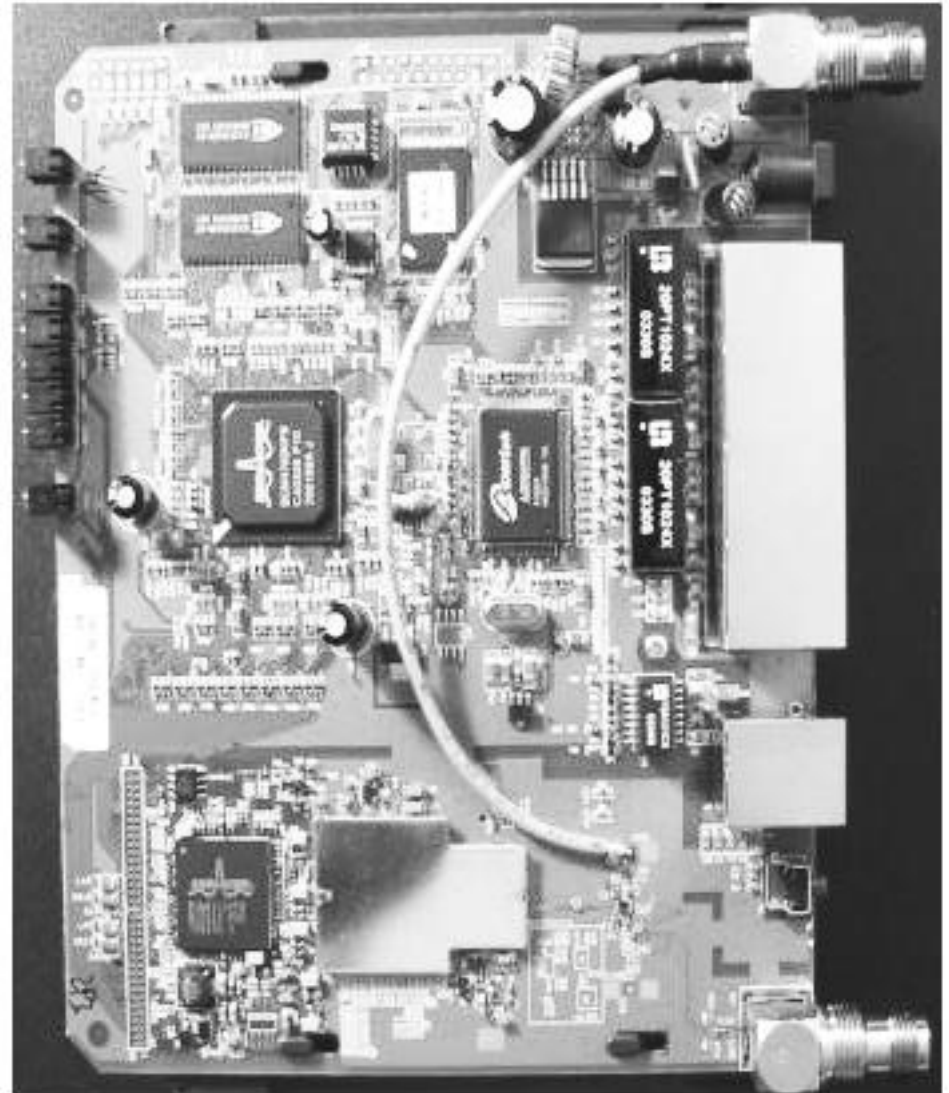


Wifi Hardware



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Agenda

Scope

Criteria for choosing hardware

Types of Wifi hardware

Anatomy of an AP/Router

Features

Some products

Scope

The term **Wifi** was used for 802.11b only in the beginning, but today applies to the **802.11 a,b and g** substandards.

Certifying and owning the Trademark: The Wifi Alliance, <http://www.wi-fi.org/>

standard	frequency	gross data rate	modulation
802.11a	5.2 GHz	54 Mbps	OFDM
802.11b	2.4 GHz	11 Mbps	DSSS
802.11g	2.4 GHz	54 Mbps	OFDM, PBCC

Criteria

How to choose the right standard – what are a, b and g good for?

802.11b oldest, robust, good for indoors and outdoors, cheapest

802.11g same frequency as 802.11b, higher bandwidth, BUT, because of OFDM, a lot less robust for outdoor longhaul links! For this, it is not a good choice!

802.11a because of higher frequency, it does not go through obstacles as well. But, it makes for excellent high bandwidth longhaul links, when LOS is given.
Indoors, it suffers from LOS problems.

Criteria

How to choose standards and products

- ▶ As always: your requirements – what do you wanna do?
- ▶ Budget & availability
 - ▶ especially for wireless gear: consider price development!
don t buy for 500 today, what next year might cost 100.
- ▶ Legal considerations:
what is legally & *practically* :) possible where you are?
- ▶ Where applicable: support/drivers for your Operating system?
- ▶ Environmental specs: temperature! humidity!
- ▶ Power consumption

Types

- ▶ Access Point
(includes Access Points, Residential Gateways, DSL & Cable Products)
- ▶ Cellular Convergence
(products that enable both Wi-Fi and cellular communications)
- ▶ Compact Flash
- ▶ Embedded Client
(includes Notebooks, etc.)
- ▶ Ethernet Client Device
(includes Wireless-to-Ethernet Station Adapters & Converters)
- ▶ External Card
(includes PC Cards, PCMCIA Cards, CardBus & SD Cards)
- ▶ Internal Card
(includes MiniPCI Cards & PCI Cards)
- ▶ PDAs
- ▶ USB Client Device
(includes Dongles & Adapters)
- ▶ Wireless Printers and Print Servers

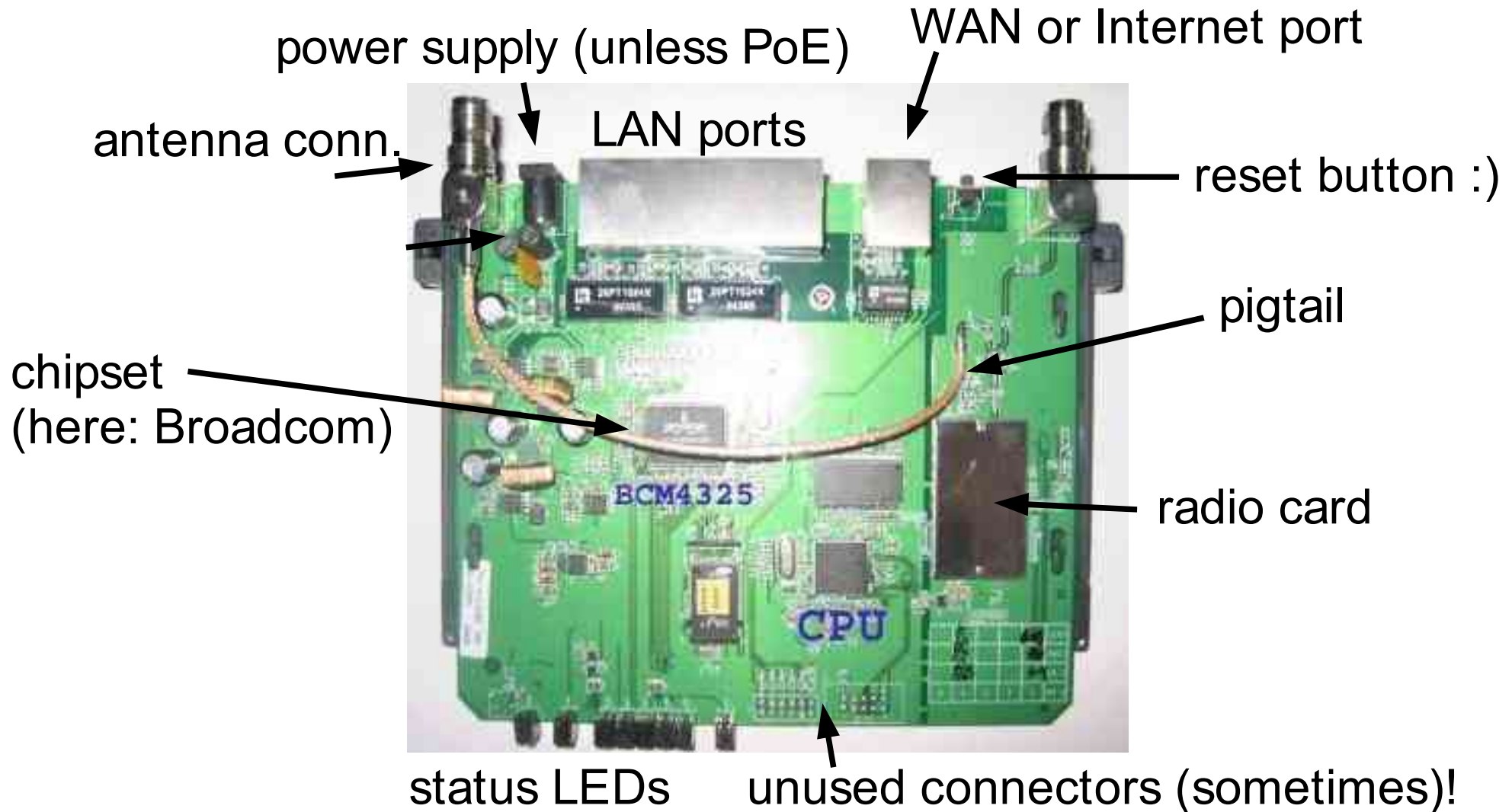
Types

This was the list of types as used by the certifier -
however,
the line between types of hardware is not a strict one.

Especially when you build and modify yourself, it makes sense to think of it as
**radio + chipset + surrounding hardware + software
+ all the externals (antennas, power supply, ...)**

Types of usage change over time and may be hard to classify, e.g.
point to point links, bridges, repeaters, mesh nodes (where the line between
client and *AP/server* disappears)

Anatomy of an AP/router



Features

Features worth keeping in mind:

- ▶ Bandwidth (but never trust the glossy paper!)
- ▶ Reach/Coverage
 - ... but never trust the glossy paper! A single device **NEVER** has a reach!!!
 - Maximum distance info is worthless! Hard facts like output power and receive sensitivity* say a lot more.
- ▶ Chipset
- ▶ Security features
- ▶ Power over ethernet (PoE, IEEE 802.3af) where applicable
- ▶ Antenna (inbuilt, ext. connectors?)

Features: output and sensitivity

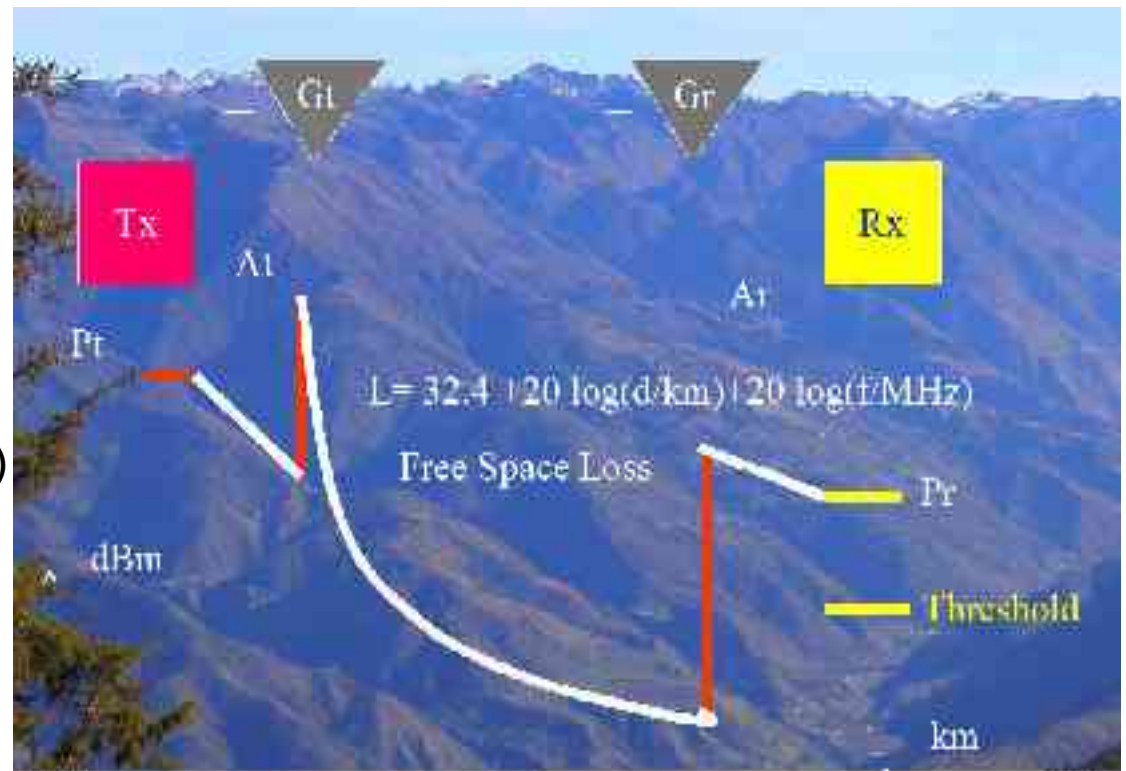
Examples for output power and receive sensitivity info

Receive Sensitivity

- 94dBm at 1 Mbps;
- 88dBm at 2 Mbps;
- 87 dBm at 5.5 Mbps;
- 84dBm at 11 Mbps

Output Power (at the N connector)

- +17.5dBm (max) to
- +11.5dBm (min)



Some Products

The following examples of wireless hardware focus mostly on infrastructure related hardware, i.e. access points, gateways, bridges, point-to-point links rather than pure client cards.

These examples are of course just a personal pick of the author - based on an overview of many international projects.

There are many many more vendors – to name a few we have omitted here: Cisco, 3COM, Gemtek, Tranzeo, Intel, Alvarion/Breezecom, ...

Pricing info in this presentation is meant as a very rough first orientation – prices change fast and are extremely dependent on quantity.

Local availability, pricing and skills easily can be the most important buying points.

(*Antennas* are subject of a separate presentation later in this course, and not being covered here).

Some Products: PC client cards

Many many vendors.

Older cards for 802.11b, g/b – newer cards are typically a/b/g and based on Atheros chipset.

Sometimes with antenna connectors.

Radio quality (output, sensitivity) varies a lot!

Vendors worth looking at:

Avaya (ex Orinoco)(old b cards!)

Senao (200 mW cards, ext. ant.)

Linksys

D-Link



Some Products: Linksys

- ① Home user equipment that can do many things more, as proven in many projects around the world. Hard to beat in price/performance. Some of their gear runs on GPLed Linux firmware, e.g. the Linksys WRT54G (b+g standards), for which a growing number of firmware hacks exist, including mesh implementations. Comparable vendors in the low price range: e.g. D-Link, Netgear, ...

Good entry points for WRT54G info:

http://www.talug.org/events/20050115/Wireless_Linux/WRT54G_firmware.html

<http://www.seattlewireless.net/index.cgi/LinksysWrt54g>

\$ APs from circa \$50, client cards from \$40, prices falling

www <http://linksys.com>
and lots of independent sites



Some Products: Mikrotik

- ① From Latvia, this company makes 2.4/5 Ghz routers, boards and WISP oriented software.
Very interesting multi-radio (a/b/g) configurations.

\$ from circa \$500 (check list!) for single AP, \$1000 for a link

www <http://www.mikrotik.com>

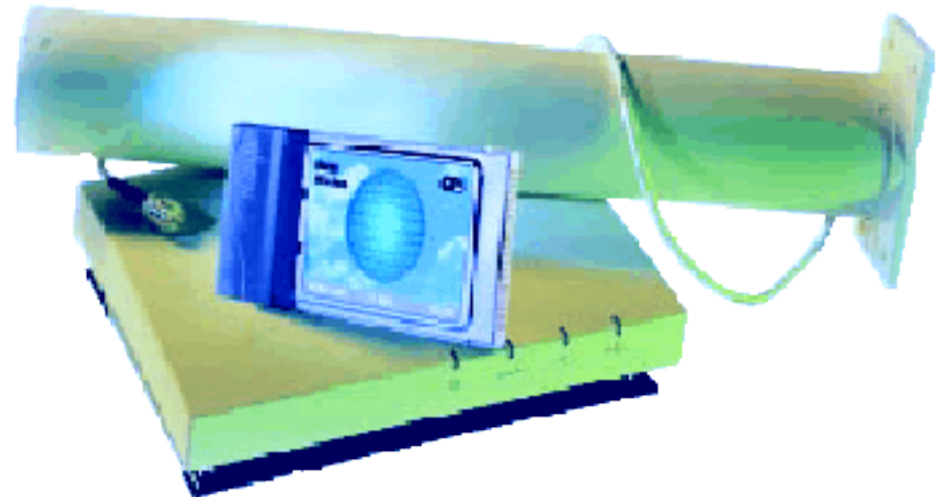


Some Products: Orinoco/Avaya

① Lucent cards, APs and outdoor routers were among the first widely deployed 802.11b systems and also inside Apple's wireless APs. Name changed to Proxim and then Avaya. Lucent or Avaya Silver and Gold cards (802.11b) are an excellent pick, stable and of high radio quality.

\$ APs from circa \$300, client cards from \$50

www <http://www.avaya.com>



Some Products: Smartbridges

- ① Very good series of point to (multi)point links (airhaul), APs (airpoint), clients. Good global distribution, track record of rural deployments, incl. Mt. Everest. Rated -40 ... +65 celsius!

\$
www AP from \$200, Links from < \$400
<http://www.smartbridges.com>



Some Products: Motorola Canopy

- ① Products in (900 MHz), 2.4 GHz and 5 GHz bands. Focus on WISP, carriers, enterprise. Point to point and multipoint links. Proprietary (non-802.11) modulation, very robust.
- \$ From circa \$400-500 per end, \$150 for reflector

www <http://www.motorola.com/canopy/>

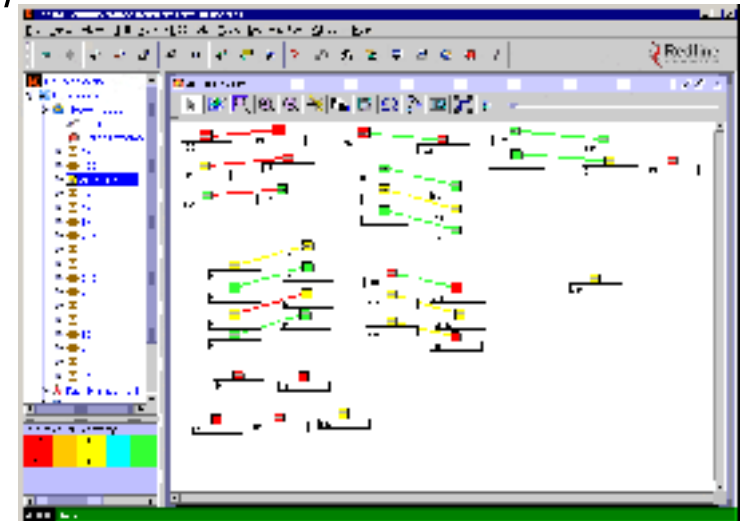


Some Products: Redline

① Redline Communications systems for both point-to-point and point-to-multipoint deployments.
Backhaul, public access, and private network operator solutions are available for the licensed 3.5 GHz band, and the unlicensed 5.4 GHz and 5.8 GHz bands.

\$ From \$3500-7000 per radio, plus software licenses

www <http://www.redlinecommunications.com/>



Some Products: 4G Access cube

① The 4G access cube is a little 2-4 radio linux mesh box.

- * dimensions: small (7x5x7cm) cube
- * waterproof outdoor casing
- * no moving parts
- * low power consumption (ca. 4W)
- * power over ethernet (802.3af standard)
- * up to 4 WLAN (802.11a/b/g) interfaces
- * 400MHz MIPS processor AMD Au1500 aka Alchemy
- * 32MB flash
- * 64MB RAM
- * USB host, USB device

\$ from EUR 200 (2 radios)

www <http://meshcube.org>
<http://4g-systems.biz>

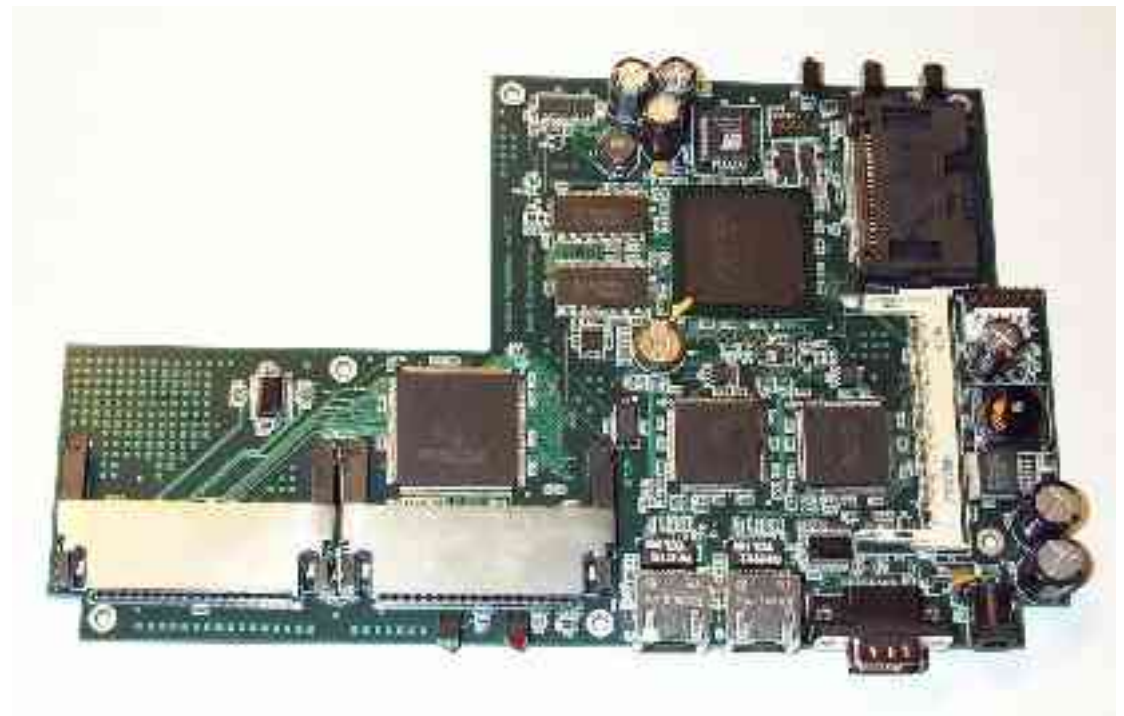


Some Products: Soekris boards

① The net4521 board with 2 PC card slots and other Soekris models are popular starting points for building your own wireless hardware - see e.g. the Metrix products.
Great for Linux or BSD.

\$ From circa \$150

www <http://www.soekris.com>



Some Products: Metrix

① I will not talk about Metrix when Rob is so close ... :)

I assume he will make his material available here ...

\$

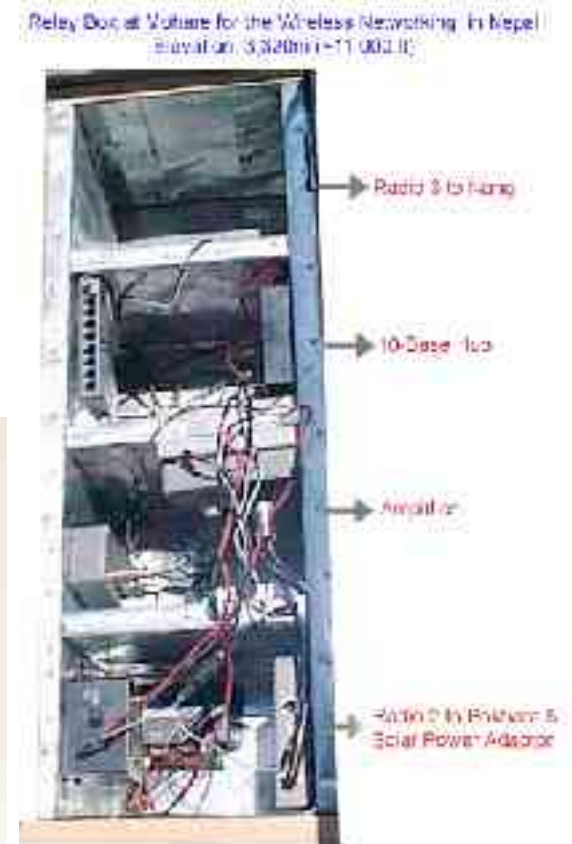
www <http://metrix.net>

Some Products: Do it yourself!

- ① Find a piece of old hardware (e.g. a laptop) and one or two radio cards, start with HostAP drivers or the Pebble distro. Parts may also be new. :) Self built wireless components can be of high quality.

\$ From \$0

www <http://www.nycwireless.net/pebble/>
<http://hostap.epitest.fi/>



Thanks!

Questions and answers? Comments? Additions?

....

Hands on work in the LAB:

Installing a USB client on your group's computer (joint activity)

Configuring an AP (joint activity)

Flashing an AP (joint activity)

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<http://thewirelessroadshow.org>