wireless networks

general overview and practical introduction to WLANs

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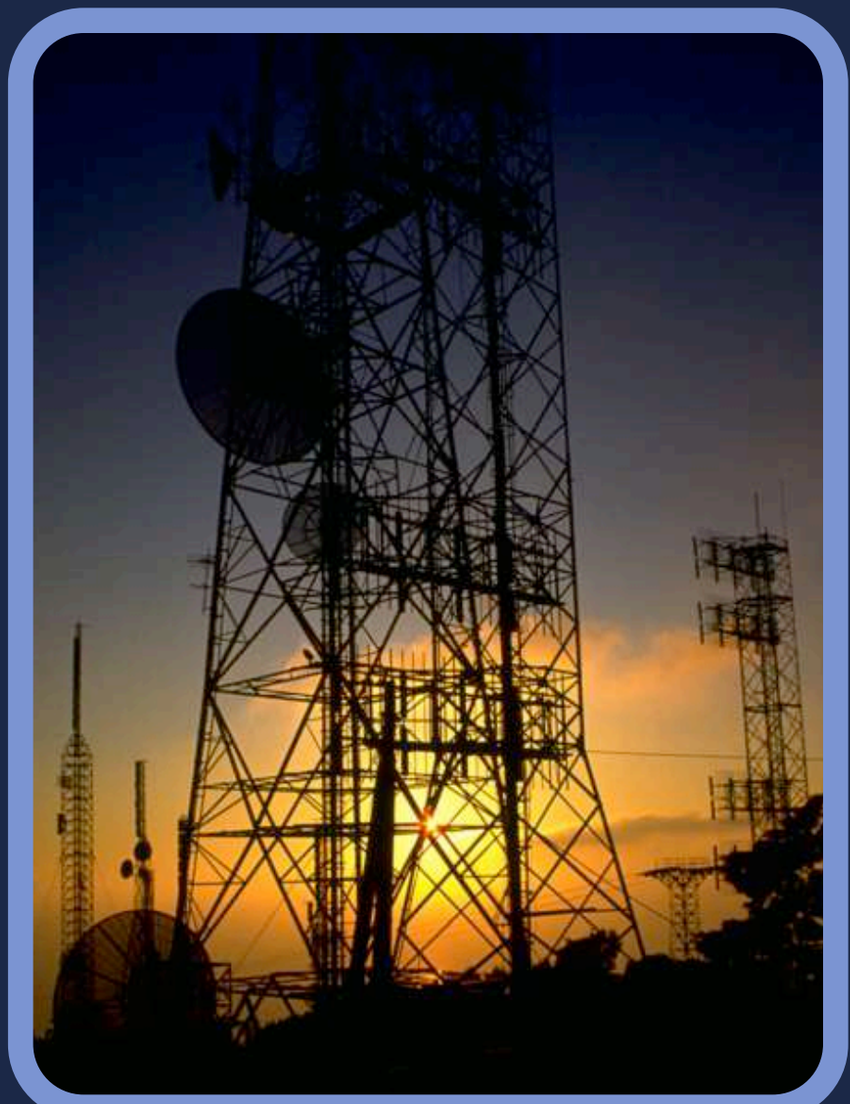
Science & Technology Collaborium
http://www.collaborium.org

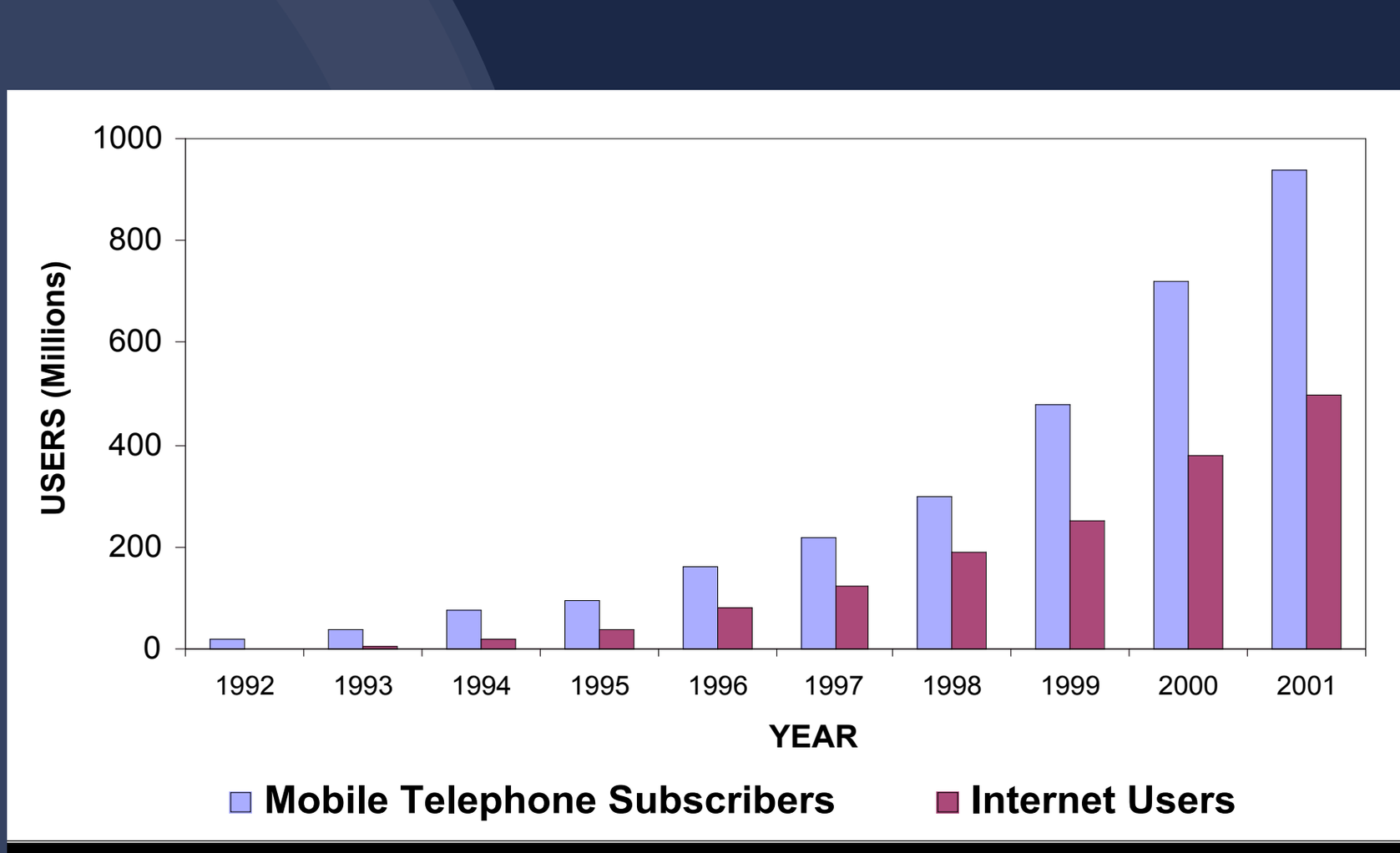
fixed or mobile ?

- Mobile Wireless Access:
  - mobile phones (ETACS, GSM)
  - mobile data (1G, 2G, 3G, ...)
- Fixed Wireless Access:
  - last mile problem
  - leapfrog poor or expensive telecom infrastructures
  - voice/data integration

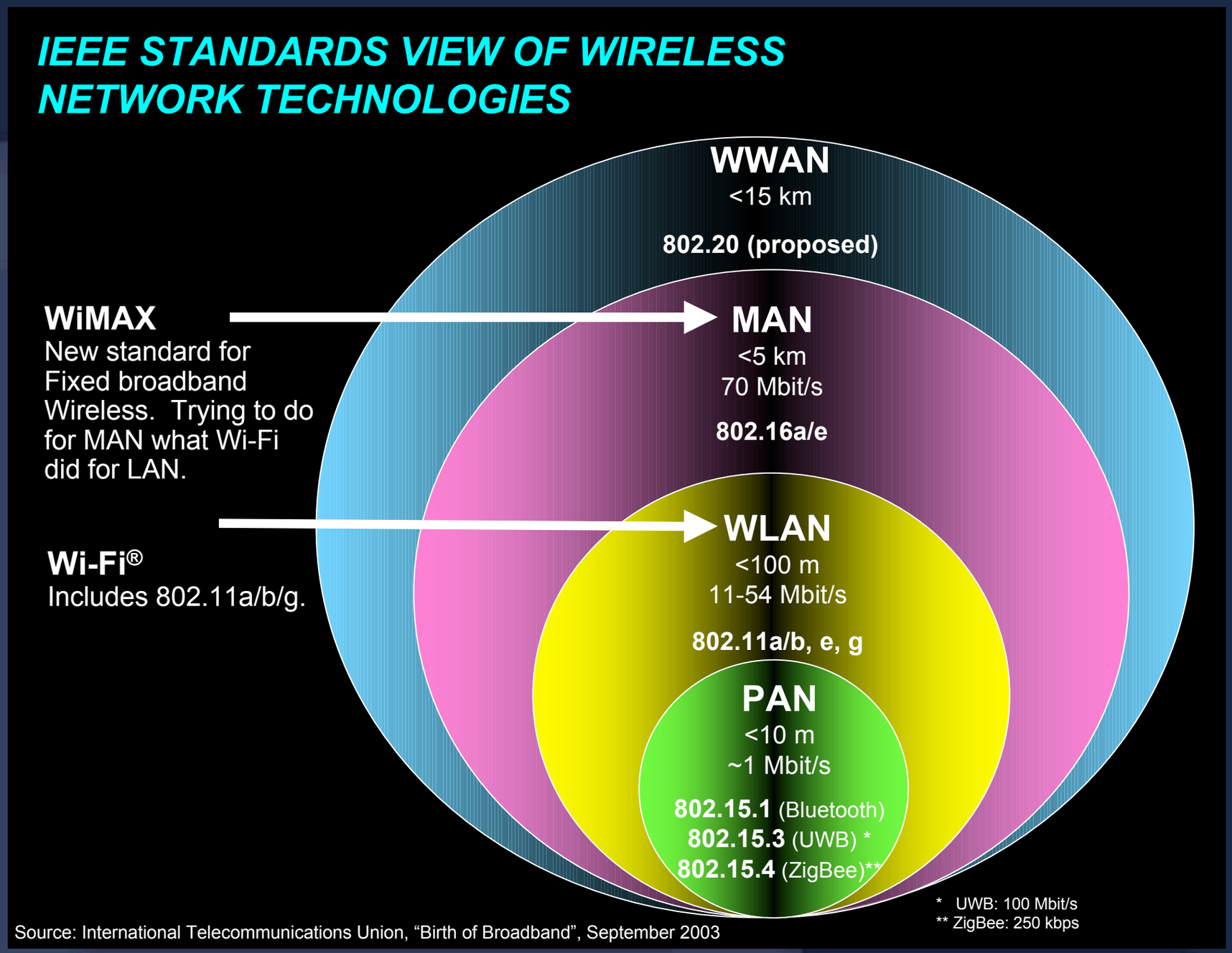


fixed or mobile ?

- Here and now, we are interested in technologies for fixed wireless access:
  - it's cheap
  - *PnP* easy
  - PTT-free
- In future: ?



Source: ITU World Telecommunication Indicators Database.



fixed wireless technologies

WLANs & WMANs

- wireless networks were designed (in 90es) for the LAN (indoor) market, but in developing countries there are even much more useful outdoor, as MANs (or even WANs), for distances up to 10 Km (or 50 Km, WiMAX)

cost of wireless

- the enormous success of this technology has led to a dramatic price reduction for the radio devices:
  - >1000 US$ in 1992
  - <100 US$ in 2004

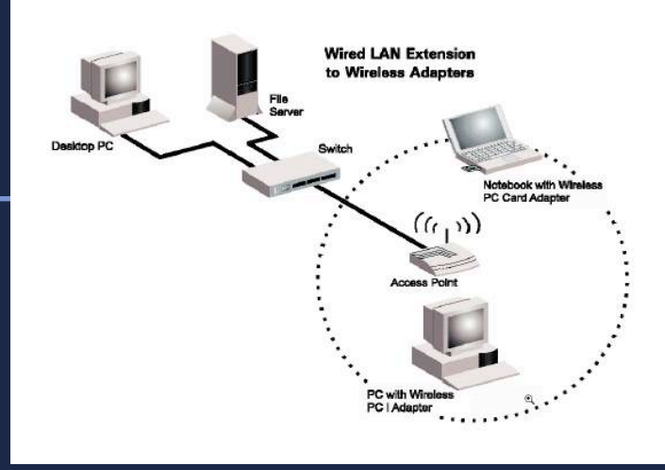
speed of wireless

- the available data transfer rate on the same radio channel (bandwidth of 20 MHz) has increased from 1 Mbps to 54 Mbps (even 74 Mbps for some applications)

wireless standards

- wireless networking has grown incredibly fast thanks to a wide adoption of common standards:
  - 802.11, 802.11a/b/g protocols
  - WiFi ™ certification
  - brand/model intercompatibility

wireless LANs

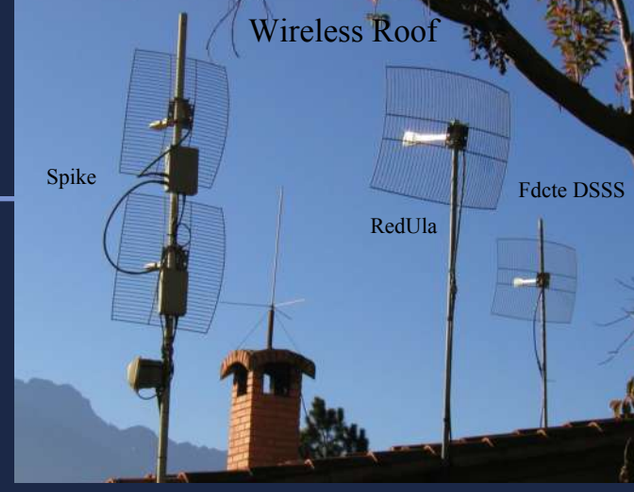


- indoor/outdoor network distribution among many clients
- typical distance: 10 - 100 m
- Point-to-MultiPoint structure:

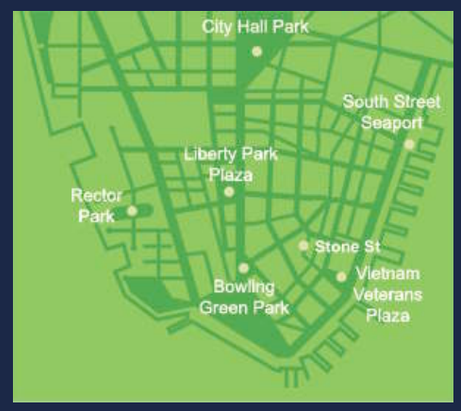
  - master station (access point, AP)

  - client station (PCI card, PC card, USB device, wireless bridge)

wireless MANs



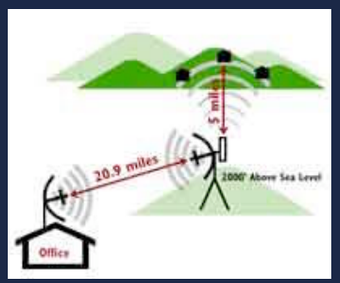
- used by ISPs (Point-to-MultiPoint)
  - typical distances: 1-5 Km



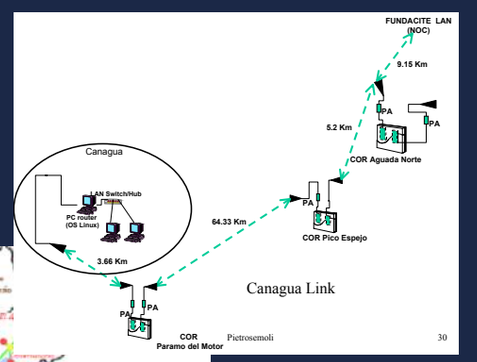
  - a large number of clients
  - coexistence problems (max. 3 non-overlapping channels)
  - line-of-sight, security issues, remote management

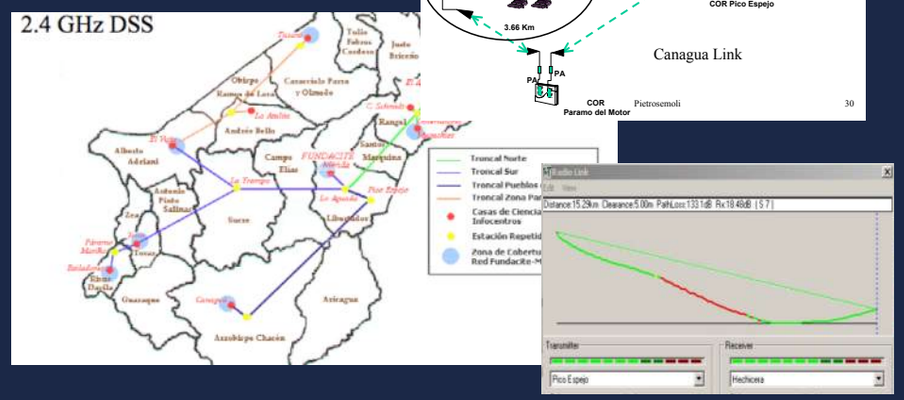
wireless MANs

- for private institutions/companies:
  - Point-to-Multipoint



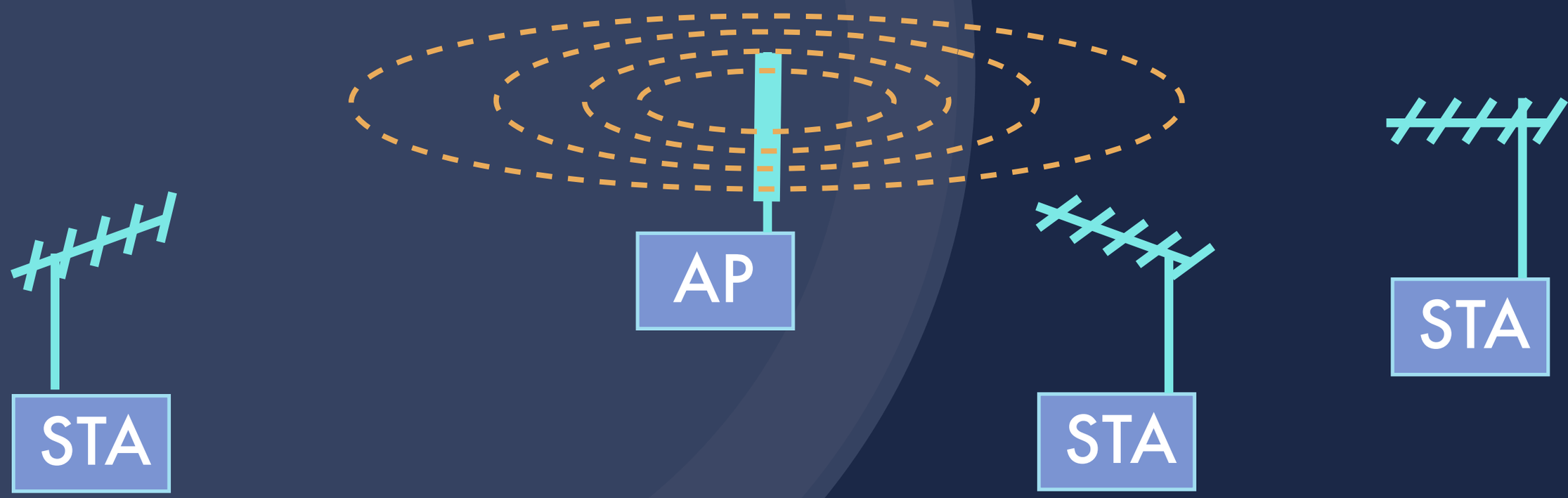
  - Point-to-Point (larger distance, less coexistence problems)
  - line-of-sight, security issues
  - radiolink planning and design





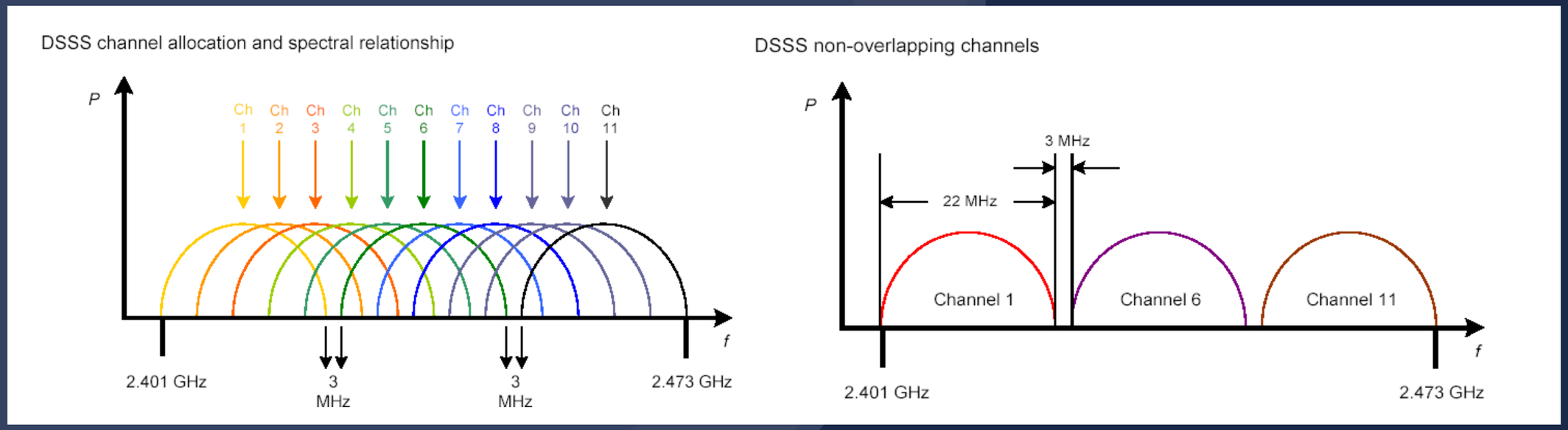
P2MP MANs

- Point-to-Multipoint
- Star topology, one AP, many stations
  - Omnidirectional antenna for AP
  - Directive antennas for stations



P2MP MANs (cont.)

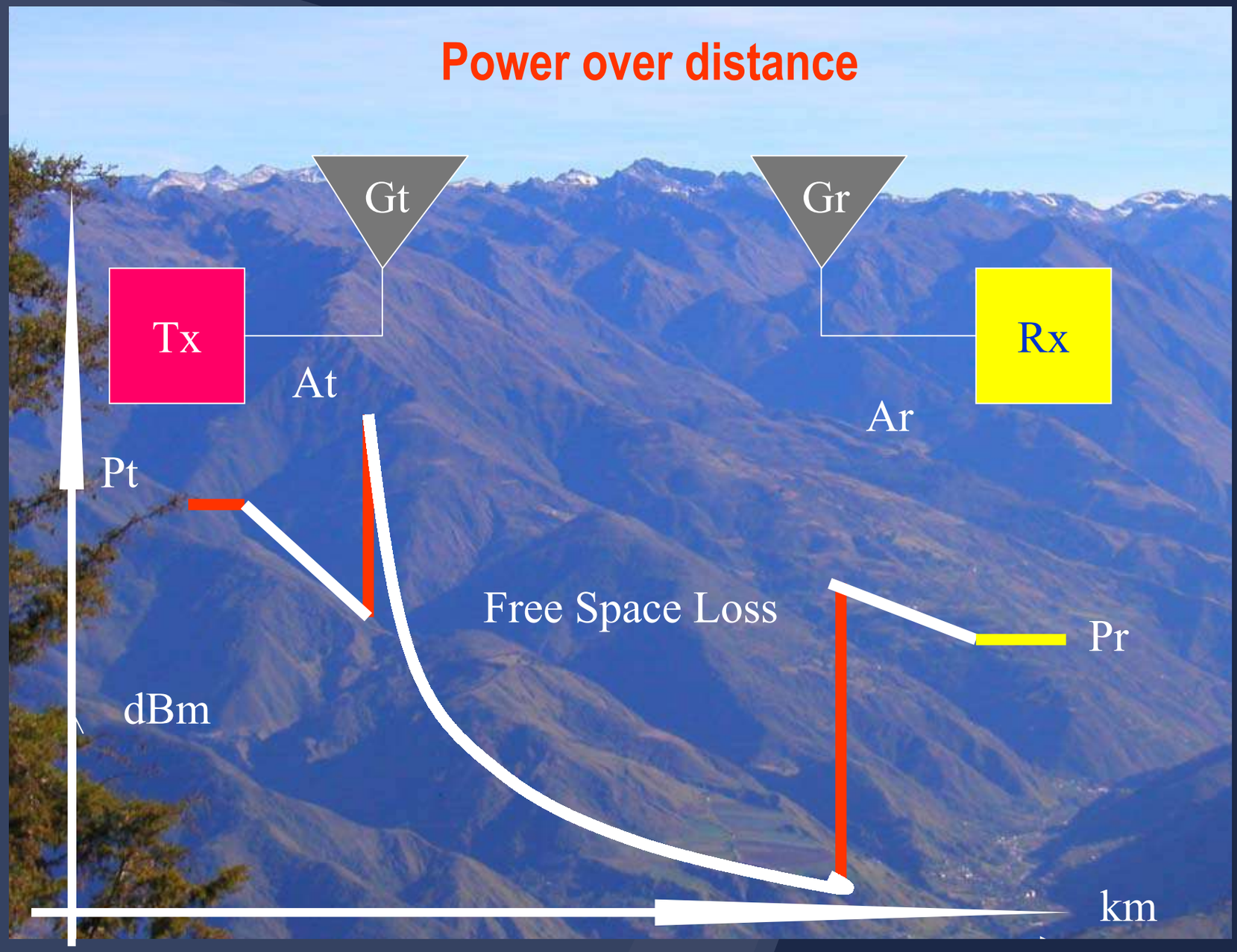
- coexistence problem:
  - APs use omni antennas, so they may interfere with other APs or stations
  - different channels can be used, but only 3 channels are non-overlapping
  - coordination is required among APs



P2P MANs (WANs)

- wireless long distance links (<10 Km)
  - provide connectivity to remote sites
  - broadband (1, 2, 5, 11, 54 Mbps)
  - no monthly/traffic fee, no recurrent costs (unlike leased lines from PPT)
  - require skills for planning and installation (power budget)

Power Budget

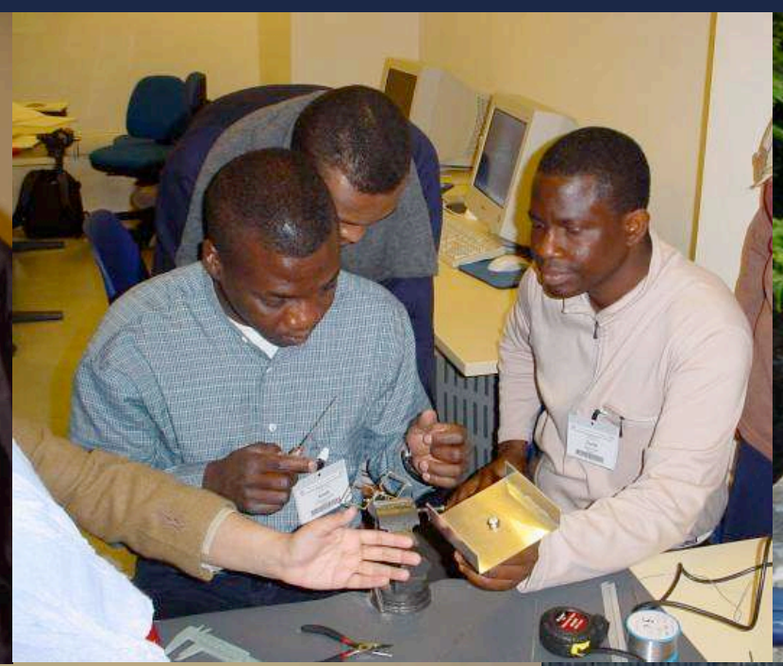
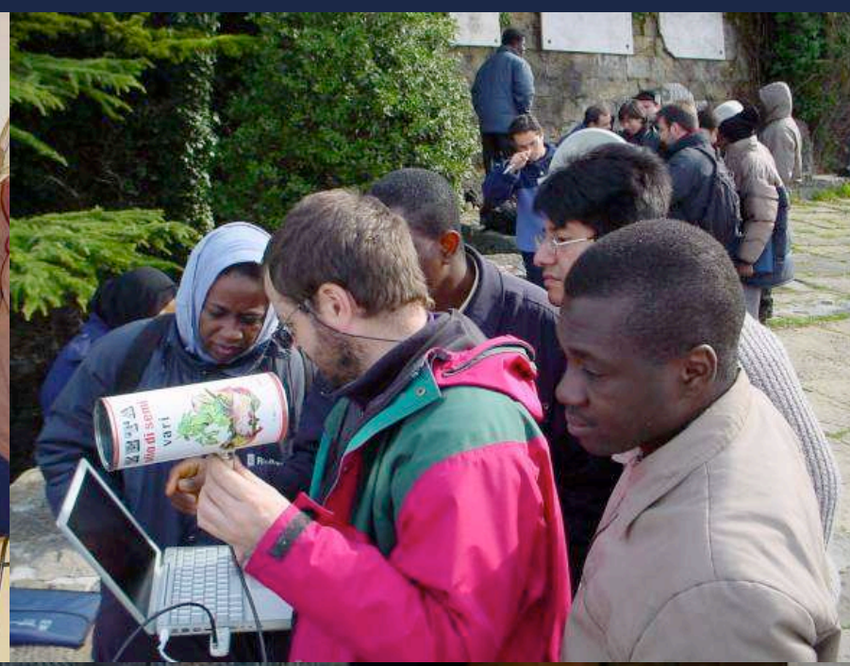


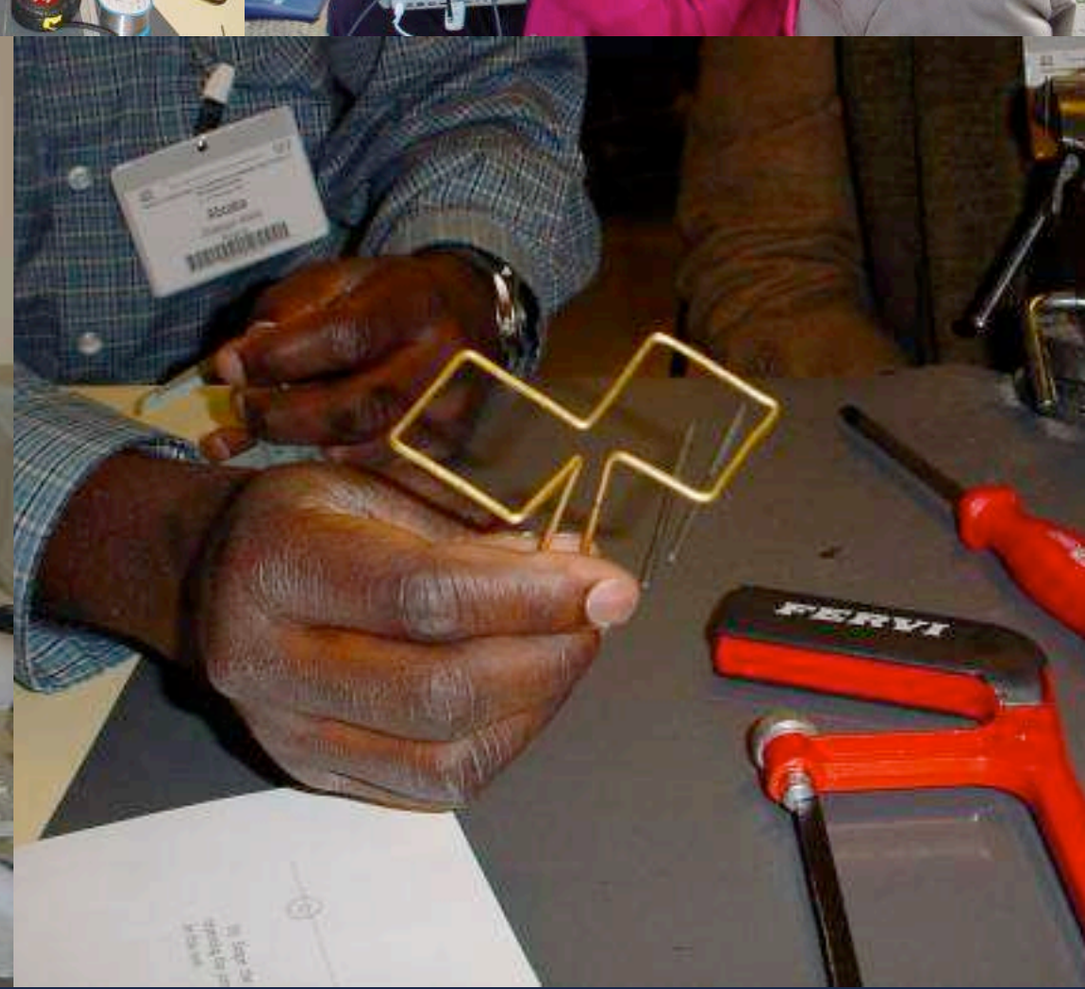
Low-cost links?

- It is possible to build inexpensive long–distance radiolinks, with old PCs, Linux OS, off–the–shelf WiFi devices (sold for indoor), home–made antennas:
  - 200-500 US$ per links
  - skill is required, but you can find plenty of information and tutorials, just surfing the WWW

Antenna making





Buying antennas?

Buying antennas?

2.4 GHz Parabolic Grid Wireless LAN Directional Antennas

	Model	Description	Gain	Sale Price	Buy Online
	HG2414D	14 dBi Backfire WLAN Directional Antenna, 25° beam	14 dBi	As low as **$31.45**	More Info..
	HG2415G	NEW! 15 dBi Mini-Reflector Grid WLAN Directional Antenna	15 dBi	**$34.95**	More Info..
	HG2415G-5PK	NEW! **5-Pack** of 15 dBi Mini-Reflector Grid WLAN Directional Antennas		As low as **$164.95**	More Info..
	HG2419G	NEW! 19 dBi Reflector Grid WLAN Directional Antenna	19 dBi	**$40.95**	More Info..
	HG2419G-5PK	NEW! **5-Pack** of 19 dBi Reflector Grid WLAN Directional Antennas		As low as **$174.95**	More Info..
	HG2424G	24 dBi Heavy Duty Grid WLAN Directional Antenna	24 dBi	**$52.95**	More Info..
	HG2424G-5PK	**5-Pack** of 24 dBi Grid WLAN Directional Antennas		As low as **$224.95**	More Info..
	HG2430D	NEW! 30 dBi Reflector Grid WLAN Directional Antenna	30 dBi	As low as **$269.95**	More Info..

2.4 GHz Radome-Enclosed Yagi Wireless LAN Directional Antennas

	Model	Description	Gain	Sale Price	Buy Online
	HG2409Y	NEW! 9 dBi Radome Yagi WLAN Directional Antenna	9 dBi	As low as **$35.95**	More Info..
	HG2412Y	12 dBi Radome Yagi WLAN Directional Antenna	12 dBi	As low as **$44.95**	More Info..
	HG2415Y	14 dBi Radome Yagi WLAN Directional Antenna	14 dBi	As low as **$52.95**	More Info..

How to learn more?

RadioCommunications Unit of the ICTP ARPL

- http://wireless.ictp.trieste.it
- Yearly ICTP-ARPL School on Wireless Networking (February)
- Radio Handbook:
  - on Antenna Building
- Join us in the Lab! ;-)