

Networking

MacTech Boot Camp II

Dallas, 2013-04-17

Zack Williams

Artisan Computer

zdw@artisancomputer.com

@zdw



Who makes the standards?

- ✦ IEEE for OSI layers 1-2 (Ethernet, WiFi, Bluetooth, etc.)
- ✦ IETF, for OSI layers 3-7 (IP, TCP, HTTP, etc.)
 - ✦ RFC's are surprisingly readable
- ✦ Many others

OSI Model

(Open Systems Interconnection)

Layer	Name	Example
1	Physical	1000Base-T
2	Data Link	802.3 Ethernet
3	Network	IP
4	Transport	TCP
5	Session	Sockets
6	Presentation	SSL
7	Application	HTTP

What layer 1 and 2 networking technologies does Apple support?

- ✦ IEEE 802 Ethernet (wired/wireless)
- ✦ Bluetooth
- ✦ Firewire
- ✦ Serial (with adapters), PPP
- ✦ Fibre Channel

Layer 1

Network Cabling

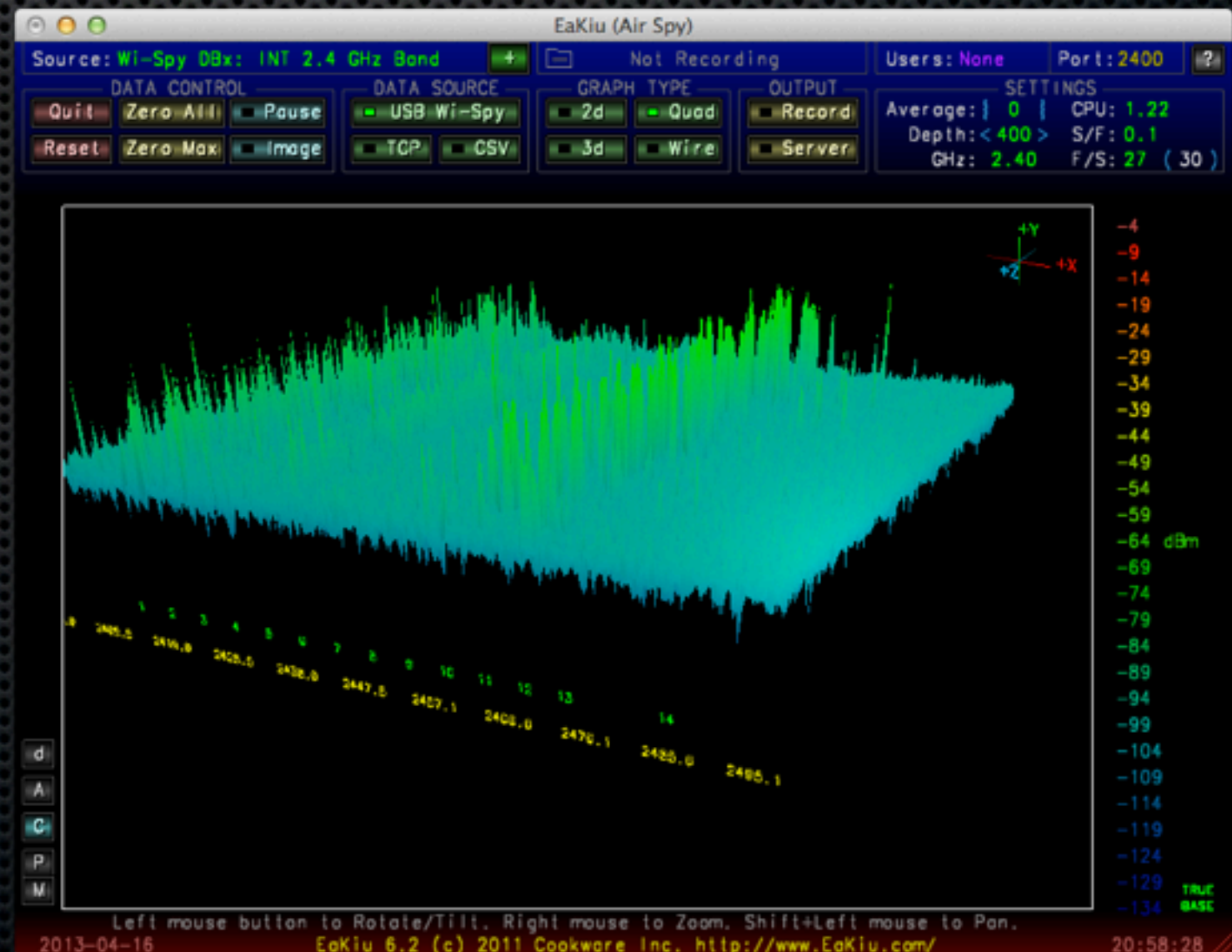
- ✦ The cost of any cable installation is mainly labor
 - ✦ Therefore, install Cat6, OM3/4
- ✦ Best Practices
 - ✦ Optimize for Maintainability

Debugging at Layer 1

- ✦ Basic continuity testing
- ✦ More advanced will identify endpoints, diagnose miswired connections, distance via capacitance
- ✦ Highest end will certify cable for specific uses

WiFi at Layer 1

- ✦ WiFi is shared medium, channels overlap
- ✦ WiSpy and similar can let you peek into the RF spectrum



Layer 2

Ethernet at Layer 2

- ✧ Switching
 - ✧ Unmanaged
 - ✧ Managed
- ✧ Routers
- ✧ Bridges

Debugging at Layer 2

- ✦ `ifconfig`
- ✦ LLDP

LLDP ► Remote Device							
Remote Device Summary							
Local Interface	Chassis ID	Port ID	Port Description	System Name	Capabilities Supported	Capabilities Enabled	System IP
8	D4:85:64:DF:DE:40	13	13	2510-24G #1	bridge	bridge	10.124.110.4

- ✦ WiFi: Kismac, iStumbler

Layer 3

IPv4 and IPv6

- ✦ Different layer 3 implementations, but same at layer 4 and above
- ✦ "Dual Stack" is common today, and will be for years to come
- ✦ IPv6 tunneling services, if you need to access v6 with only a v4 connection

IPv4

- ✦ An “experiment”
- ✦ RIR's are out of Public IPv4 addresses to hand out
- ✦ Probably going to be around for a long, long time

IPv6

- ✦ 128-bit address space, enough addresses for foreseeable future
 - ✦ You'll likely get a /64, so
18,446,744,073,709,551,616 addresses
- ✦ ISP's probably aren't ready
 - ✦ Chicken and the Egg
 - ✦ Much more important for mobile carriers, Asia, etc.
- ✦ Security Considerations

ICMP Tools

IPv4	IPv6
arp	ndp
ping	ping6
tracert	tracert6

More Tools

- ✧ GUI
 - ✧ Network Utility
 - ✧ Network Preference Pane
- ✧ CLI
 - ✧ **ipconfig**
 - ✧ **networksetup**

Subnetting

- ✦ Use Base 2 subnets so you can split as needed
- ✦ Tools like `ipcalc` can help do the math

```
$ ipcalc 10.0.10.1/26
Address:    10.0.10.1          00001010.00000000.00001010.00 000001
Netmask:    255.255.255.192 = 26 11111111.11111111.11111111.11 000000
Wildcard:   0.0.0.63          00000000.00000000.00000000.00 111111
=>
Network:    10.0.10.0/26      00001010.00000000.00001010.00 000000
HostMin:    10.0.10.1         00001010.00000000.00001010.00 000001
HostMax:    10.0.10.62        00001010.00000000.00001010.00 111110
Broadcast:  10.0.10.63        00001010.00000000.00001010.00 111111
Hosts/Net:  62                Class A, Private Internet
```


NAT and Port Forwarding

- ✦ NAT = Network Address Translation
 - ✦ RFC1918 block behind a single Public IP
 - ✦ Translates the IP header, keeps track of state
- ✦ Port forwarding
 - ✦ Allows ports inside network to be exposed to outside

Port Forwarding Example 1

- ✦ Airport Base Station

The screenshot shows the 'Firewall' tab in the Airport Base Station configuration utility. The 'Firewall Entry Type' is set to 'IPv4 Port Mapping'. The 'Router Mode' is 'NAT'. The 'Description' is 'Mac OS X Server VPN - L2TP'. The 'Public UDP Ports' are set to '1701'. The 'Public TCP Ports' are empty. The 'Private IP Address' is '10.0.1.201'. The 'Private UDP Ports' are set to '1701'. The 'Private TCP Ports' are empty. At the bottom, there is a 'Port Settings' table with one entry: 'Mac OS X Server VPN - L2TP' with type 'IPv4'. The 'Cancel' and 'Save' buttons are at the bottom right.

Port Settings:	Description	Type
	Mac OS X Server VPN - L2TP	IPv4

Port Forwarding Example 2

- OpenBSD's pf

```
pass in on $ext_if proto tcp \
from any to $ext_if port 22 \
rdr-to $ssh_server port 22
```


Layer 4 and up

How is Apple different?

- ✦ Uses MDNS (Bonjour) for service discovery
- ✦ DNS lookup isn't necessarily in-order
- ✦ Uses NetBoot instead of PXE for network booting
- ✦ Tricks to speed up DHCP lookups

Debugging above Level 3

- ✦ `telnet` and `openssl s_client`
- ✦ `curl`
- ✦ iStumbler
- ✦ `nmap`

