 |
| | |
| Channel | 6 |
| Main Channel | 6 |
| Supported Rates | 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, 54 |
| Signal | 110 |
| MaxSignal | 113 |
| AvgSignal | 110 |
| Type | managed |
| Encryption | WPA |
| | |
| Packets | 600 |
| Data Packets | 146 |
| Unique IVs | 0 |
| Inj. Packets | 0 |
| Bytes | 88.91KiB |
| Key | <unresolved> |
| ASCII Key | <unresolved> |
| LastIV | 05:25:36 |
| | |
| Latitude | |
| Longitude | |
| Elevation | |

| Client | Vendor | Signal | sent Bytes | recv. Bytes | Last Seen |
|---|---|---|---|---|---|
| FF:FF:FF:FF:FF:FF | unknown | 0 | 0B | 67.64KiB | |
| 01:00:5E:00:00:FB | multicast | 0 | 0B | 4.20KiB | |
| 01:00:5E:00:00:02 | all-routers-multicast | 0 | 0B | 3.32KiB | |
| 01:00:5E:00:00:01 | all-hosts-multicast | 0 | 0B | 240B | |
| 01:00:0C:CC:CC:CC | Cisco-multicast | 0 | 0B | 433B | |
| 00:23:6C:8B:26:78 | Apple, Inc | 0 | 0B | 12.84KiB | |
| 00:11:24:09:68:E2 | Apple Computer | 111 | 199B | 0B | 2009-10-02 13:13:08 +0200 |
| 00:15:6D:63:6C:3F | Ubiquiti Networks Inc. | 112 | 153B | 0B | 2009-10-02 13:13:14 +0200 |
| 00:11:24:09:6A:56 | Apple Computer | 111 | 217B | 0B | 2009-10-02 13:13:26 +0200 |
| 00:14:51:0A:D5:84 | Apple Computer Inc. | 111 | 535B | 0B | 2009-10-02 13:13:38 +0200 |
| 00:16:CB:A7:EA:3A | Apple Computer | 111 | 0.76KiB | 0B | 2009-10-02 13:13:44 +0200 |
| 00:12:01:61:EE:92 | Cisco | 111 | 433B | 0B | 2009-10-02 13:13:47 +0200 |
| 00:16:CB:AA:13:20 | Apple Computer | 110 | 207B | 0B | 2009-10-02 13:13:49 +0200 |
| 00:16:CB:A7:9D:F5 | Apple Computer | 110 | 213B | 0B | 2009-10-02 13:13:49 +0200 |
| 00:16:CB:AA:12:D3 | Apple Computer | 111 | 207B | 0B | 2009-10-02 13:13:49 +0200 |
| 00:14:51:0A:CC:A6 | Apple Computer Inc. | 111 | 205B | 0B | 2009-10-02 13:13:49 +0200 |
| 00:16:CB:A8:6A:37 | Apple Computer | 111 | 218B | 0B | 2009-10-02 13:13:49 +0200 |
| 00:16:CB:A8:69:BD | Apple Computer | 110 | 213B | 0B | 2009-10-02 13:13:49 +0200 |
| 00:16:CB:A7:EB:CF | Apple Computer | 111 | 207B | 0B | 2009-10-02 13:13:49 +0200 |
| 00:17:F2:00:B2:64 | Apple Computer | 111 | 1.44KiB | 0B | 2009-10-02 13:13:49 +0200 |
| 00:11:50:E7:67:DE | Belkin Corporation | 111 | 0.72KiB | 0B | 2009-10-02 13:13:49 +0200 |
| 00:1E:52:F1:F7:2C | Apple Inc | 110 | 0.79KiB | 0B | 2009-10-02 13:13:51 +0200 |
| 00:11:24:09:6A:57 | Apple Computer | 110 | 62.53KiB | 0B | 2009-10-02 13:13:52 +0200 |
| 00:11:21:ED:B6:C0 | Cisco Systems | 0 | 0B | 270B | |
| 00:0C:42:2F:AF:F4 | Routerboard.com | 111 | 153B | 0B | 2009-10-02 13:13:17 +0200 |
| 00:01:02:97:C1:57 | 3COM CORPORATION | 112 | 196B | 0B | 2009-10-02 13:13:25 +0200 |
| 00:00:0C:07:AC:00 | CISCO SYSTEMS, INC. | 111 | 1.56KiB | 0B | 2009-10-02 13:13:50 +0200 |
| 00:0F:F8:20:EC:00 | Cisco Systems | 110 | 1.75KiB | 0B | 2009-10-02 13:13:50 +0200 |
| 00:0F:F8:28:34:00 | Cisco Systems | 110 | 16.08KiB | 0B | 2009-10-02 13:13:52 +0200 |

KisMAC is an open source network detection and logging tool for Mac OS X. It has many of the same features as Kismet, but includes a much friendlier graphical interface. Like Kismet, it can log raw 802.11 frames when using radio cards capable of supporting monitor mode. KisMAC supports custom maps for GPS integration, and many advanced security features.

# Handheld wireless clients



MiniStumbler 9:59a

| MAC | SSID |
|---|---|
| 00032F0119CF | FORD707 |
| 00026F03FE64 | NoCat-Sebastopol |
| 00022D1D293B | AthenaBC |
| 00062560130F | linksys |
| 00022D8D03F7 | 2WIRE403 |
| 00601DF2211F | ORA |
| 00022D0C11F4 | ORA |
| 00022D0C5F07 | ORA |
| 00601DF22136 | ORA |
| 004005B1F5E3 | victree |

WifiTrak

- known-secure — Strength: 20 Channel: 1 Open
- verified — Strength: 20 Channel: 2 Open
- open — Strength: 20 Channel: 3 Open
- undetermined — Strength: 6 Channel: 4 Open
- redirected — Strength: 38 Channel: 5 Open
- wep-secured — Strength: 12 Channel: 6 WEP
- wpa-secured — Strength: 14 Channel: 7 WPA

| | Channel | RSSI |
|---|---|---|
| NETGEAR - 0<br>00:1b:2f:96:2a:d3 | 11 | -68 |
| asus<br>00:30:54:41:a2:52 | 1 🔒 | -70 |
| BLW-54PM<br>00:90:cc:c3:19:e6 | 6 🔒 | -70 |
| BT Fusion-0032<br>00:1b:5b:06:49:4b | 12 🔒 | -76 |
| BTBusinessHub-032<br>00:1b:5b:06:49:49 | | |
| Sandyford<br>00:1b:2f:92:02:71 | | |
| GT-WIREFREE<br>00:17:3f:ed:46:6c | | |

Wi-Fi ON

Choose a Network...

- linksys
- ✓ whyme
- Other...

Ask to Join Networks OFF

```
-Network List—(Autofit)              T W Ch  Packts Flags      -Info
  Name                               A Y 001   120             Ntwrks
 ! <no ssid>                         A Y 001   100                87
 ! <no ssid>                         G N 011   459   G         Pckets
  Adhoc networks                     A Y 011   152              15634
 ! <no ssid>                         A Y 011   155             Cryptd
 ! <no ssid>                         A Y 011   146                 0
 ! <no ssid>                         A Y 011   155             Weak
 ! <no ssid>                         A Y 011   156                 0
 ! Schiphol-Group                    A O 011   135             Noise
 ! <no ssid>                         A N 011   302   T2          8757
 ! KPN                               A O 011   129             Discrd
 ! <no ssid>                         A Y 001   215   T4          8757
 ! KPN                               A Y 001   114             Pkts/s
 ! <no ssid>                         A Y 001   100                157
 ! <no ssid>                         A Y 001    97             Nokia7
 ! Schiphol-Group                    A O 001    89              Ch: 3
 ! <no ssid>                         A O 011     1             Elapsd
 ! <no ssid>                                                   00:01:45
Status
  Associated probe network "00:19:02:[redacted]" with "00:16:CA:[redacted]
    via data.
  Found new network "<no ssid>" bssid 00:16:CA:[redacted] Crypt Y Ch 11 @
    18.00 mbit
```

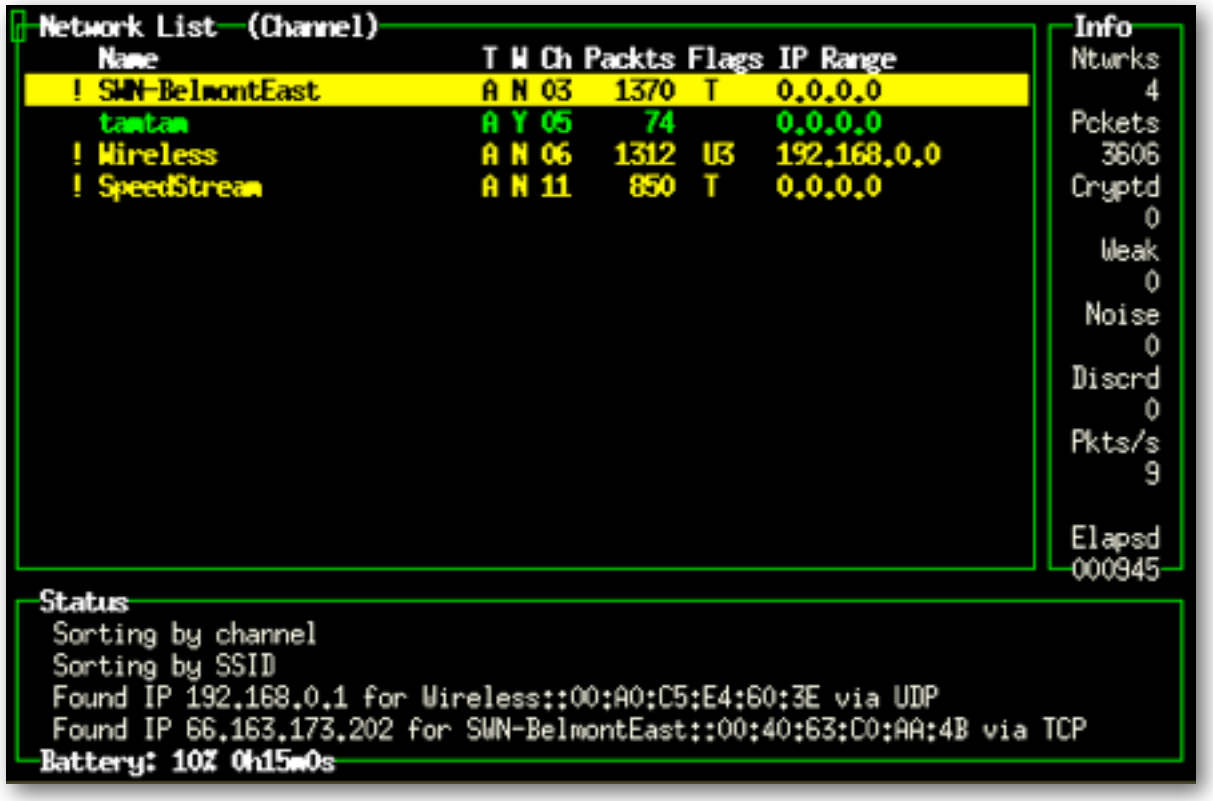
```
-Networks--(First Seen)------------  -Info---
    Name              T W Ch Packts !!
  -Network Details----------------------- ks
    Name      : Nerv                       4
    SSID      : nerv                      ts
    BSSID     : 00:04:5A:2E:3D:C1         11
    Max Rate  : 11.0                      td
    First     : Tue Jan  1 00:16:55 20     5
    Latest    : Tue Jan  1 00:30:05 20    ak
    Type      : Access Point (infrastr     0
    Channel   : 6                         se
    WEP       : Yes                        0
    Beacon    : 100 (0.102400 sec)        rd
    Packets   : 358                       28
      Data      : 12                      /s
      LLC       : 341                      0
      Crypt     : 5
      Weak      : 0
    IP Type   : None detected

                                          sd
                                          13-
Found new network "dfgyh" bssid 00:30:65:1A
Autofitting network display
-Battery: 100% 0h28m15s--------------------
```

Many wifi scanning devices exist for handheld computers.

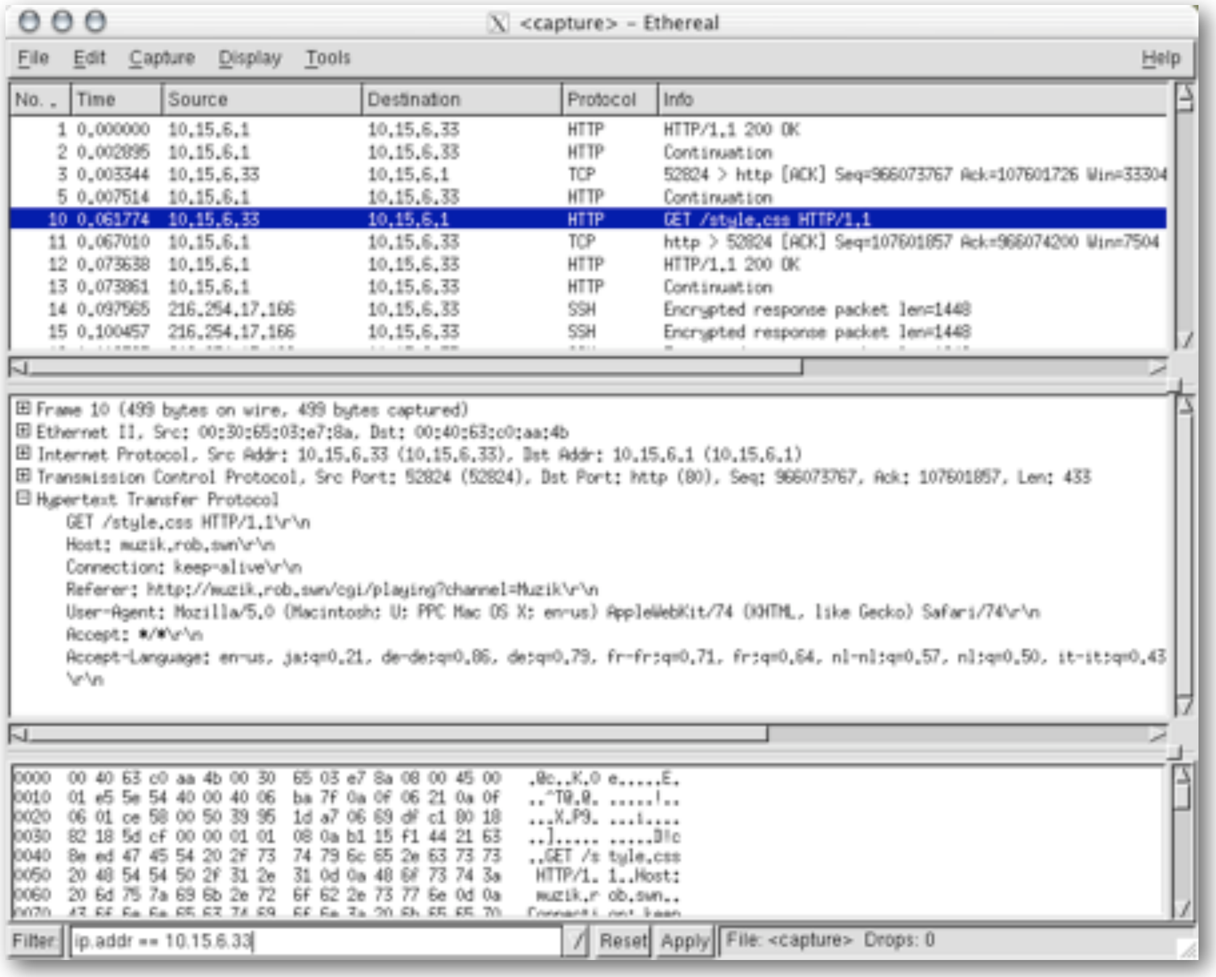
KISMET

+

WIRESHARK



```
Network List (Channel)                                            Info
   Name                          T W Ch Packts Flags IP Range     Ntwrks
 ! SWN-BelmontEast               A N 03  1370  T     0.0.0.0           4
   tamtam                        A Y 05    74        0.0.0.0      Pckets
 ! Wireless                      A N 06  1312  U3    192.168.0.0    3606
 ! SpeedStream                   A N 11   850  T     0.0.0.0      Cryptd
                                                                       0
                                                                    Weak
                                                                       0
                                                                   Noise
                                                                       0
                                                                  Discrd
                                                                       0
                                                                  Pkts/s
                                                                       9

                                                                  Elapsd
                                                                  000945
Status
 Sorting by channel
 Sorting by SSID
 Found IP 192.168.0.1 for Wireless::00:A0:C5:E4:60:3E via UDP
 Found IP 66.163.173.202 for SWN-BelmontEast::00:40:63:C0:AA:4B via TCP
Battery: 10% 0h15m0s
```



<capture> - Ethereal

```
No. . Time     Source          Destination  Protocol Info
    1 0.000000 10.15.6.1       10.15.6.33   HTTP     HTTP/1.1 200 OK
    2 0.002895 10.15.6.1       10.15.6.33   HTTP     Continuation
    3 0.003344 10.15.6.33      10.15.6.1    TCP      52824 > http [ACK] Seq=966073767 Ack=107601726 Win=33304
    5 0.007514 10.15.6.1       10.15.6.33   HTTP     Continuation
   10 0.061774 10.15.6.33      10.15.6.1    HTTP     GET /style.css HTTP/1.1
   11 0.067010 10.15.6.1       10.15.6.33   TCP      http > 52824 [ACK] Seq=107601857 Ack=966074200 Win=7504
   12 0.073638 10.15.6.1       10.15.6.33   HTTP     HTTP/1.1 200 OK
   13 0.073861 10.15.6.1       10.15.6.33   HTTP     Continuation
   14 0.097565 216.254.17.166  10.15.6.33   SSH      Encrypted response packet len=1448
   15 0.100457 216.254.17.166  10.15.6.33   SSH      Encrypted response packet len=1448
```

```
⊞ Frame 10 (499 bytes on wire, 499 bytes captured)
⊞ Ethernet II, Src: 00:30:65:03:e7:8a, Dst: 00:40:63:c0:aa:4b
⊞ Internet Protocol, Src Addr: 10.15.6.33 (10.15.6.33), Dst Addr: 10.15.6.1 (10.15.6.1)
⊞ Transmission Control Protocol, Src Port: 52824 (52824), Dst Port: http (80), Seq: 966073767, Ack: 107601857, Len: 433
⊟ Hypertext Transfer Protocol
    GET /style.css HTTP/1.1\r\n
    Host: muzik.rob.swn\r\n
    Connection: keep-alive\r\n
    Referer: http://muzik.rob.swn/cgi/playing?channel=Muzik\r\n
    User-Agent: Mozilla/5.0 (Macintosh; U; PPC Mac OS X; en-us) AppleWebKit/74 (KHTML, like Gecko) Safari/74\r\n
    Accept: */*\r\n
    Accept-Language: en-us, ja;q=0.21, de-de;q=0.86, de;q=0.79, fr-fr;q=0.71, fr;q=0.64, nl-nl;q=0.57, nl;q=0.50, it-it;q=0.43
    \r\n
```

```
0000  00 40 63 c0 aa 4b 00 30  65 03 e7 8a 08 00 45 00   .@c..K.0 e.....E.
0010  01 e5 5e 54 40 00 40 06  ba 7f 0a 0f 06 21 0a 0f   ..^T@.@. .....!..
0020  06 01 ce 58 00 50 39 95  1d a7 06 69 df c1 80 18   ...X.P9. ...i....
0030  82 18 5d cf 00 00 01 01  08 0a b1 15 f1 44 21 63   ..]..... .....D!c
0040  8e ed 47 45 54 20 2f 73  74 79 6c 65 2e 63 73 73   ..GET /s tyle.css
0050  20 48 54 54 50 2f 31 2e  31 0d 0a 48 6f 73 74 3a    HTTP/1. 1..Host:
0060  20 6d 75 7a 69 6b 2e 72  6f 62 2e 73 77 6e 0d 0a    muzik.r ob.swn..
```

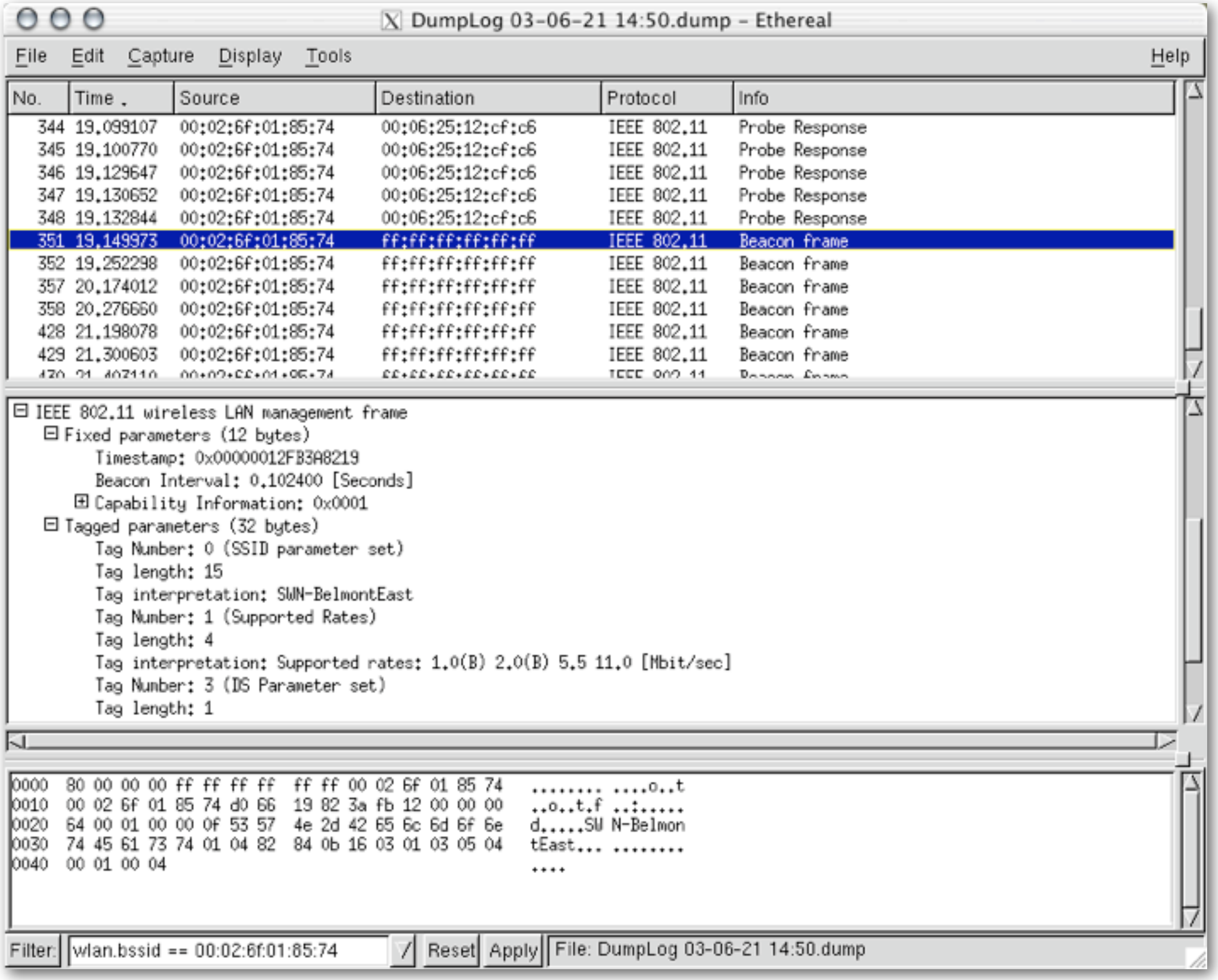
Filter: ip.addr == 10.15.6.33

File: <capture> Drops: 0

Kismet will log 802.11 frames in standard pcap format. You can then open these files in Wireshark for further analysis.

=

*extremely* powerful wireless protocol analyzer


DumpLog 03-06-21 14:50.dump - Ethereal
File Edit Capture Display Tools Help

| No. | Time | Source | Destination | Protocol | Info |
|---|---|---|---|---|---|
| 344 | 19.099107 | 00:02:6f:01:85:74 | 00:06:25:12:cf:c6 | IEEE 802.11 | Probe Response |
| 345 | 19.100770 | 00:02:6f:01:85:74 | 00:06:25:12:cf:c6 | IEEE 802.11 | Probe Response |
| 346 | 19.129647 | 00:02:6f:01:85:74 | 00:06:25:12:cf:c6 | IEEE 802.11 | Probe Response |
| 347 | 19.130652 | 00:02:6f:01:85:74 | 00:06:25:12:cf:c6 | IEEE 802.11 | Probe Response |
| 348 | 19.132844 | 00:02:6f:01:85:74 | 00:06:25:12:cf:c6 | IEEE 802.11 | Probe Response |
| 351 | 19.149973 | 00:02:6f:01:85:74 | ff:ff:ff:ff:ff:ff | IEEE 802.11 | Beacon frame |
| 352 | 19.252298 | 00:02:6f:01:85:74 | ff:ff:ff:ff:ff:ff | IEEE 802.11 | Beacon frame |
| 357 | 20.174012 | 00:02:6f:01:85:74 | ff:ff:ff:ff:ff:ff | IEEE 802.11 | Beacon frame |
| 358 | 20.276660 | 00:02:6f:01:85:74 | ff:ff:ff:ff:ff:ff | IEEE 802.11 | Beacon frame |
| 428 | 21.198078 | 00:02:6f:01:85:74 | ff:ff:ff:ff:ff:ff | IEEE 802.11 | Beacon frame |
| 429 | 21.300603 | 00:02:6f:01:85:74 | ff:ff:ff:ff:ff:ff | IEEE 802.11 | Beacon frame |

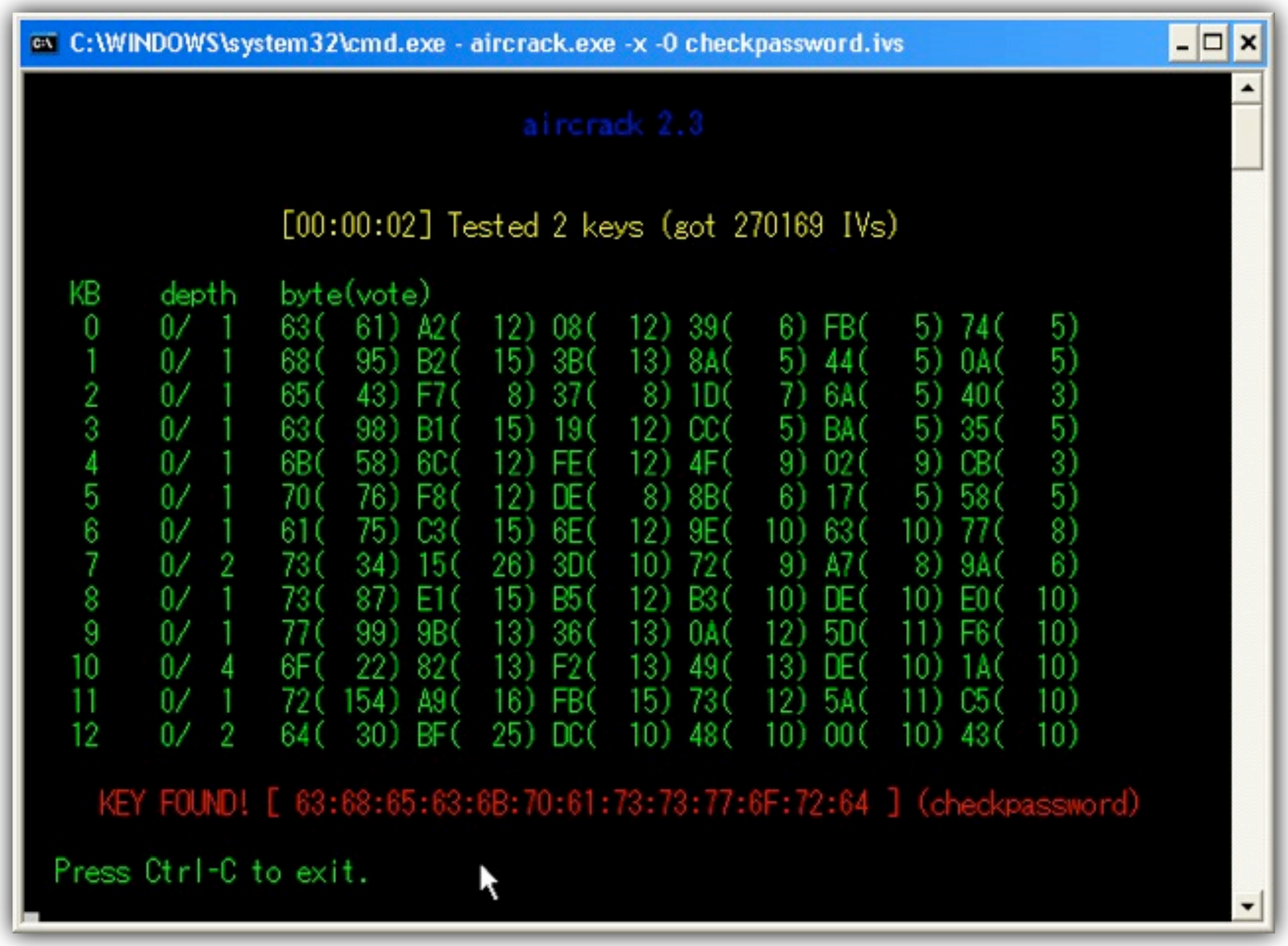
```
⊟ IEEE 802.11 wireless LAN management frame
  ⊟ Fixed parameters (12 bytes)
      Timestamp: 0x00000012FB3A8219
      Beacon Interval: 0.102400 [Seconds]
    ⊞ Capability Information: 0x0001
  ⊟ Tagged parameters (32 bytes)
      Tag Number: 0 (SSID parameter set)
      Tag length: 15
      Tag interpretation: SWN-BelmontEast
      Tag Number: 1 (Supported Rates)
      Tag length: 4
      Tag interpretation: Supported rates: 1.0(B) 2.0(B) 5.5 11.0 [Mbit/sec]
      Tag Number: 3 (DS Parameter set)
      Tag length: 1
```

```
0000  80 00 00 00 ff ff ff ff  ff ff 00 02 6f 01 85 74   ........ ....o..t
0010  00 02 6f 01 85 74 d0 66  19 82 3a fb 12 00 00 00   ..o..t.f ..:.....
0020  64 00 01 00 00 0f 53 57  4e 2d 42 65 6c 6d 6f 6e   d.....SW N-Belmon
0030  74 45 61 73 74 01 04 82  84 0b 16 03 01 03 05 04   tEast... ........
0040  00 01 00 04                                        ....
```

Filter: wlan.bssid == 00:02:6f:01:85:74

File: DumpLog 03-06-21 14:50.dump

Using Kismet in conjunction with Wireshark allows you to inspect data all the way down to the level of individual 802.11 frames, making it possible to debug even the most difficult wireless problems.



```
C:\WINDOWS\system32\cmd.exe - aircrack.exe -x -0 checkpassword.ivs

                                 aircrack 2.3


                  [00:00:02] Tested 2 keys (got 270169 IVs)

   KB    depth   byte(vote)
    0    0/  1   63(  61) A2(  12) 08(  12) 39(   6) FB(   5) 74(   5)
    1    0/  1   68(  95) B2(  15) 3B(  13) 8A(   5) 44(   5) 0A(   5)
    2    0/  1   65(  43) F7(   8) 37(   8) 1D(   7) 6A(   5) 40(   3)
    3    0/  1   63(  98) B1(  15) 19(  12) CC(   5) BA(   5) 35(   5)
    4    0/  1   6B(  58) 6C(  12) FE(  12) 4F(   9) 02(   9) CB(   3)
    5    0/  1   70(  76) F8(  12) DE(   8) 8B(   6) 17(   5) 58(   5)
    6    0/  1   61(  75) C3(  15) 6E(  12) 9E(  10) 63(  10) 77(   8)
    7    0/  2   73(  34) 15(  26) 3D(  10) 72(   9) A7(   8) 9A(   6)
    8    0/  1   73(  87) E1(  15) B5(  12) B3(  10) DE(  10) E0(  10)
    9    0/  1   77(  99) 9B(  13) 36(  13) 0A(  12) 5D(  11) F6(  10)
   10    0/  4   6F(  22) 82(  13) F2(  13) 49(  13) DE(  10) 1A(  10)
   11    0/  1   72( 154) A9(  16) FB(  15) 73(  12) 5A(  11) C5(  10)
   12    0/  2   64(  30) BF(  25) DC(  10) 48(  10) 00(  10) 43(  10)

     KEY FOUND! [ 63:68:65:63:6B:70:61:73:73:77:6F:72:64 ] (checkpassword)

  Press Ctrl-C to exit.
```

Aircrack-ng is an 802.11 WEP and WPA-PSK keys cracking program that can recover keys once enough data packets have been captured.

## COWPATTY - ATTACKING WPA/WPA2-PSK EXCHANGES

*http://www.willhackforsushi.com/Cowpatty.html*

- Implementation of an offline dictionary attack against WPA-PSK and WPA2-PSK networks

## CHURCH OF WIFI

TIME TO PLAY

*http://www.renderlab.net/projects/WPA-tables/*

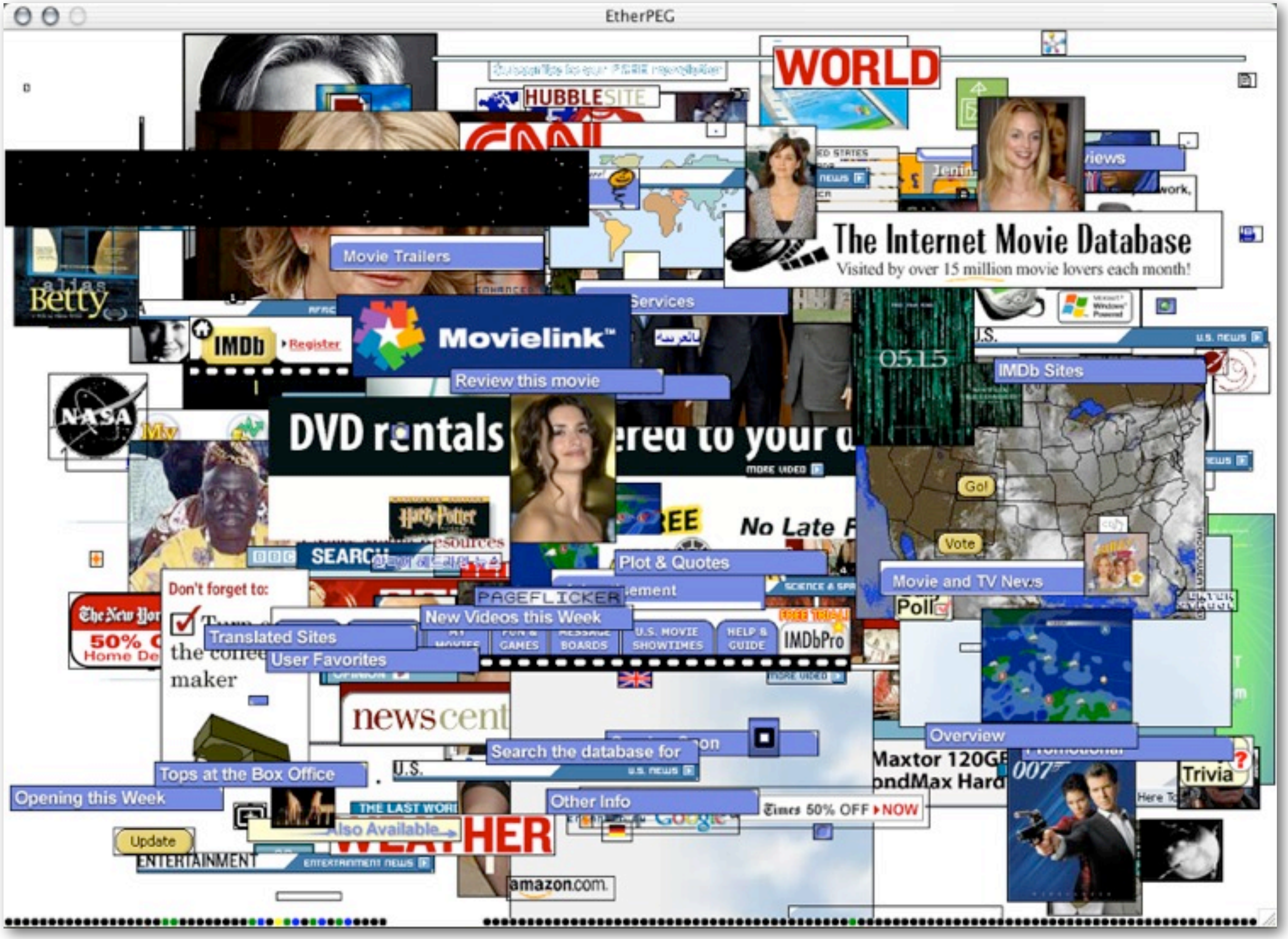
- WPA2-PSK Rainbow Tables: 1 million common passwords x 1,000 common SSIDs. 40 GB of lookup tables available on DVDs.

Cowpatty is a WPA/WPA2-PSK brute-force dictionary attack tool.

The Church of WiFi has released a set of pre-computed hash tables that match the 1,000 most commonly used ESSIDs (as determined by public War Driving maps) to 1 million commonly used passwords (harvested through Google and other sources). The result is a huge looku table that can crack networks that use these poor defaults in a matter of seconds.

# Etherpeg

*http://www.etherpeg.org/*

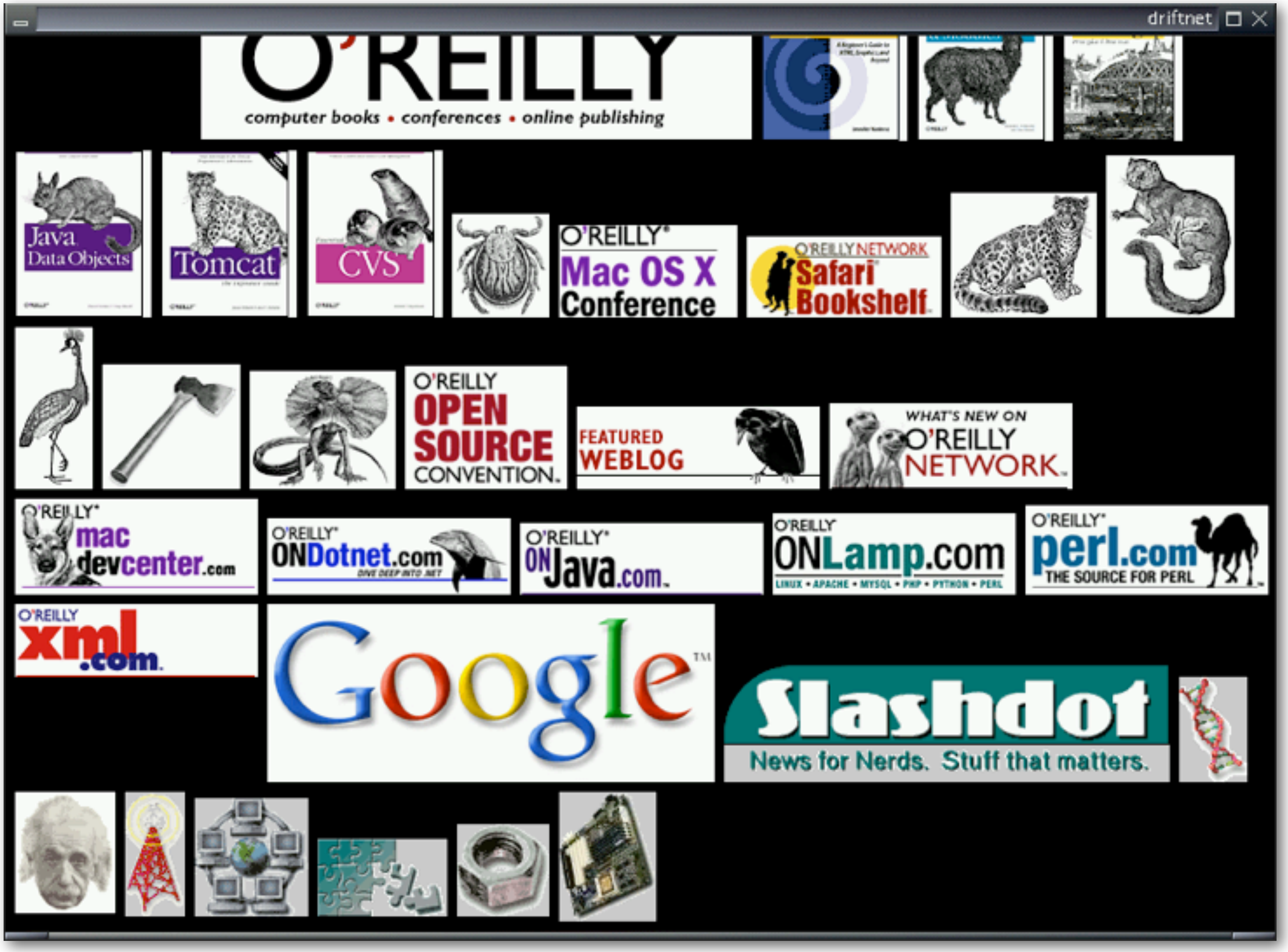


Etherpeg and Driftnet are packet capture tools that decode graphical data (such as GIF and JPEG files) and display them as a collage. Tools such as these are of limited use in troubleshooting problems, but are very valuable for demonstrating the insecurity of unencrypted protocols.

Etherpeg is an old Mac-only software, no longer supported.

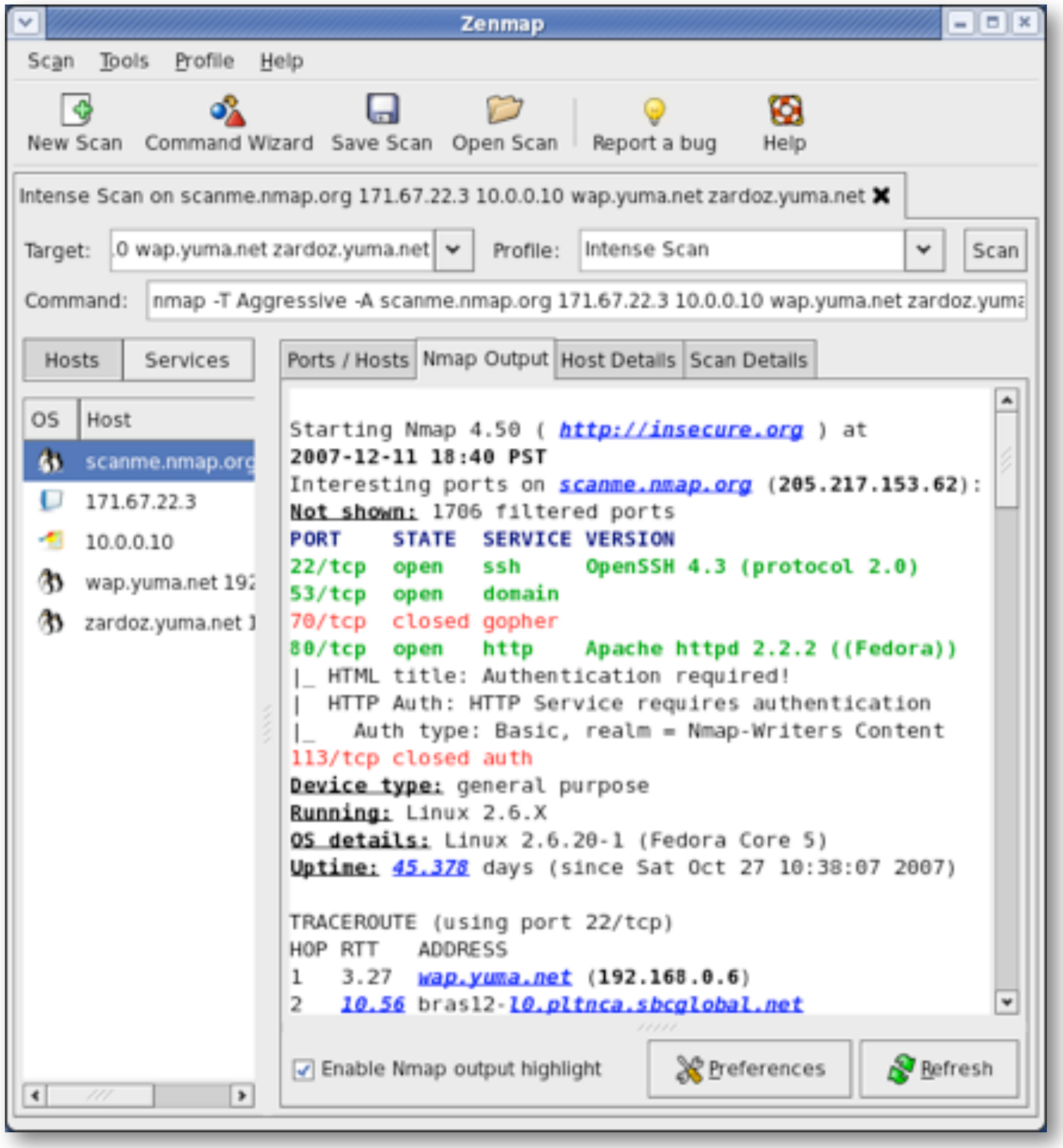
# Driftnet

*http://www.ex-parrot.com/~chris/driftnet/*


driftnet
O'REILLY
computer books • conferences • online publishing
Java Data Objects
Tomcat
CVS
O'REILLY Mac OS X Conference
O'REILLY NETWORK Safari Bookshelf
O'REILLY OPEN SOURCE CONVENTION
FEATURED WEBLOG
WHAT'S NEW ON O'REILLY NETWORK
O'REILLY mac devcenter.com
O'REILLY ONDotnet.com
O'REILLY ONJava.com
O'REILLY ONLamp.com
LINUX • APACHE • MYSQL • PHP • PYTHON • PERL
O'REILLY perl.com THE SOURCE FOR PERL
O'REILLY xml.com
Google
Slashdot
News for Nerds. Stuff that matters.

In addition to logging and displaying graphical images, Driftnet can decode MPEG audio streams. Driftnet is free software for Linux.

*http://nmap.org/*



Intense Scan on scanme.nmap.org 171.67.22.3 10.0.0.10 wap.yuma.net zardoz.yuma.net

Target: 0 wap.yuma.net zardoz.yuma.net  Profile: Intense Scan  Scan

Command: nmap -T Aggressive -A scanme.nmap.org 171.67.22.3 10.0.0.10 wap.yuma.net zardoz.yuma

```
Starting Nmap 4.50 ( http://insecure.org ) at
2007-12-11 18:40 PST
Interesting ports on scanme.nmap.org (205.217.153.62):
Not shown: 1706 filtered ports
PORT    STATE  SERVICE VERSION
22/tcp  open   ssh     OpenSSH 4.3 (protocol 2.0)
53/tcp  open   domain
70/tcp  closed gopher
80/tcp  open   http    Apache httpd 2.2.2 ((Fedora))
|_ HTML title: Authentication required!
|  HTTP Auth: HTTP Service requires authentication
|_   Auth type: Basic, realm = Nmap-Writers Content
113/tcp closed auth
Device type: general purpose
Running: Linux 2.6.X
OS details: Linux 2.6.20-1 (Fedora Core 5)
Uptime: 45.378 days (since Sat Oct 27 10:38:07 2007)

TRACEROUTE (using port 22/tcp)
HOP RTT   ADDRESS
1   3.27  wap.yuma.net (192.168.0.6)
2   10.56 bras12-10.pltnca.sbcglobal.net
```

☑ Enable Nmap output highlight

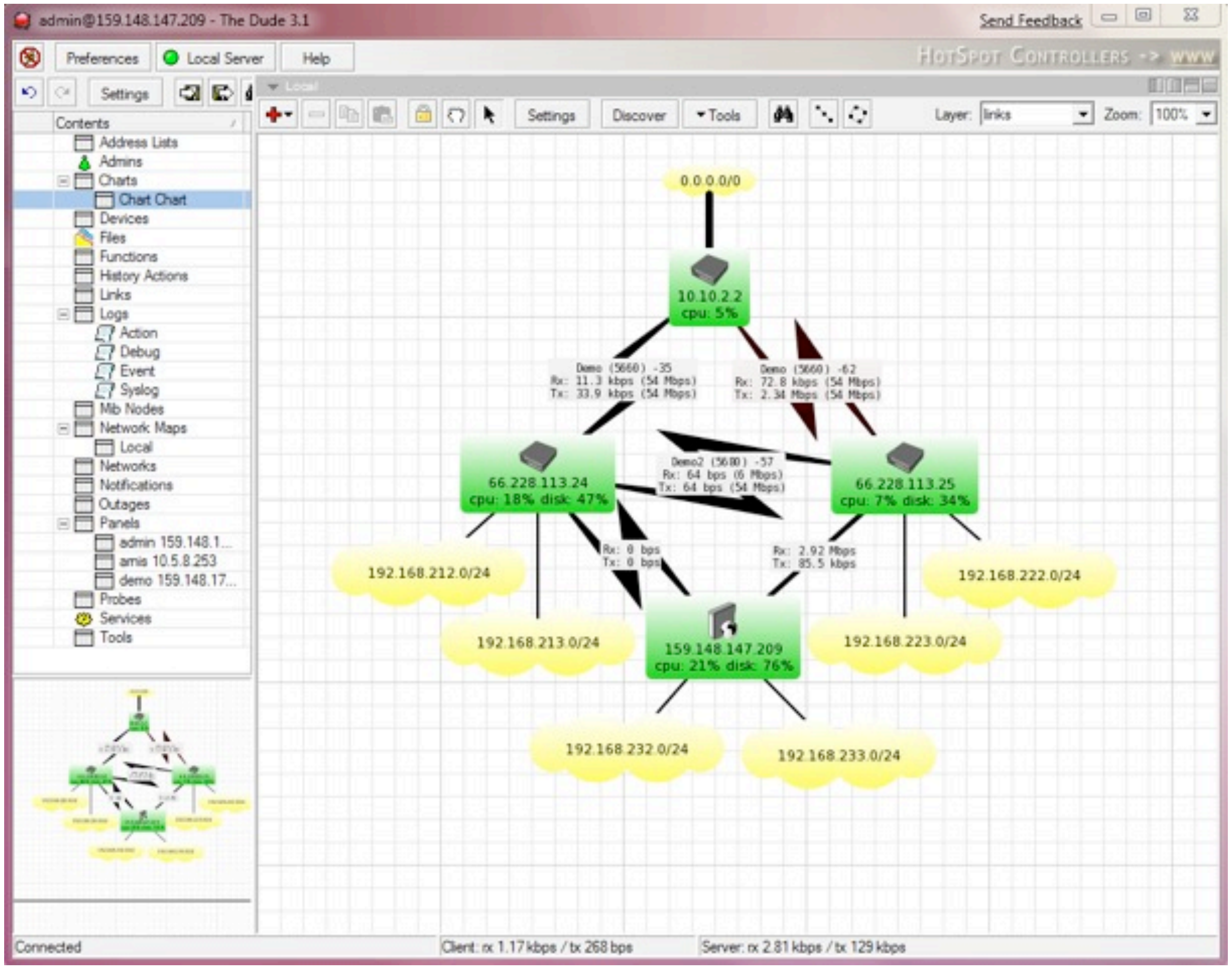
- Network and port scanner
- Rogue AP detection
- Scans any number of ports on any number of hosts
- Sophisticated stealth scanning
- Idle, undetectable service "scanning"
- Available for all platforms

Nmap (short for "Network Mapper") is a free and open source utility for network exploration or security auditing. It can be used for tasks such as network inventory, managing service upgrade schedules, monitoring host or service uptime, and finding rogue access points or other unauthorized services on your network. Nmap runs on all major computer operating systems, and official binary packages are available for Linux, Windows, and Mac OS X.

# The Dude

*http://www.mikrotik.com/thedude.php*

- The Dude network monitor is a network auditing and monitoring tool by MikroTik.
- The Dude automatically scans devices within specified subnets, draws a map of the networks monitors services and sends alerts when there are problems.
- Only available for Windows.



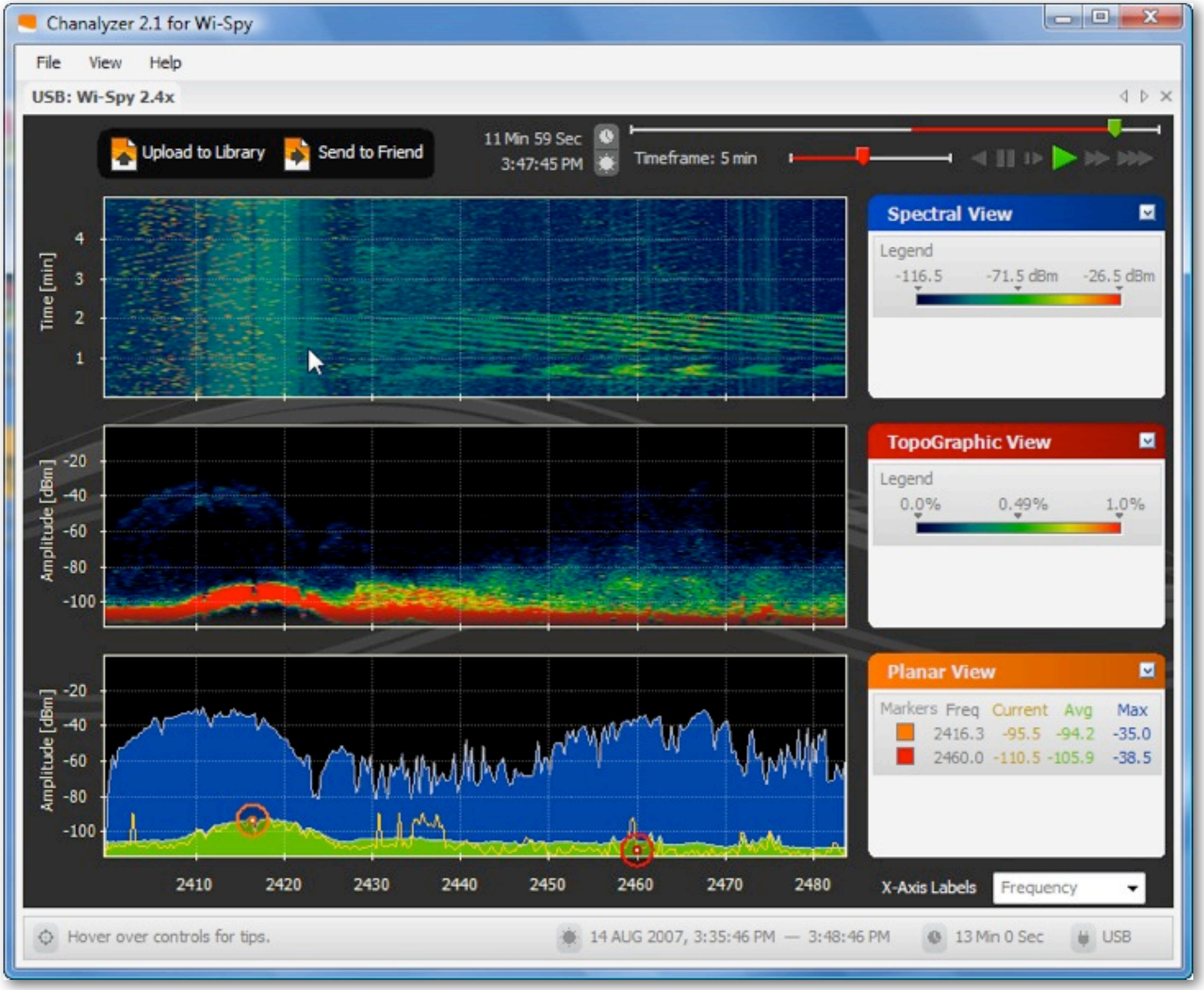
# Wi-Spy spectrum analyzer

*http://www.metageek.net/*

One inexpensive spectrum analyzer is the Wi-Spy. It is a 2.4 GHz USB device that is designed to show you information about 2.4 GHz WiFi. It does this by tuning to a narrow channel in the 2.4 GHz band and listening for energy, then changing to another, and so on all throughout the band as quickly as it can. In this respect it acts a bit like a frequency hopping radio that never transmits. By plotting this information on a graph, you can get a very clear picture of how the 2.4 GHz spectrum is being used by devices in your area. Other versions of the Wi-Spy can also detect 900 MHz and 5 GHz signals.

There are a number of free software packages that work well with the WiSpy.

# Chanalyzer



Timeframe: 5 min

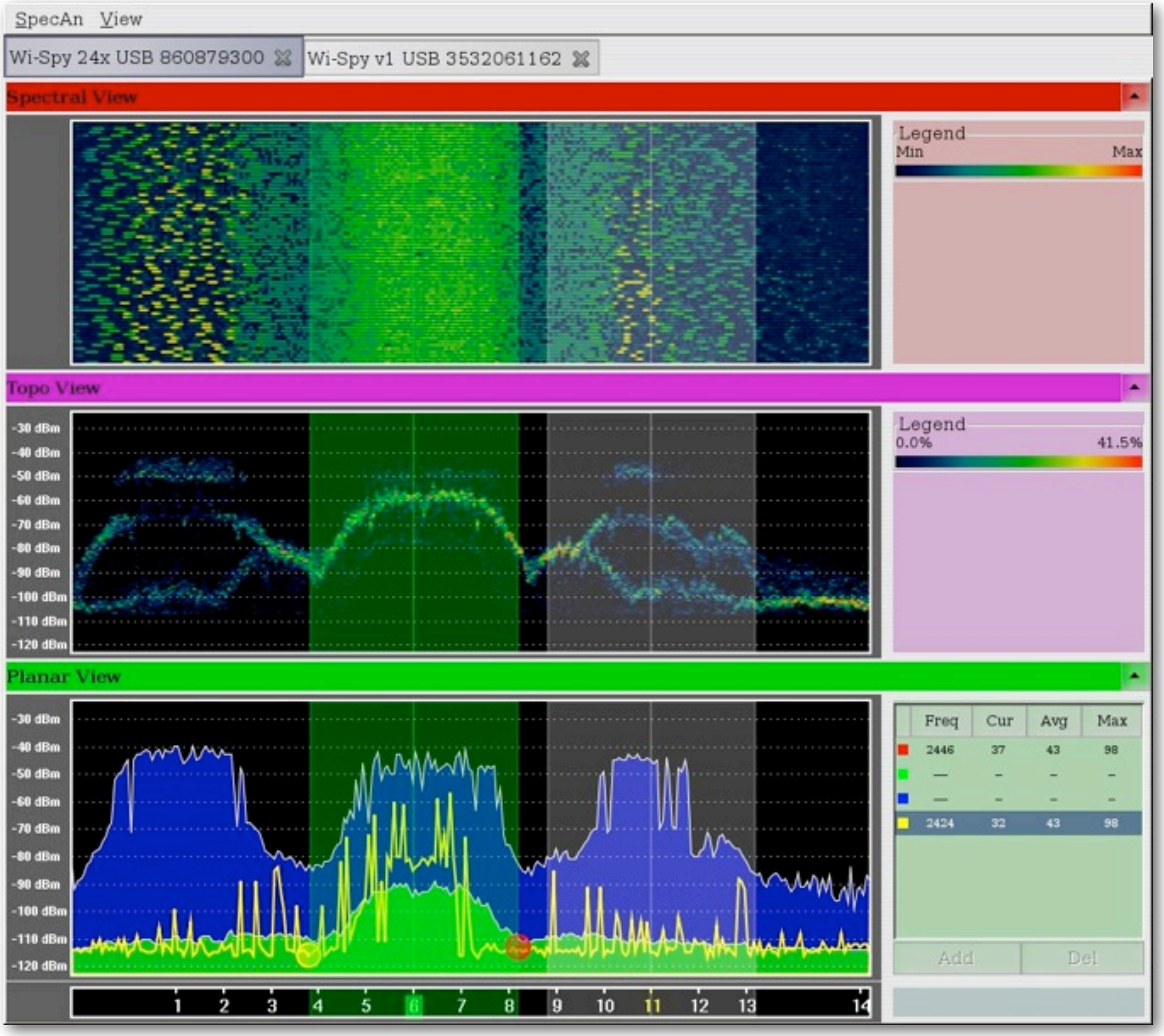
| Markers | Freq | Current | Avg | Max |
|---|---|---|---|---|
| 🟧 | 2416.3 | -95.5 | -94.2 | -35.0 |
| 🟥 | 2460.0 | -110.5 | -105.9 | -38.5 |

X-Axis Labels Frequency

14 AUG 2007, 3:35:46 PM — 3:48:46 PM | 13 Min 0 Sec | USB

The manufacturer supplies very good software called Chanalyzer that works only in Microsoft Windows.

# Spectools

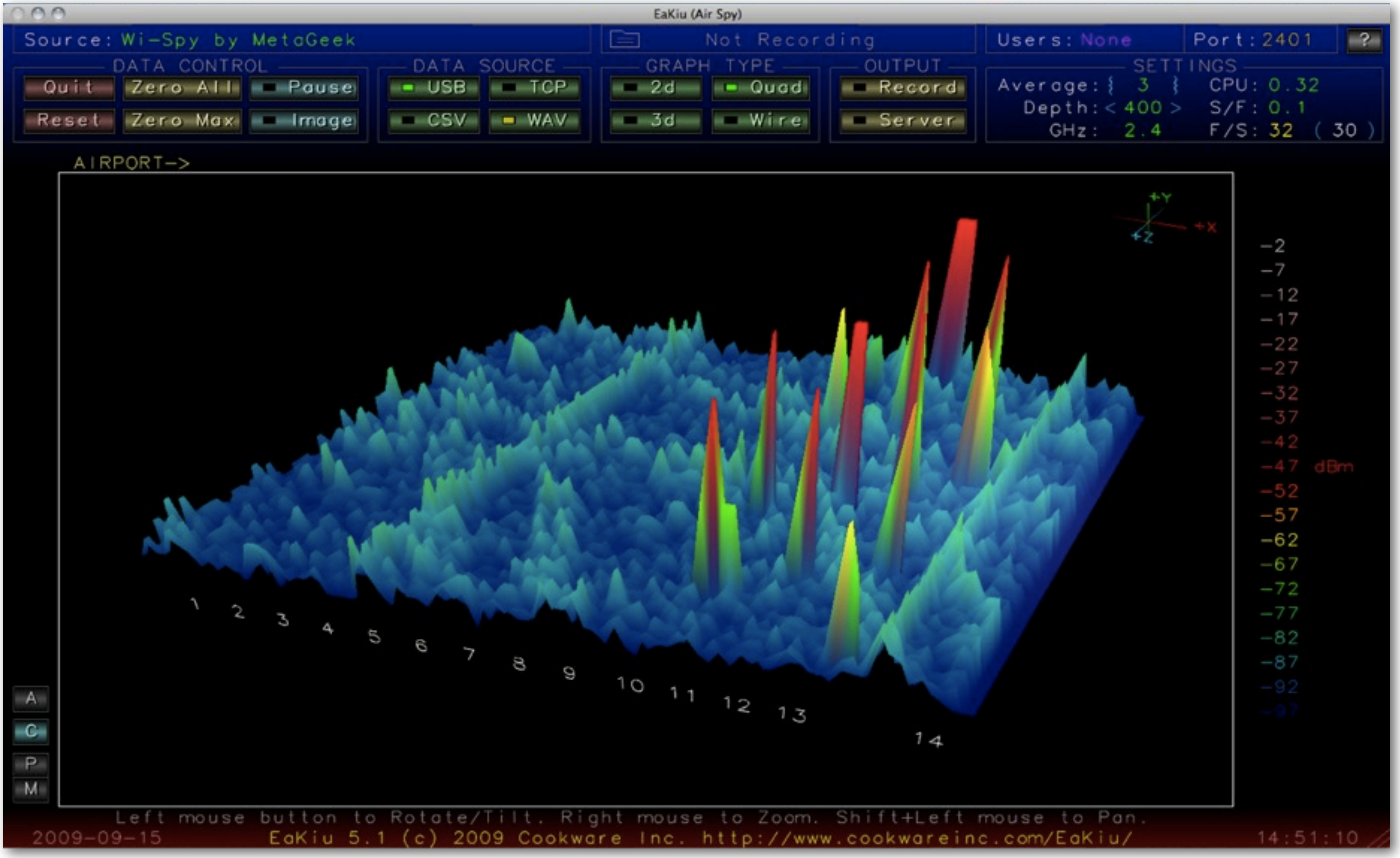


|  | Freq | Cur | Avg | Max |
|---|---|---|---|---|
| 🟥 | 2446 | 37 | 43 | 98 |
| 🟩 | — | - | - | - |
| 🟦 | — | - | - | - |
| 🟨 | 2424 | 32 | 43 | 98 |

The Kismet wireless project provides a package called Spectools that works with Linux, OS X, and Windows.

# EaKiu

*http://www.metageek.net/*



EaKiu (Air Spy)

Source: Wi-Spy by MetaGeek

Not Recording

Users: None

Port: 2401

Average: { 3 }
Depth: < 400 >
GHz: 2.4
CPU: 0.32
S/F: 0.1
F/S: 32 ( 30 )

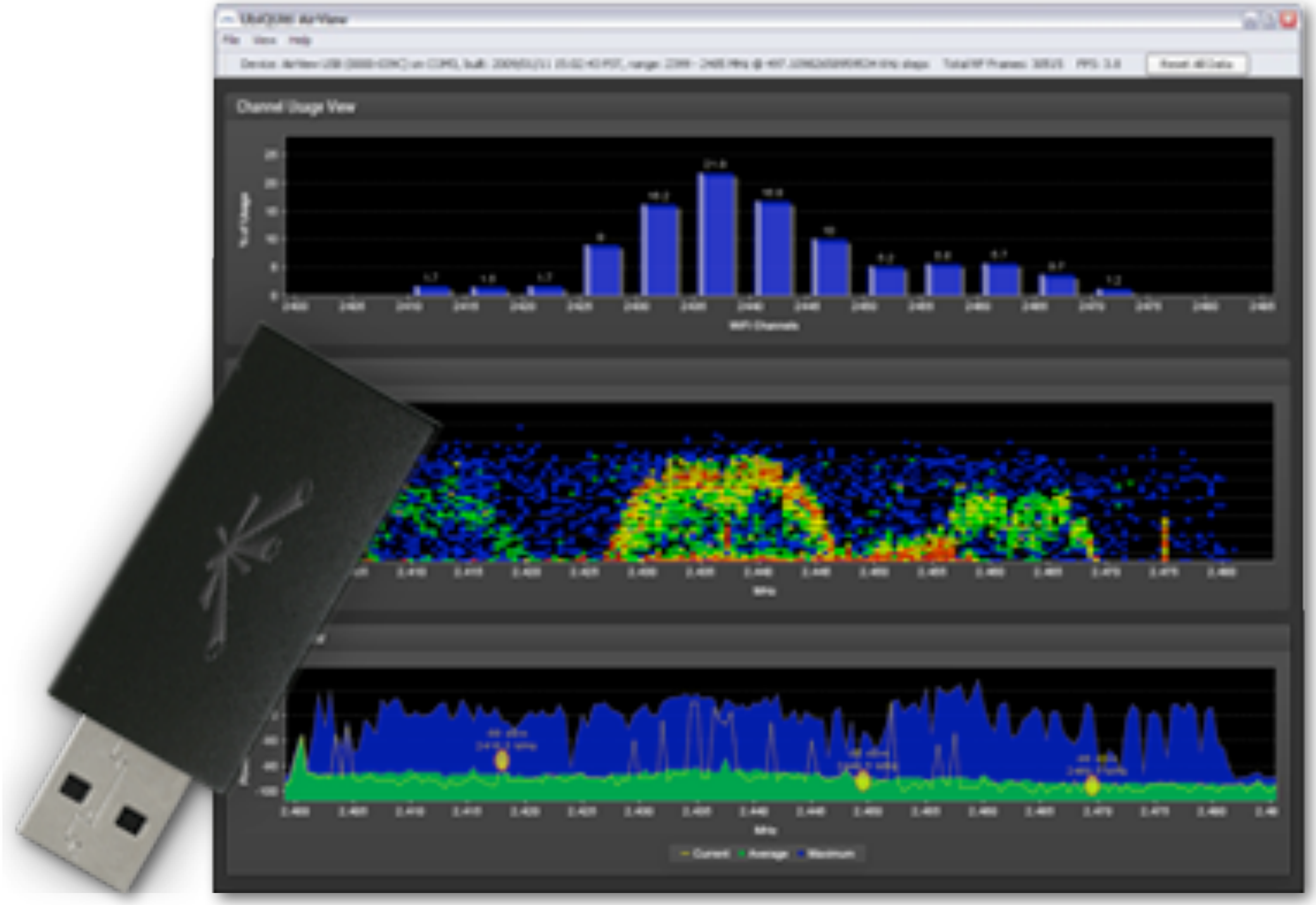
Left mouse button to Rotate/Tilt. Right mouse to Zoom. Shift+Left mouse to Pan.

2009-09-15 EaKiu 5.1 (c) 2009 Cookware Inc. http://www.cookwareinc.com/EaKiu/ 14:51:10

There is a very good package for Mac OS X called EaKiu. In addition to the standard views provided by Chanalyzer and Spectools, EaKiu provides a realtime 3D graph of everything that is happening over time, over the given range of frequencies.

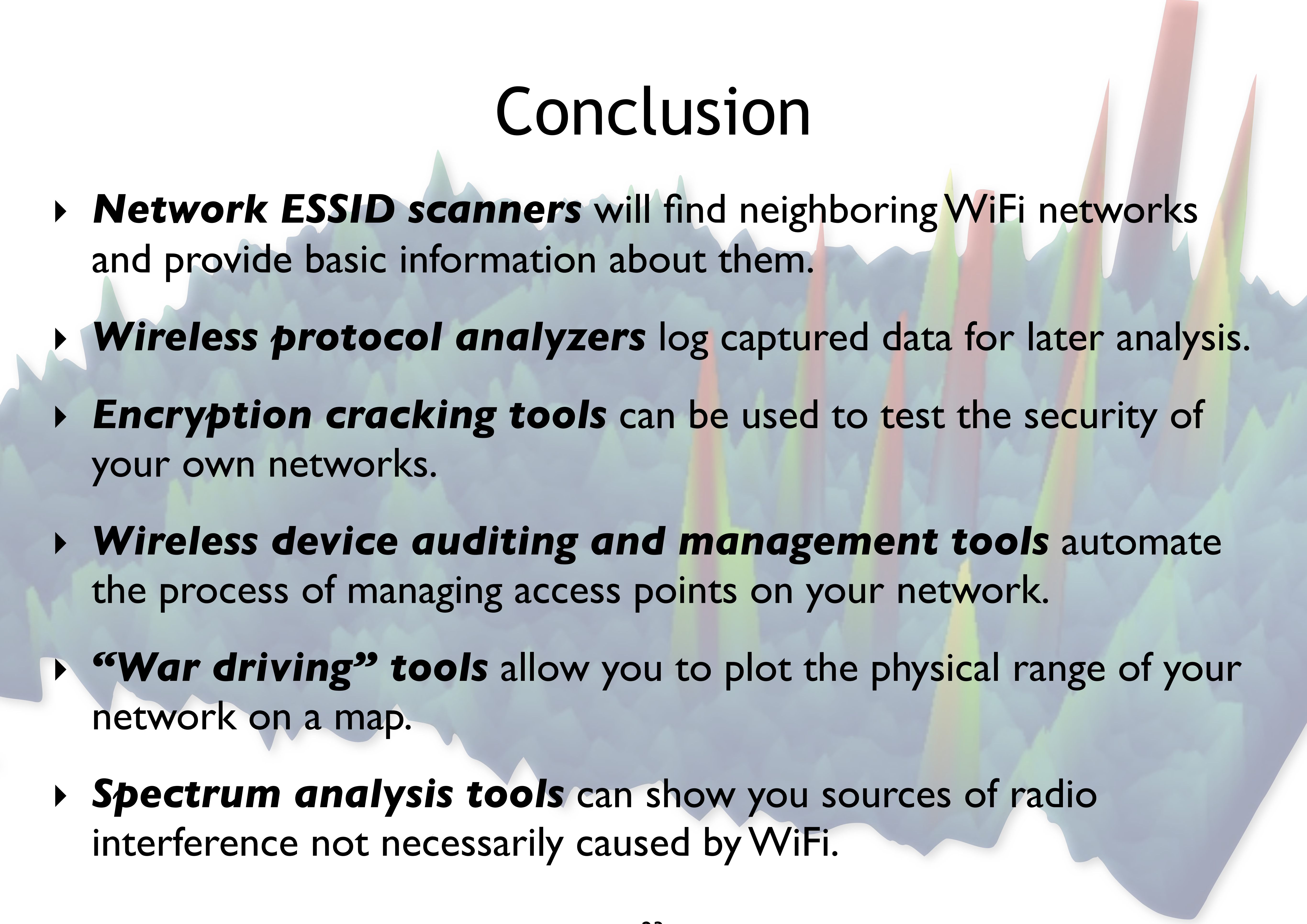
# Ubiquiti AirView

*http://www.ubnt.com/*



Another new USB spectrum analyzer is the AirView by Ubiquiti. It has similar features to the Wi-Spy, and is considerably cheaper. The AirView software is Java-based and runs on Windows, Mac OS X, and Linux. The AirView comes in 2.4 GHz and 900 MHz models.

# Conclusion



- ***Network ESSID scanners*** will find neighboring WiFi networks and provide basic information about them.
- ***Wireless protocol analyzers*** log captured data for later analysis.
- ***Encryption cracking tools*** can be used to test the security of your own networks.
- ***Wireless device auditing and management tools*** automate the process of managing access points on your network.
- ***"War driving" tools*** allow you to plot the physical range of your network on a map.
- ***Spectrum analysis tools*** can show you sources of radio interference not necessarily caused by WiFi.

# Thank you for your attention

For more details about the topics presented in this lecture, please see the book ***Wireless Networking in the Developing World***, available as free download in many languages at:

*http://wndw.net/*

WIRELESS NETWORKING
IN THE DEVELOPING WORLD
SECOND EDITION
A practical guide to planning and building low-cost telecommunications infrastructure
wndw.net

See Chapter 6 of the book for more detailed information about the material covered in this talk.