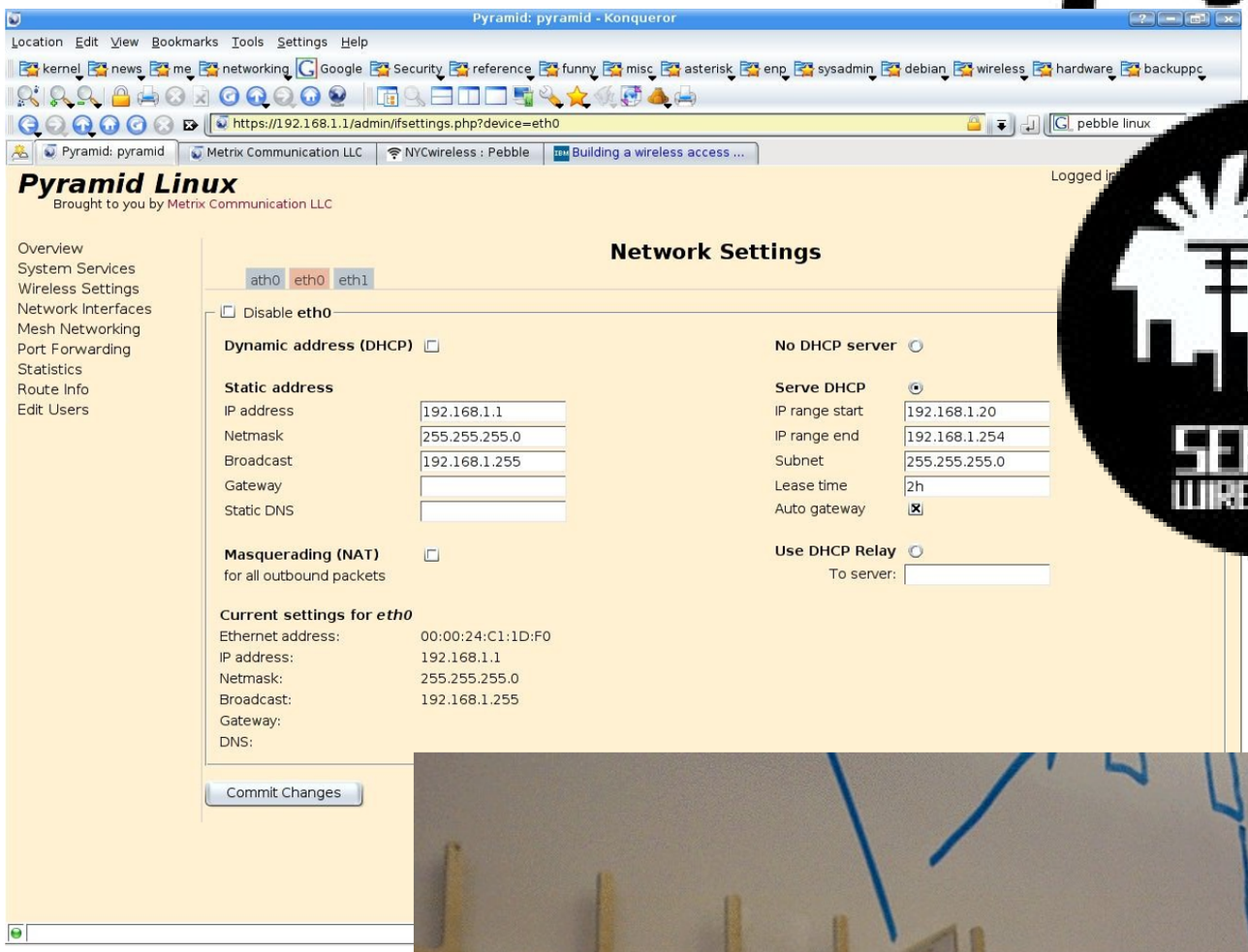
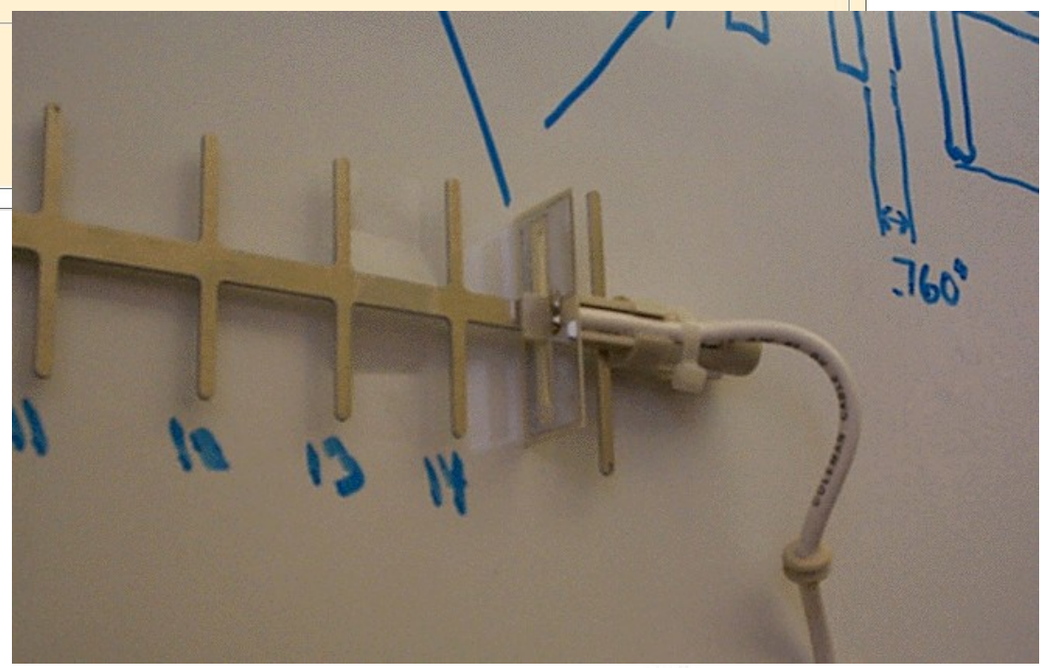
Wireless Community Networks

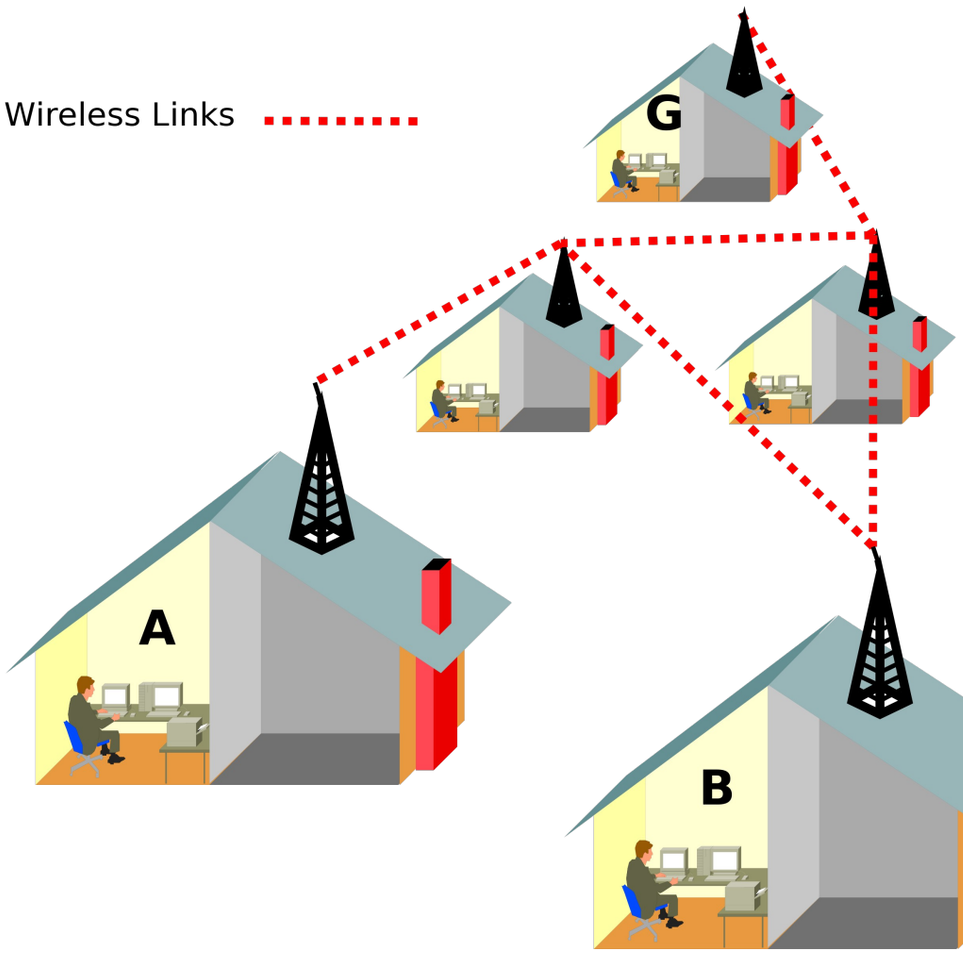
Claudio Pisa <clauz@ninux.org>

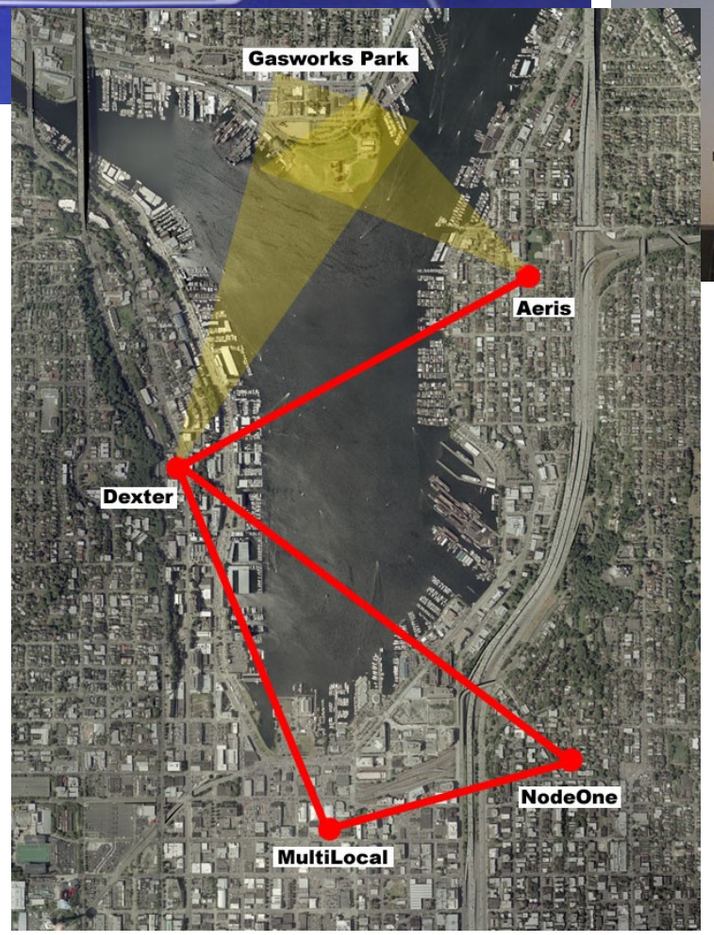
Seattle Wireless (2000)





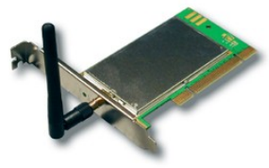
Wireless Community Networks – The Idea





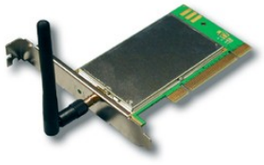
Wireless

- **IEEE 802.11** a.k.a. **Wi-Fi**
  - Wireless networking technology
  - Unlicensed band(s)
  - Available in stores since ~2000
  - Cheap
  - Everywhere



IEEE 802.11

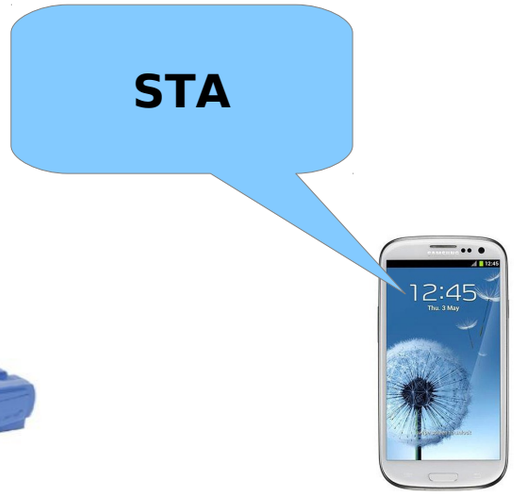
- **IEEE 802.11a:** 5GHz, up to 54Mbps
- **IEEE 802.11b:** 2.4GHz, up to 11Mbps
- **IEEE 802.11g:** 2.4GHz, up to 54Mbps
- **IEEE 802.11n:** 2.4 and 5GHz, up to 600Mbps
- **IEEE 802.11ac:** 5GHz, Gigabits



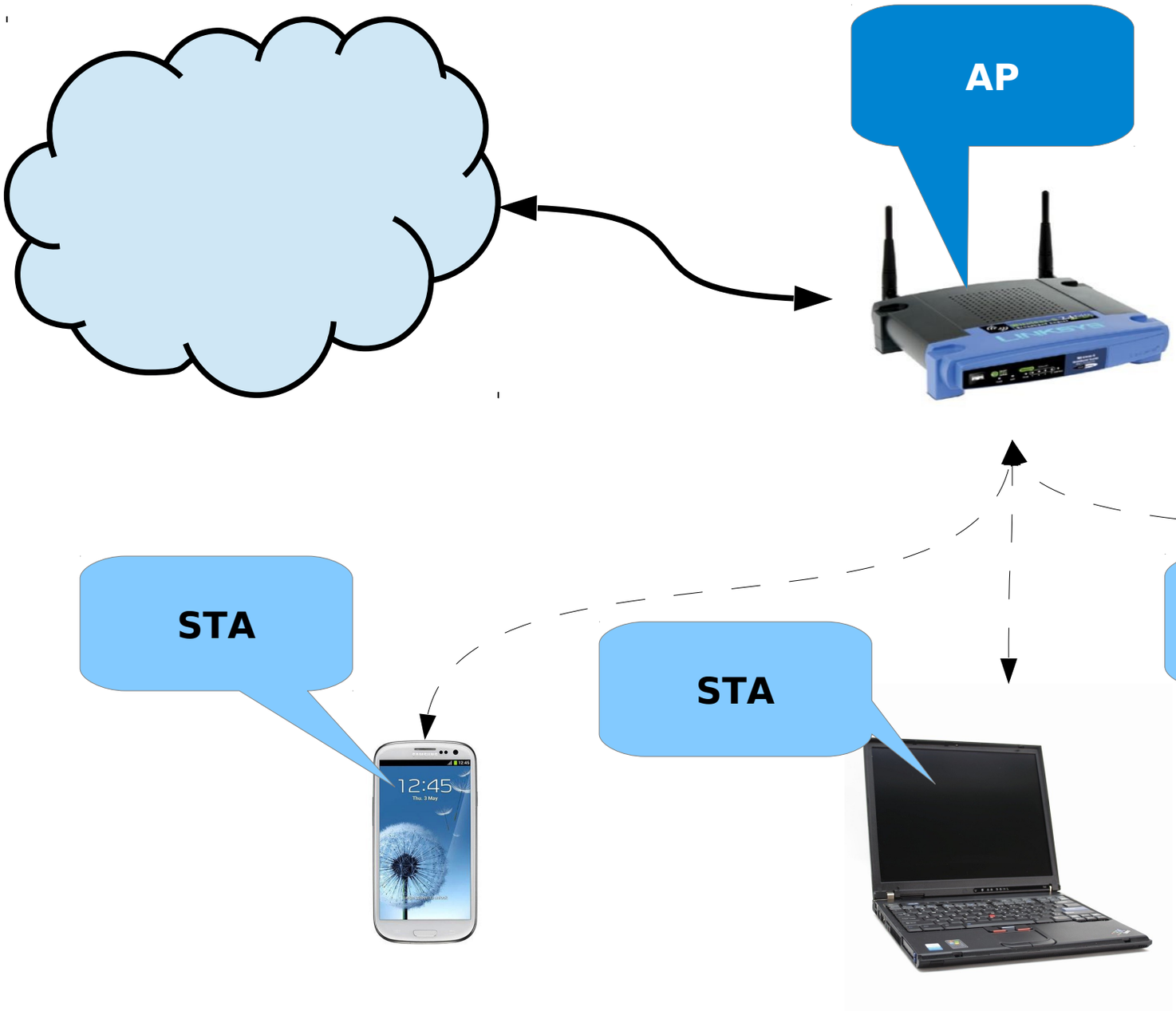
Wireless

- 3 main operation modes for IEEE 802.11 devices:
  - Access Point (AP)
  - Station (STA)
  - Ad-Hoc

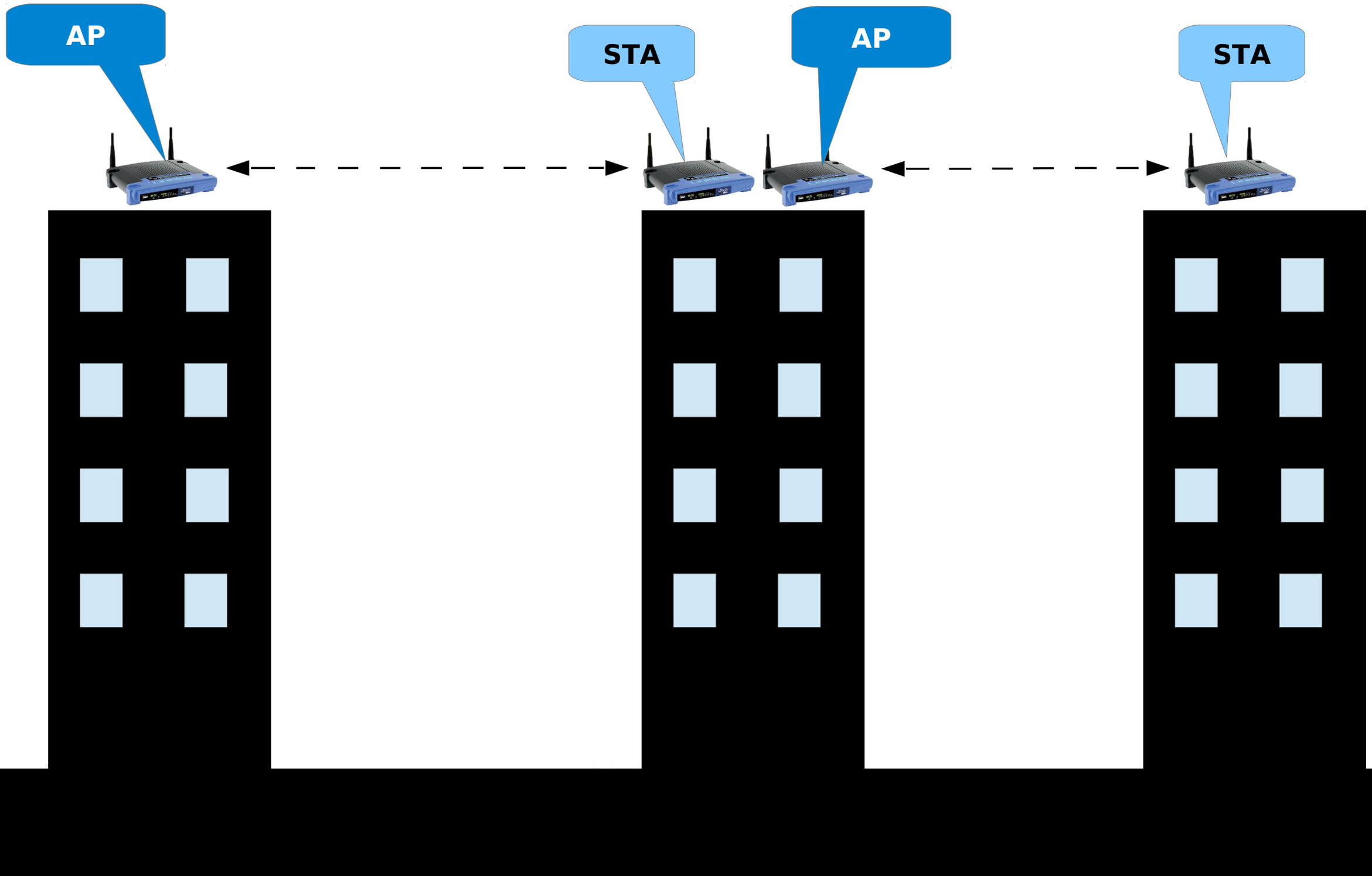
Infrastructure mode



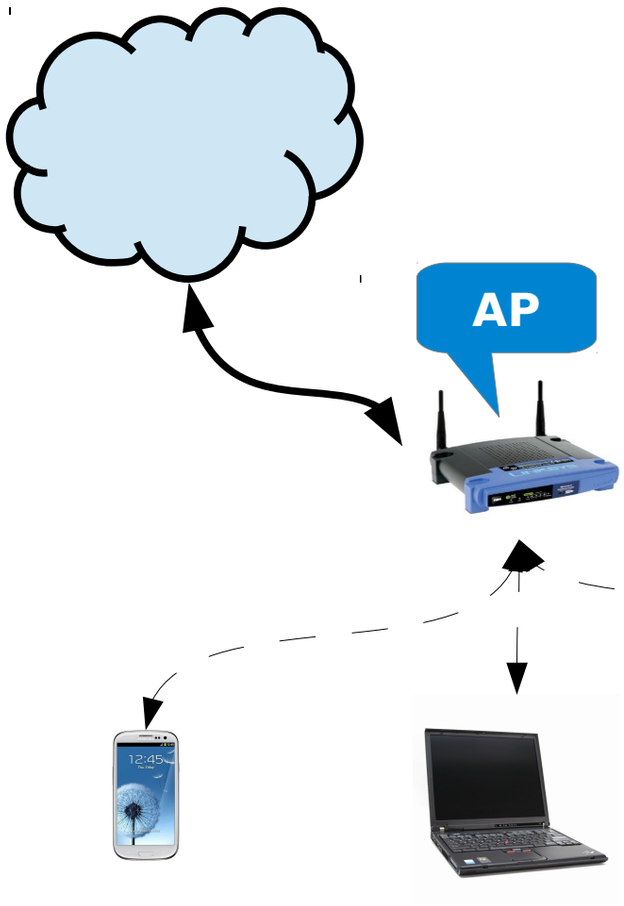
Infrastructure mode

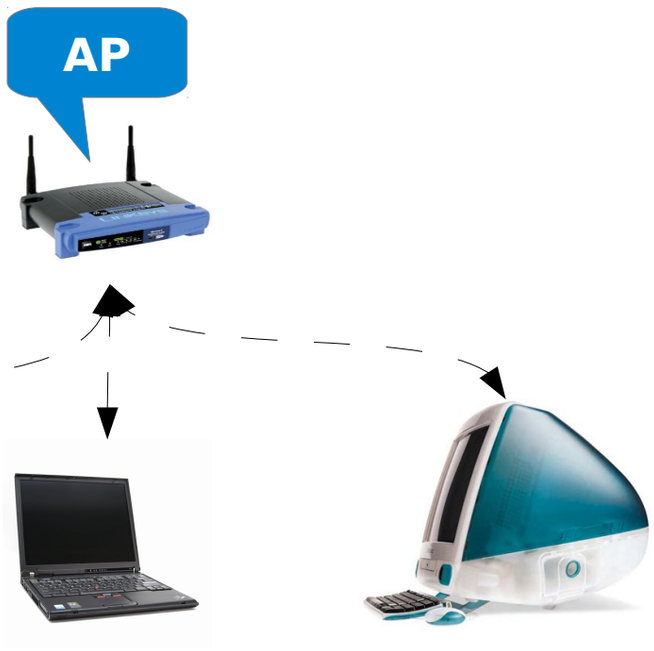


Infrastructure mode

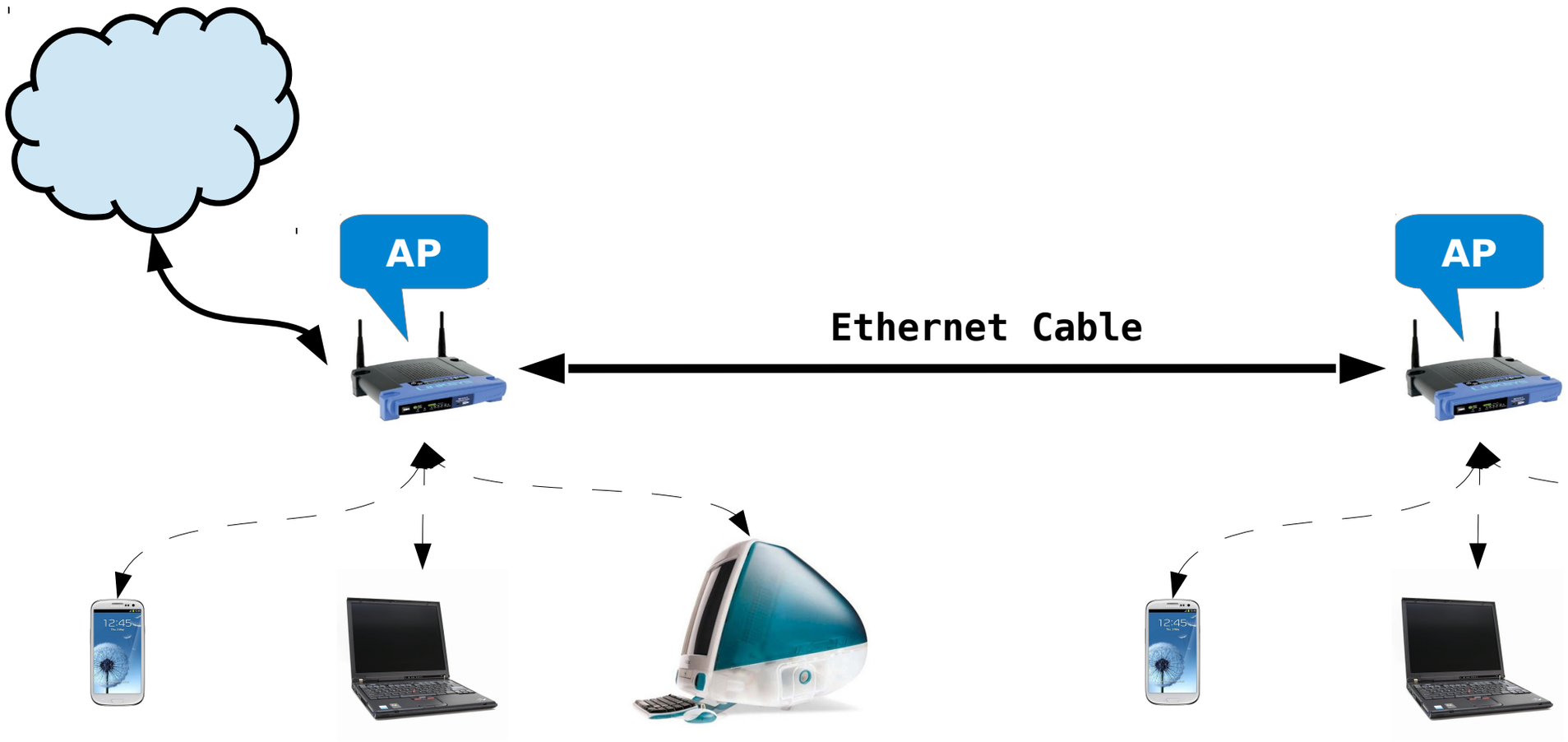


Infrastructure mode



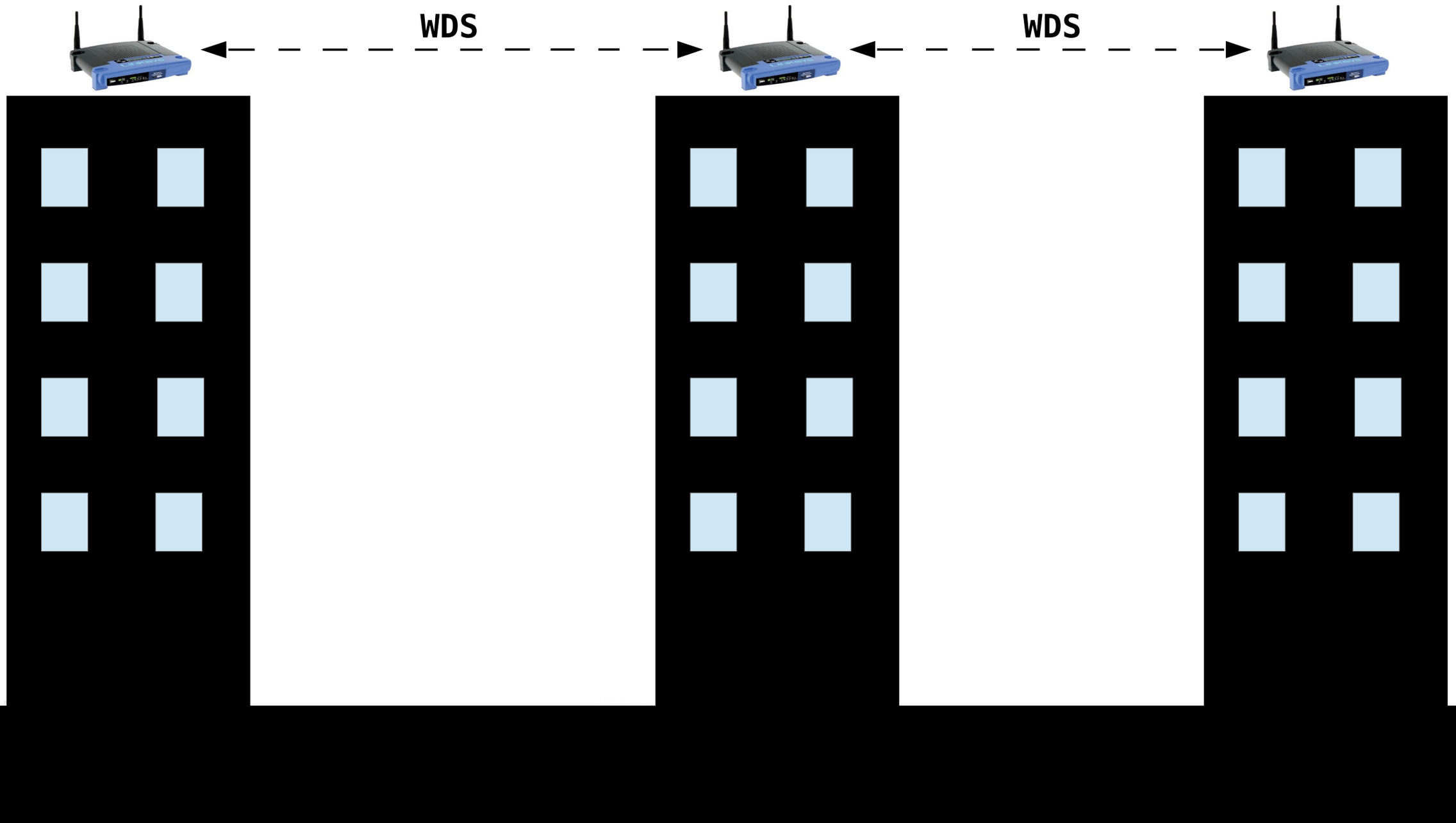


Infrastructure mode

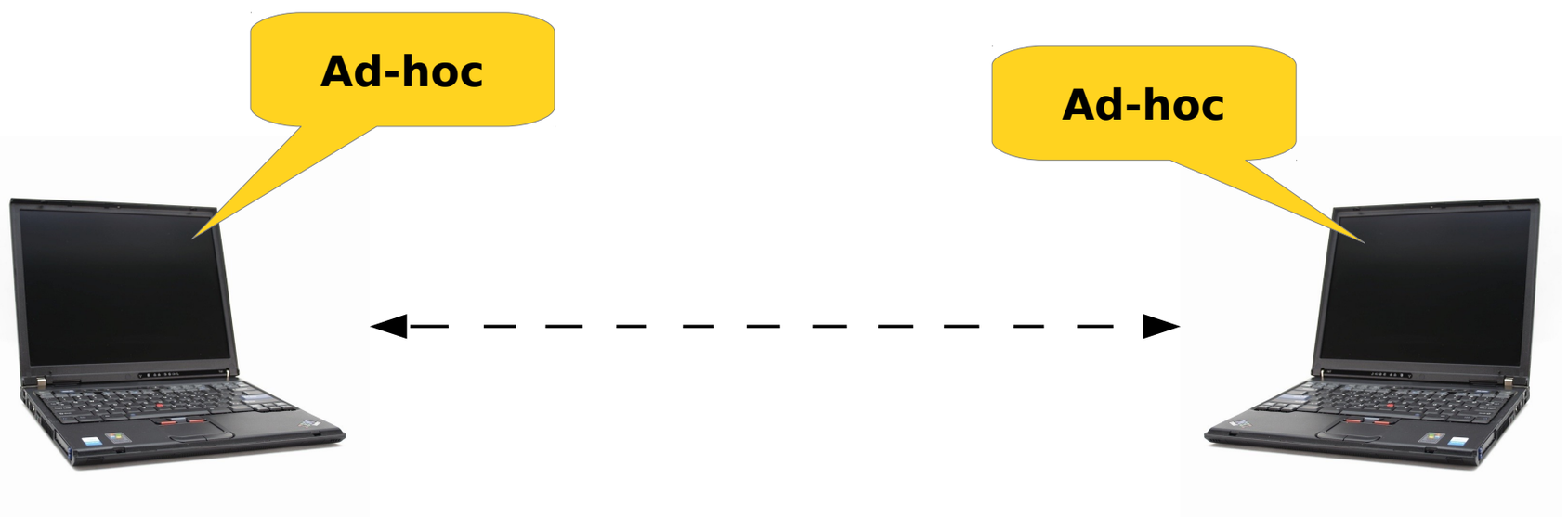


Infrastructure mode

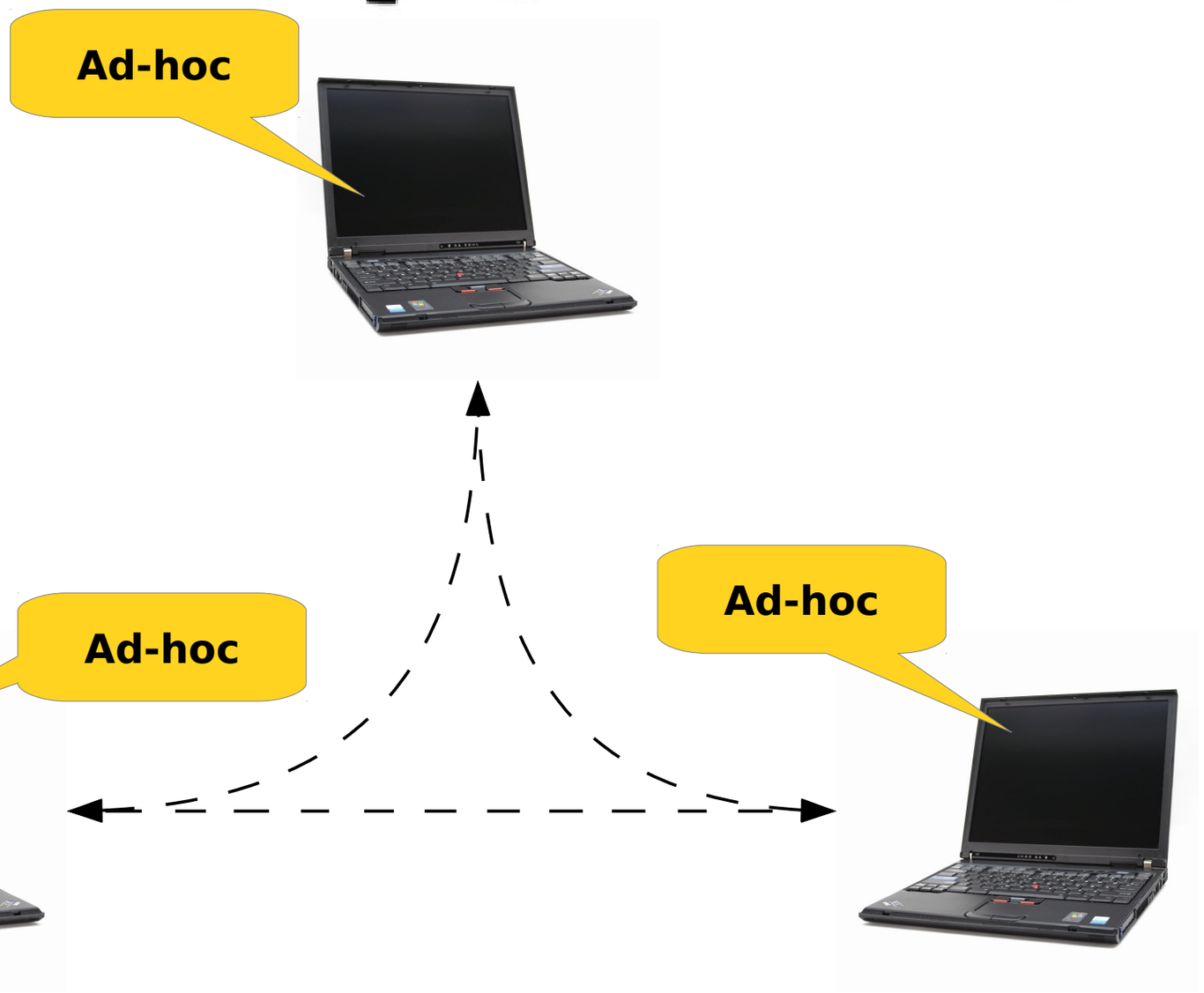
WDS



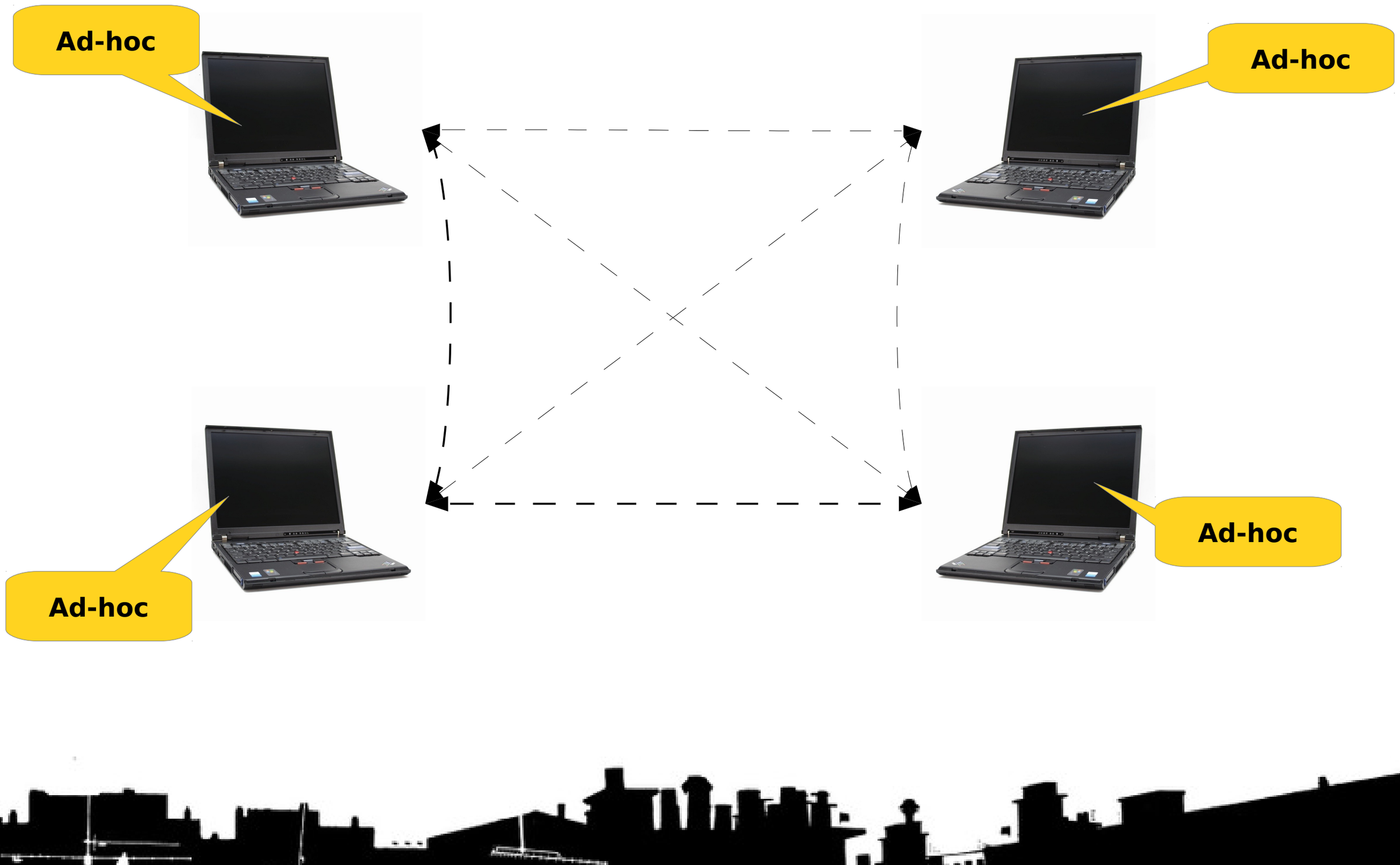
Adhoc mode



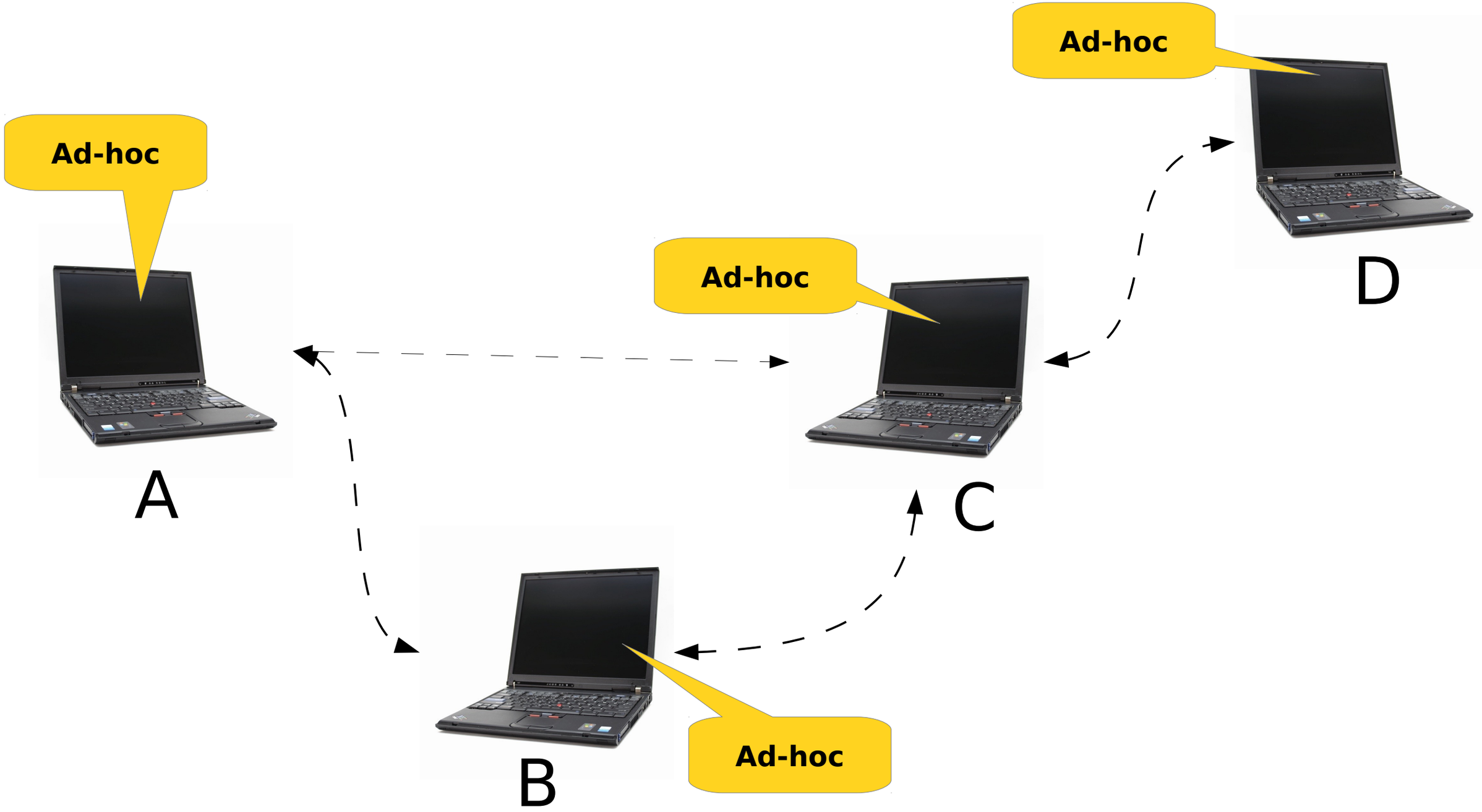
Adhoc mode



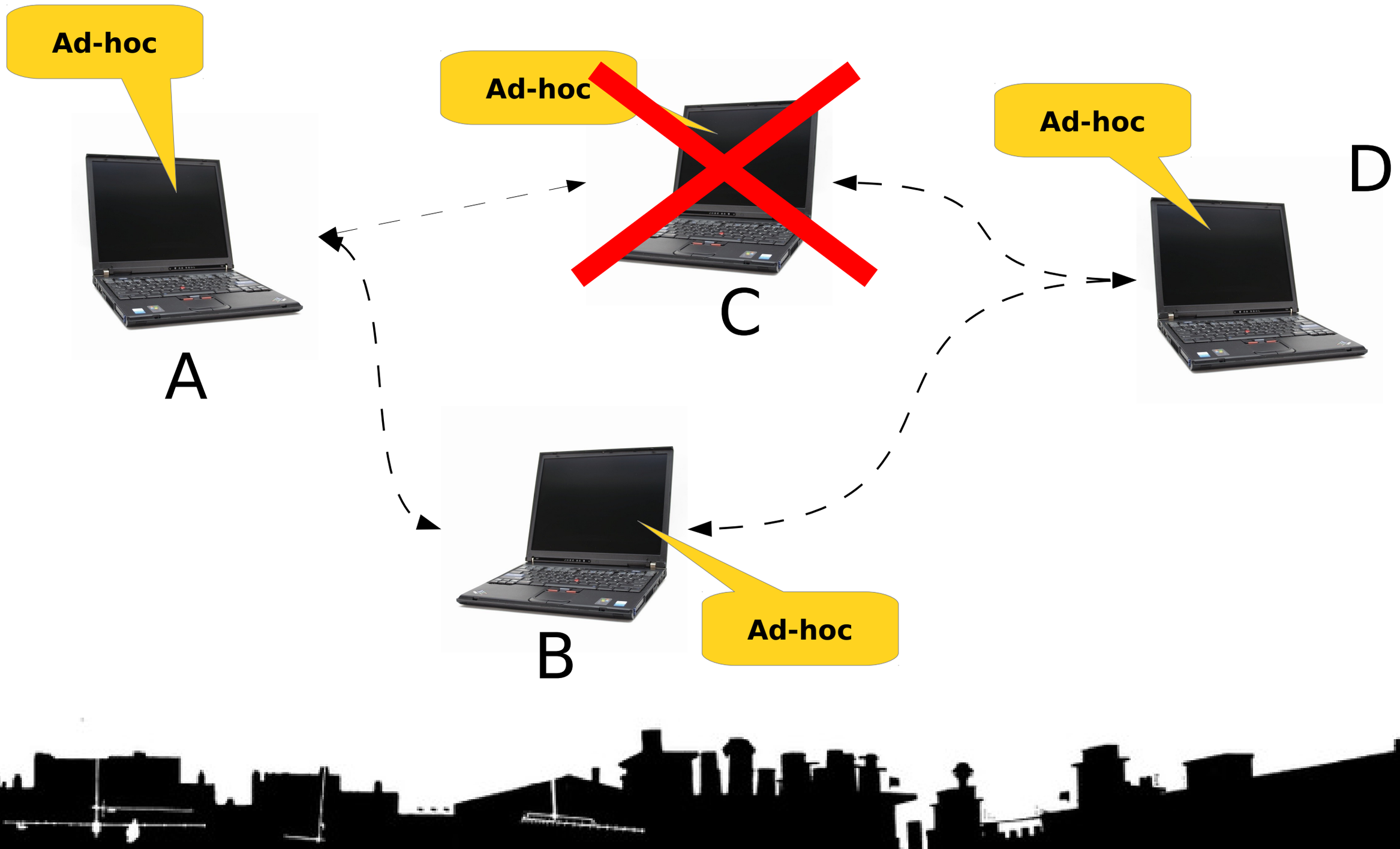
Adhoc mode



Adhoc mode



Adhoc mode



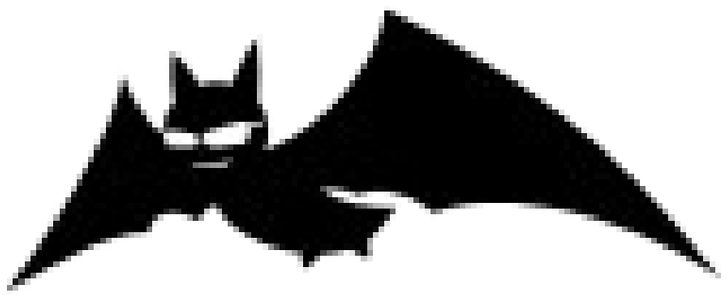
Mesh networks

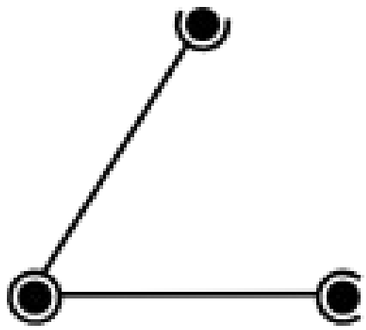
- 3 or more devices in ad-hoc mode can form a **mesh network**
- Need for a **routing protocol** to automatically reconfigure the network:
  - wireless links are unstable
  - devices can be turned on or off (e.g. power outages)
  - devices can break or crash
  - in some scenarios devices can move (MANETs)

Routing protocols

- Devices in a mesh need to run a **routing protocol**, periodically exchanging data about the **status of devices and links**
- Some routing protocols are **especially designed for wireless mesh networks**:
  - **OLSR**
  - **B.A.T.M.A.N.**
    - batmand
    - BMX
    - batman-advanced
  - **Babel**
  - **...**

olsrd
an adhoc wireless mesh routing daemon





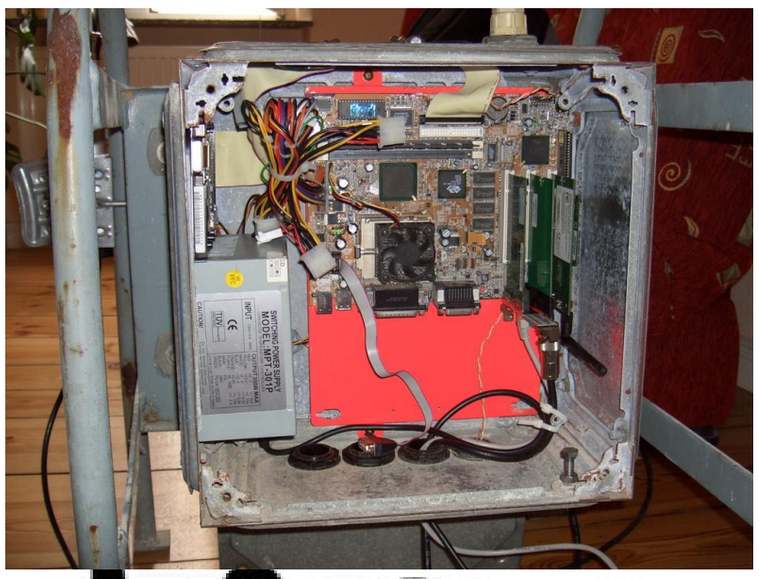
Babel

Open Firmware

- Open firmwares:
  - **Linux distributions on embedded devices**
    - “turn a 50 euro router into a 400 euro router”
    - Package management, especially **routing protocol daemons**
- E.g.:
  - **OpenWrt**
  - Dd-wrt

Network Nodes

- Network nodes hardware has gone through many stages:
  - PCs on the roofs
  - Self-made antennas
  - Off-the-shelf routers with modified firmware
  - routerboards
  - router+antenna in embedded devices suitable for outdoor operation



Network Nodes

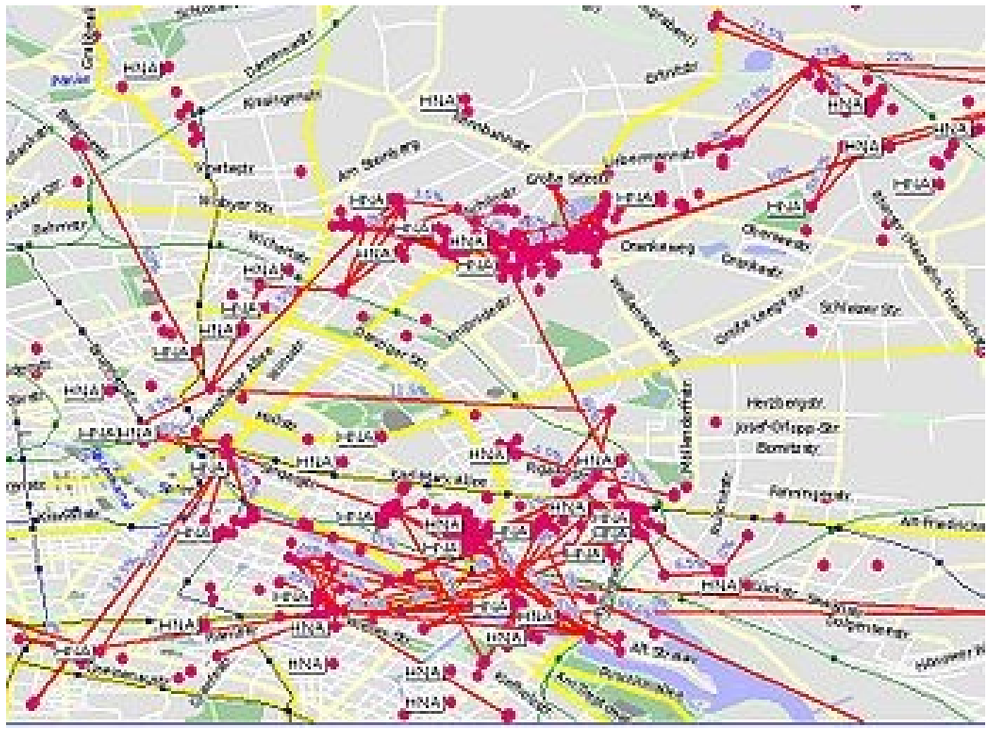
- Typical node today
  - Outdoor router(s) with custom firmware + embedded antenna on the roof
  - Ethernet cable
  - Power over Ethernet
  - Indoor router

Wireless Community Networks in Europe

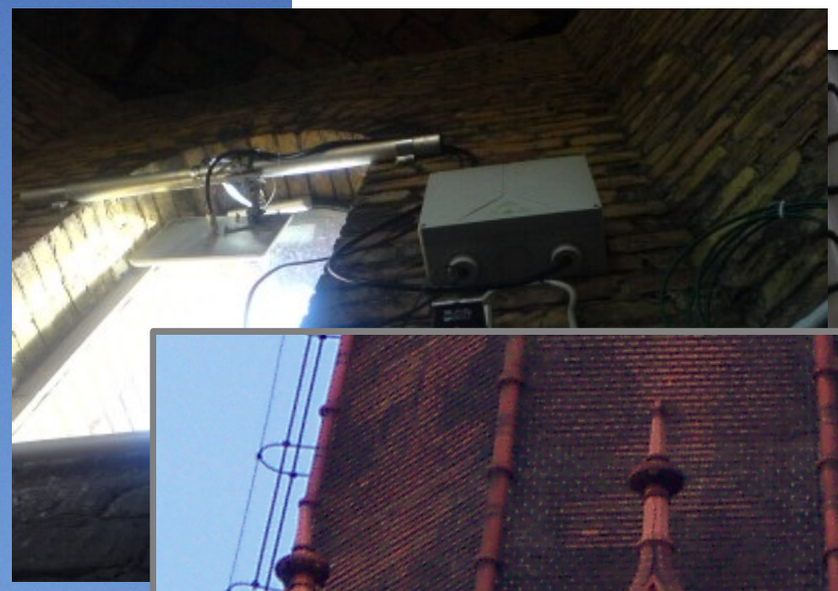
Berlin + Germany – Freifunk.net

- **“Freifunk” == free radio**
- Started from **Berlin**, spread all over Germany
- Mesh
- Huge contributions to (but not only):
  - Open source routing protocol daemons
  - Open source tools
  - Wireless Commons Manifesto

freifunk.net



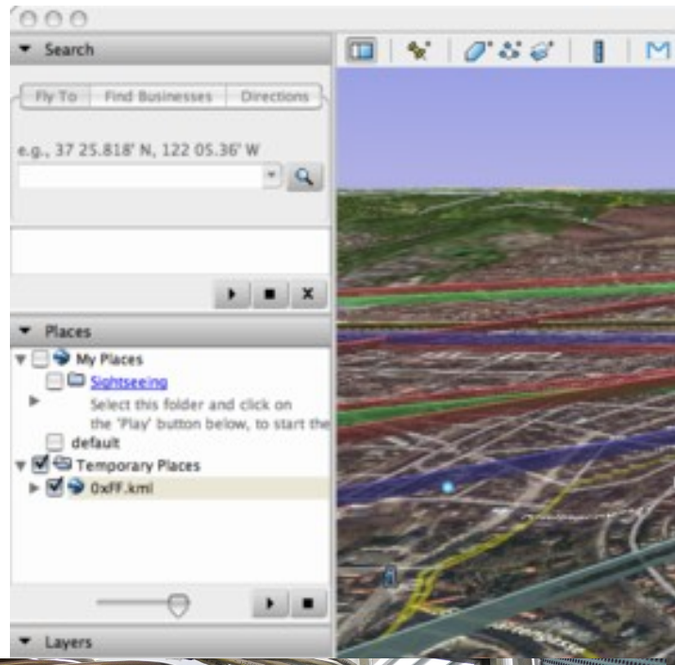
Berlin + Germany – Freifunk.net

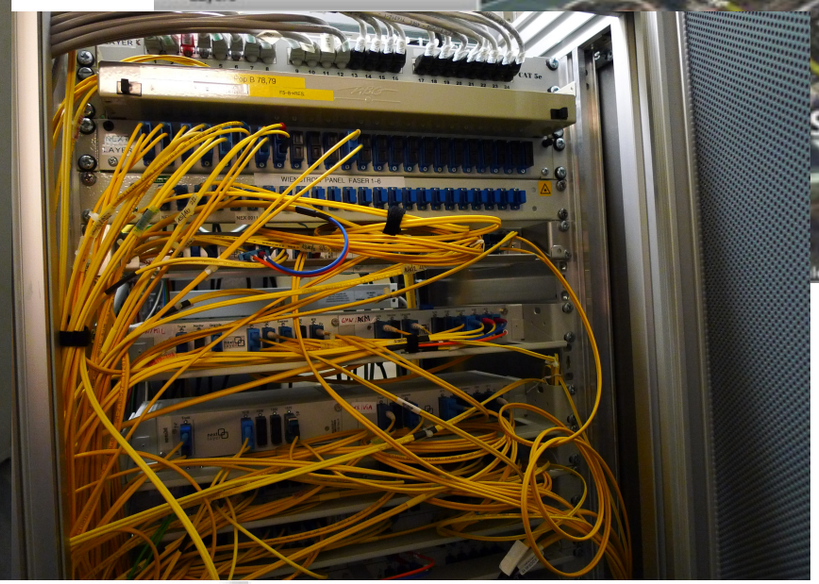


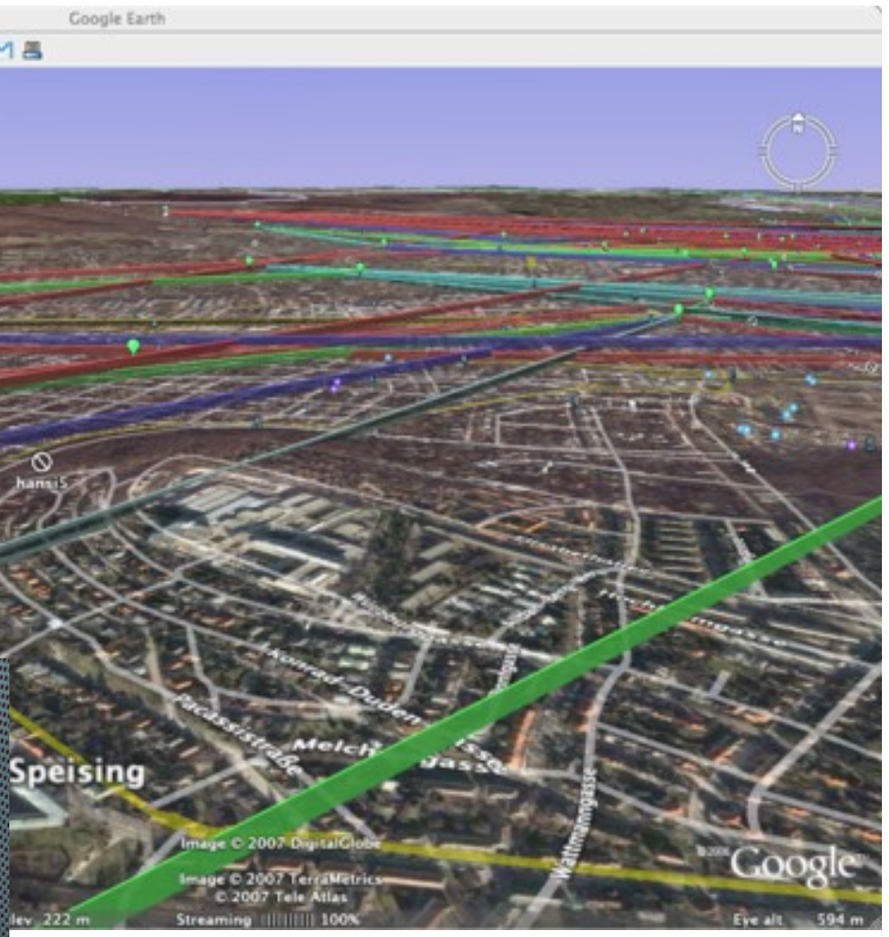
Vienna + Austria – Funkfeuer.at

0xFF FUNKFEUER FREE NET

- Funkfeuer: Vienna, Graz
- IPv6 Mesh



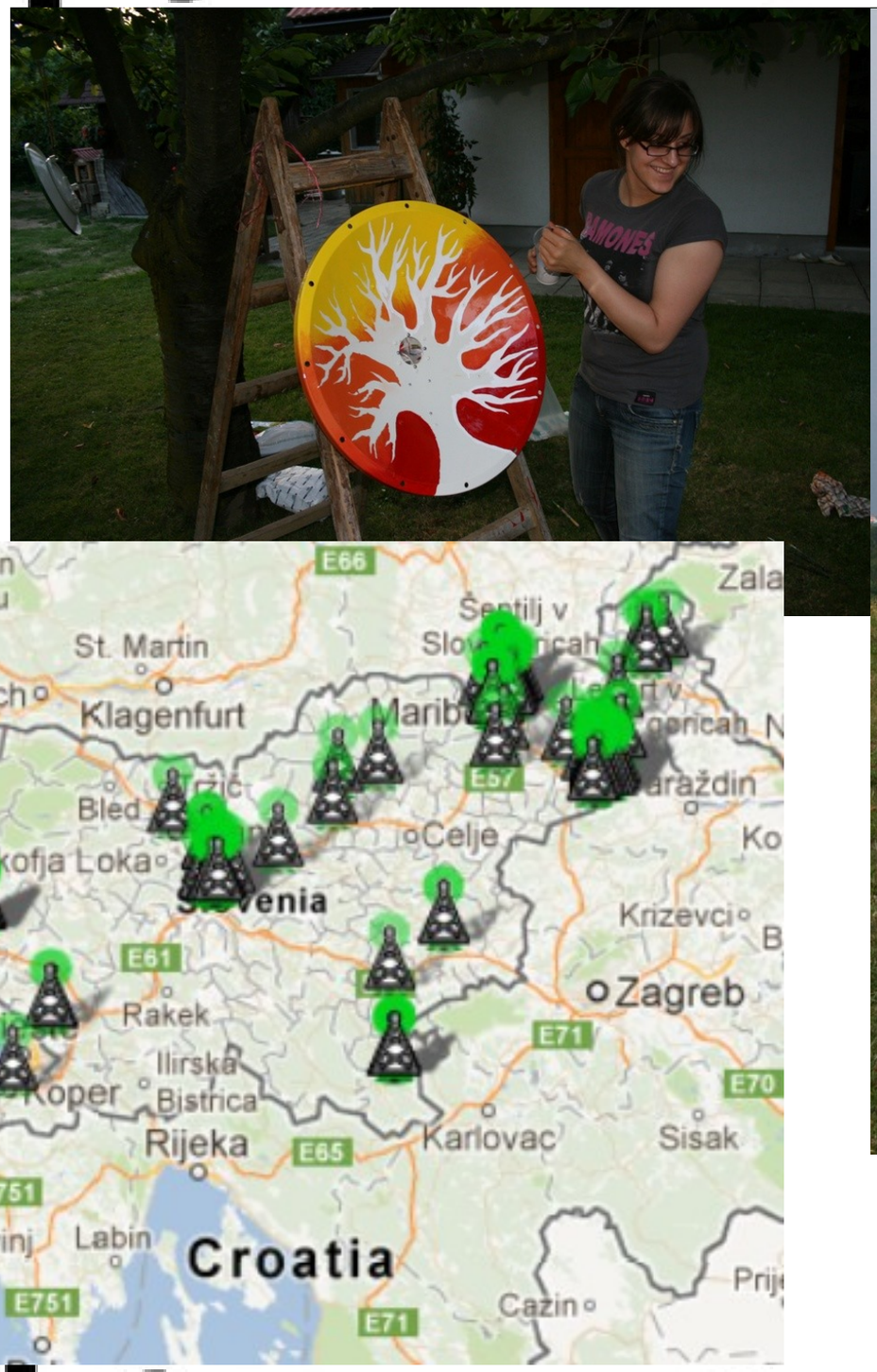




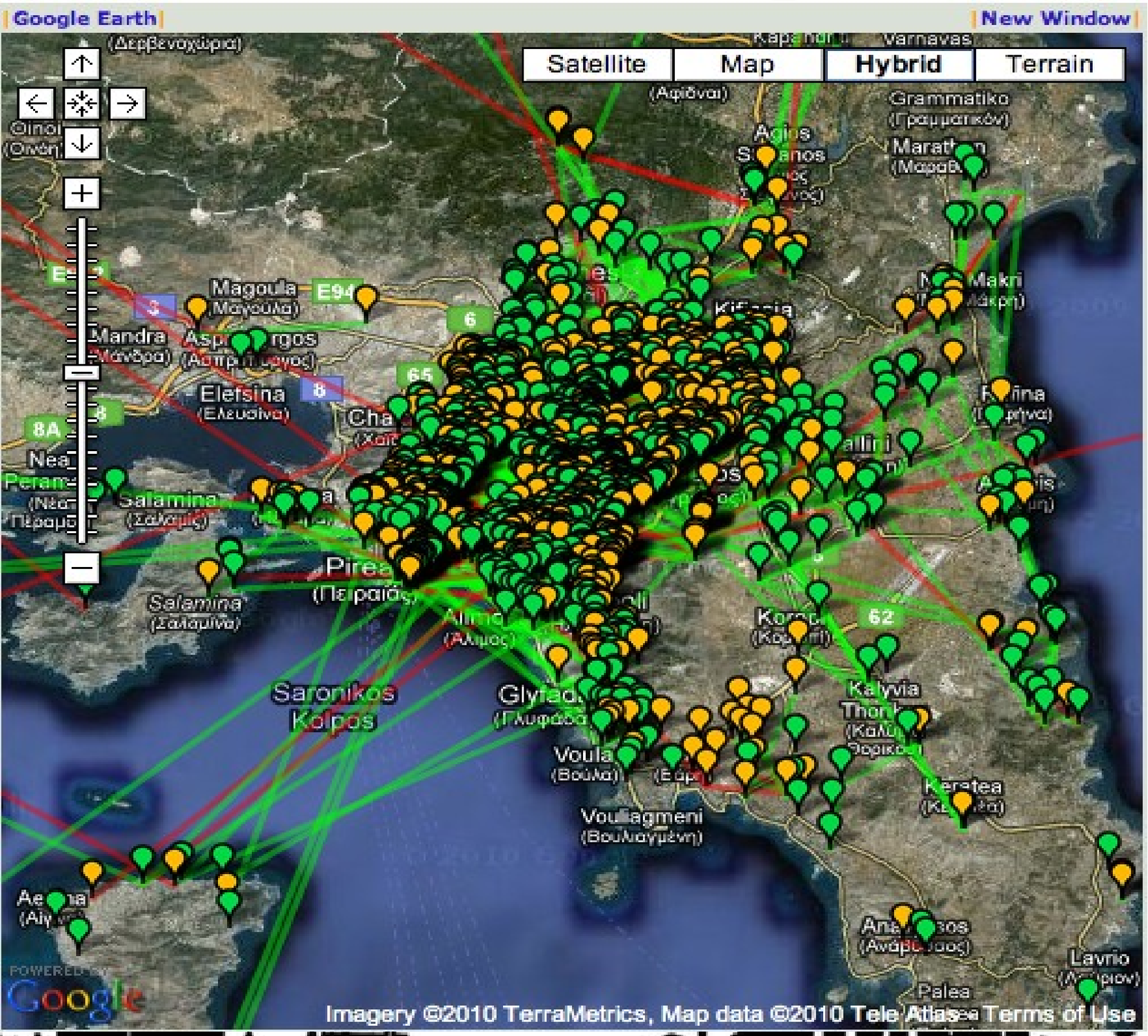
Ljubljana+Slovenia – wlan slovenija

- WLAN Slovenija
- Towards a cross-border network

wlanslovenija
open wireless network of Slovenia



Athens - AWMN

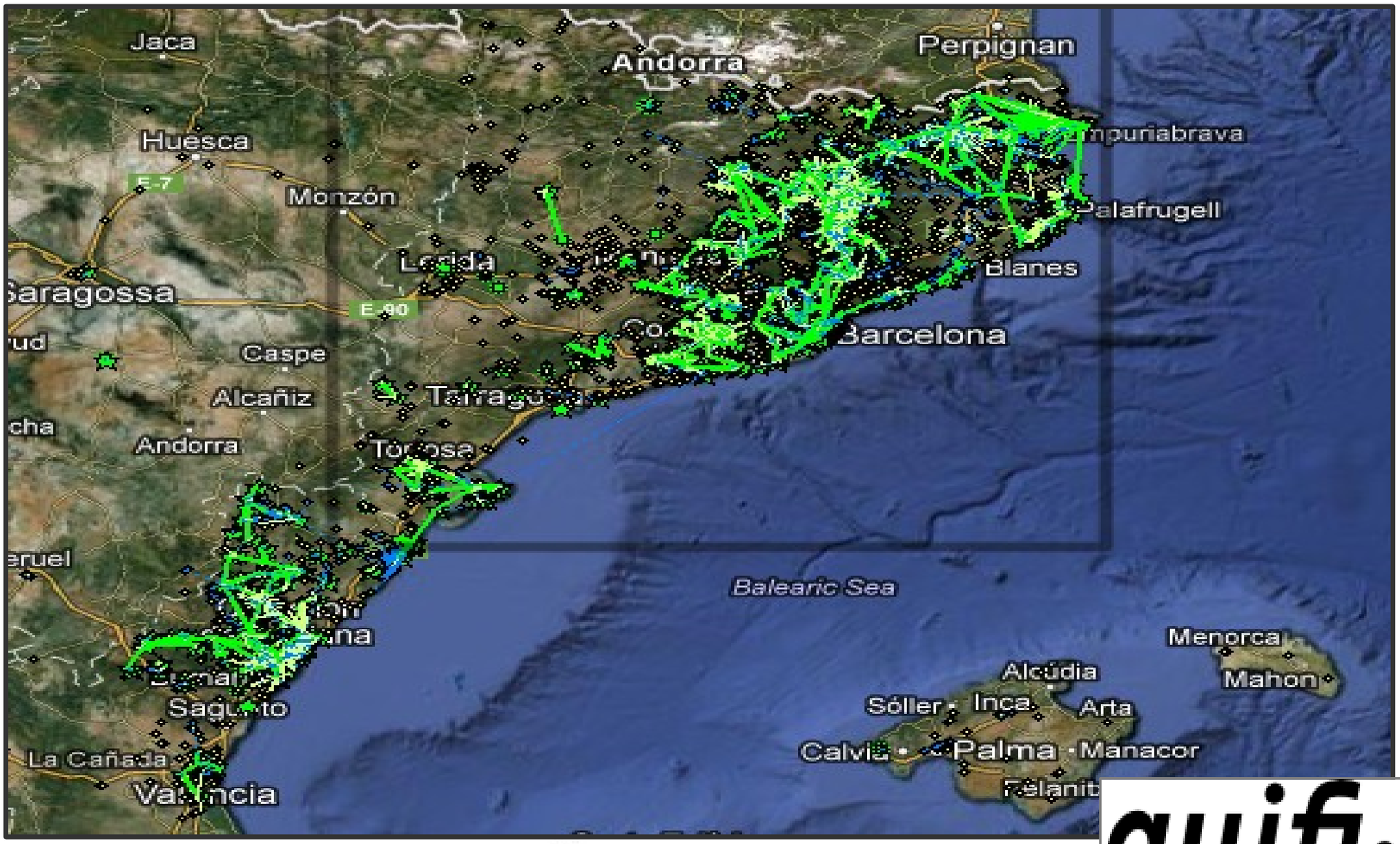


Athens Wireless Metropolitan Network (Greece)

2394/11222 active nodes
1169 backbone nodes
2739 links
789 access points
759/834 active services

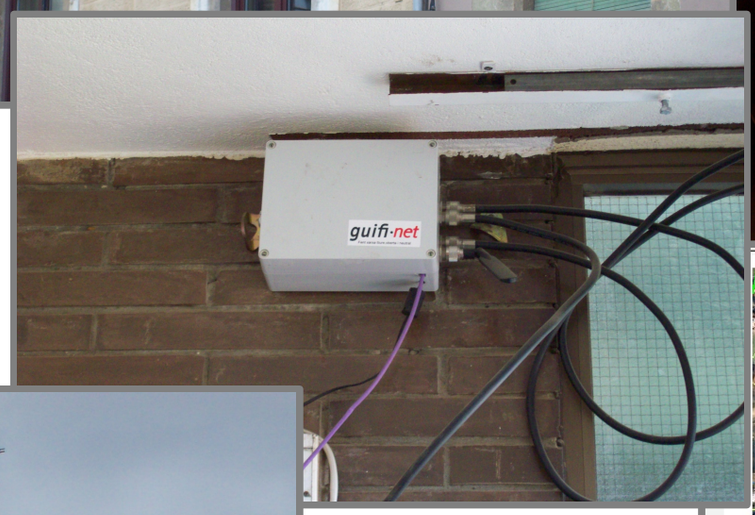
Catalunya – Guifi.net

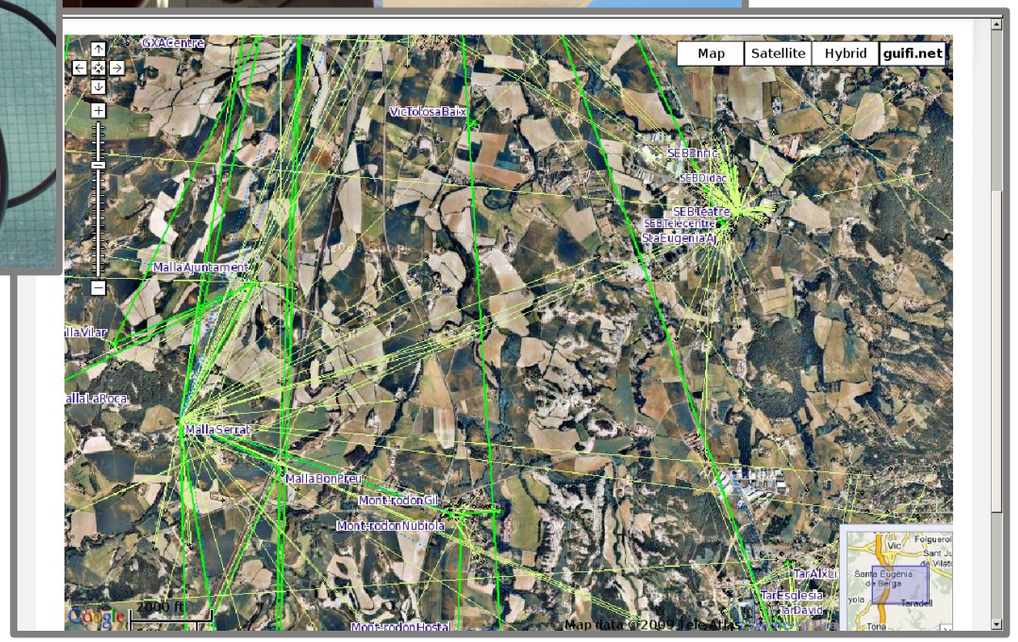
Guifi.net (Catalunya): **18000** active nodes



guifi·net

Catalunya – Guifi.net





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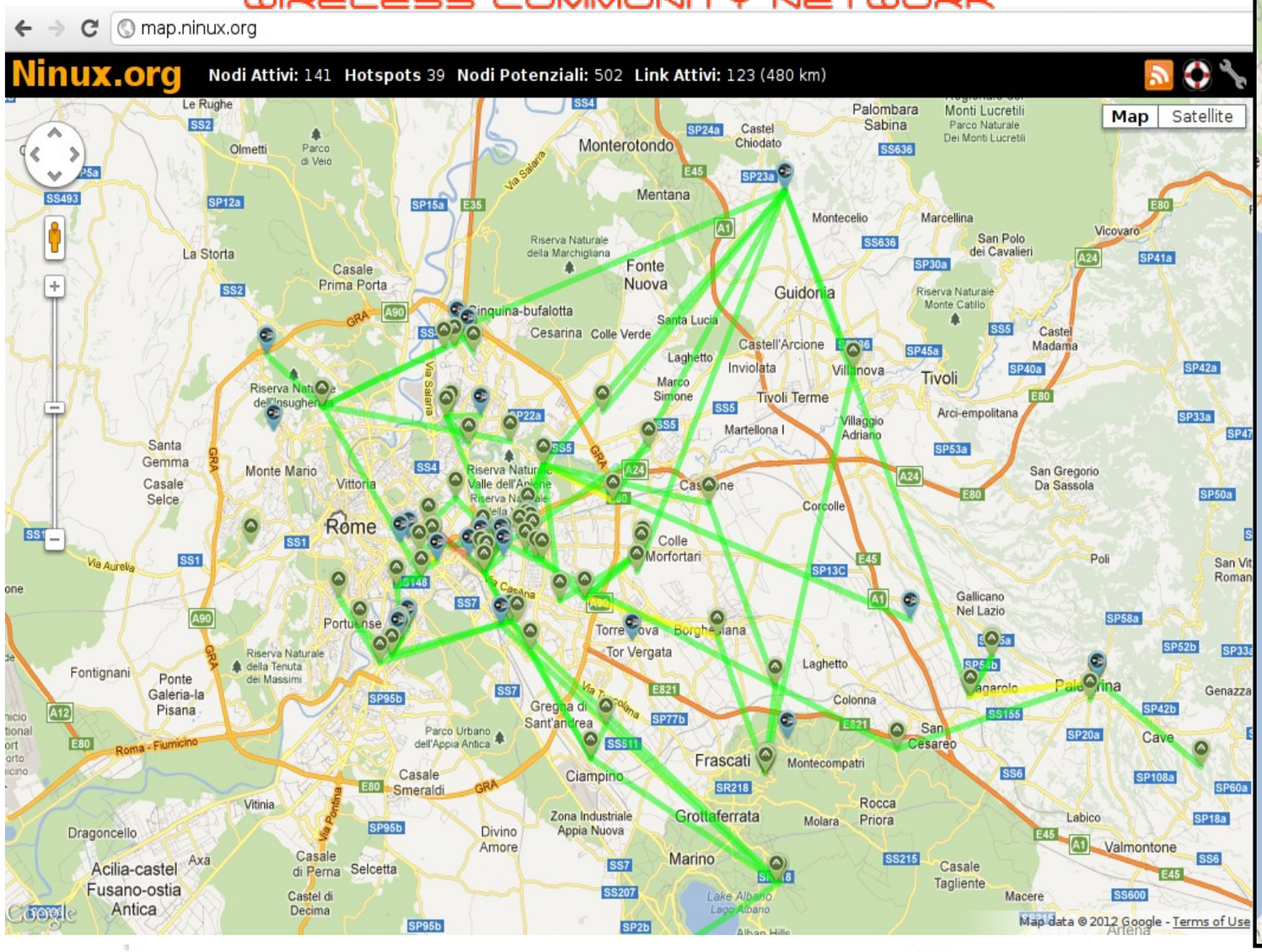
WIRELESS COMMUNITY NETWORK



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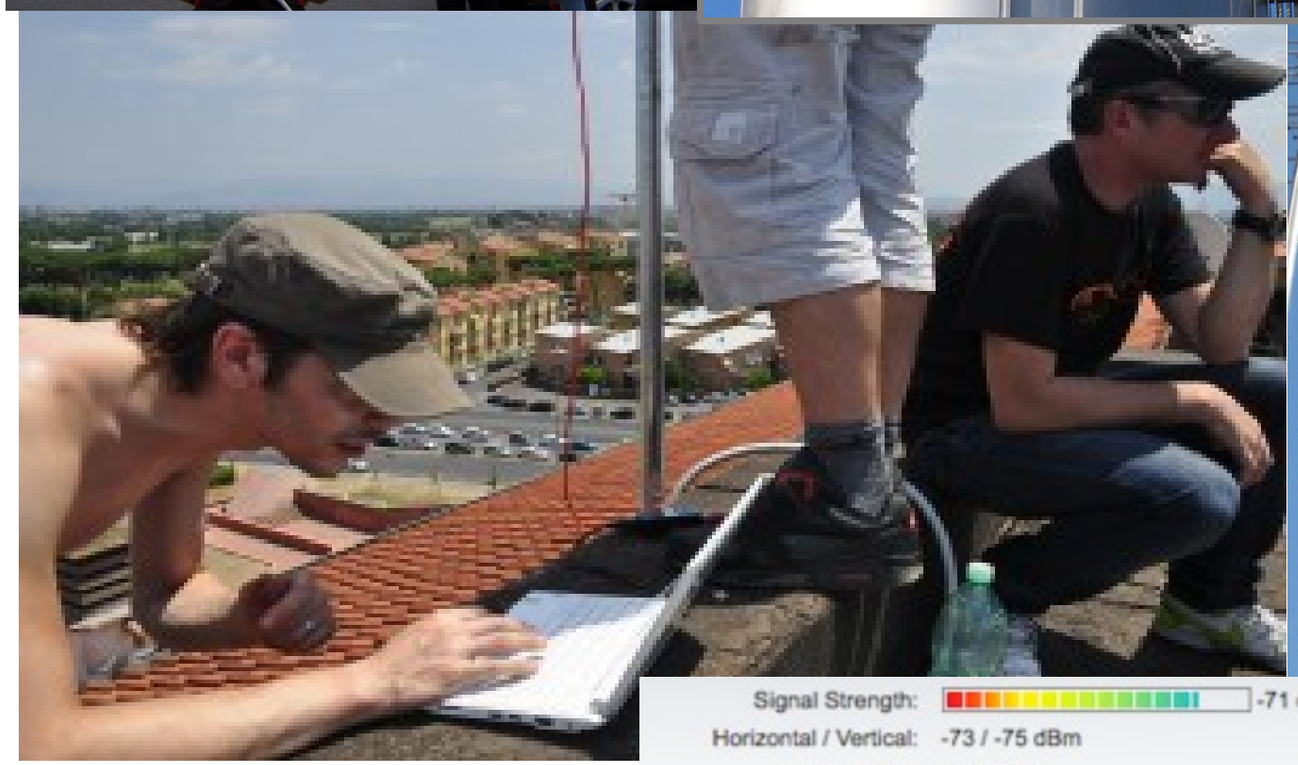
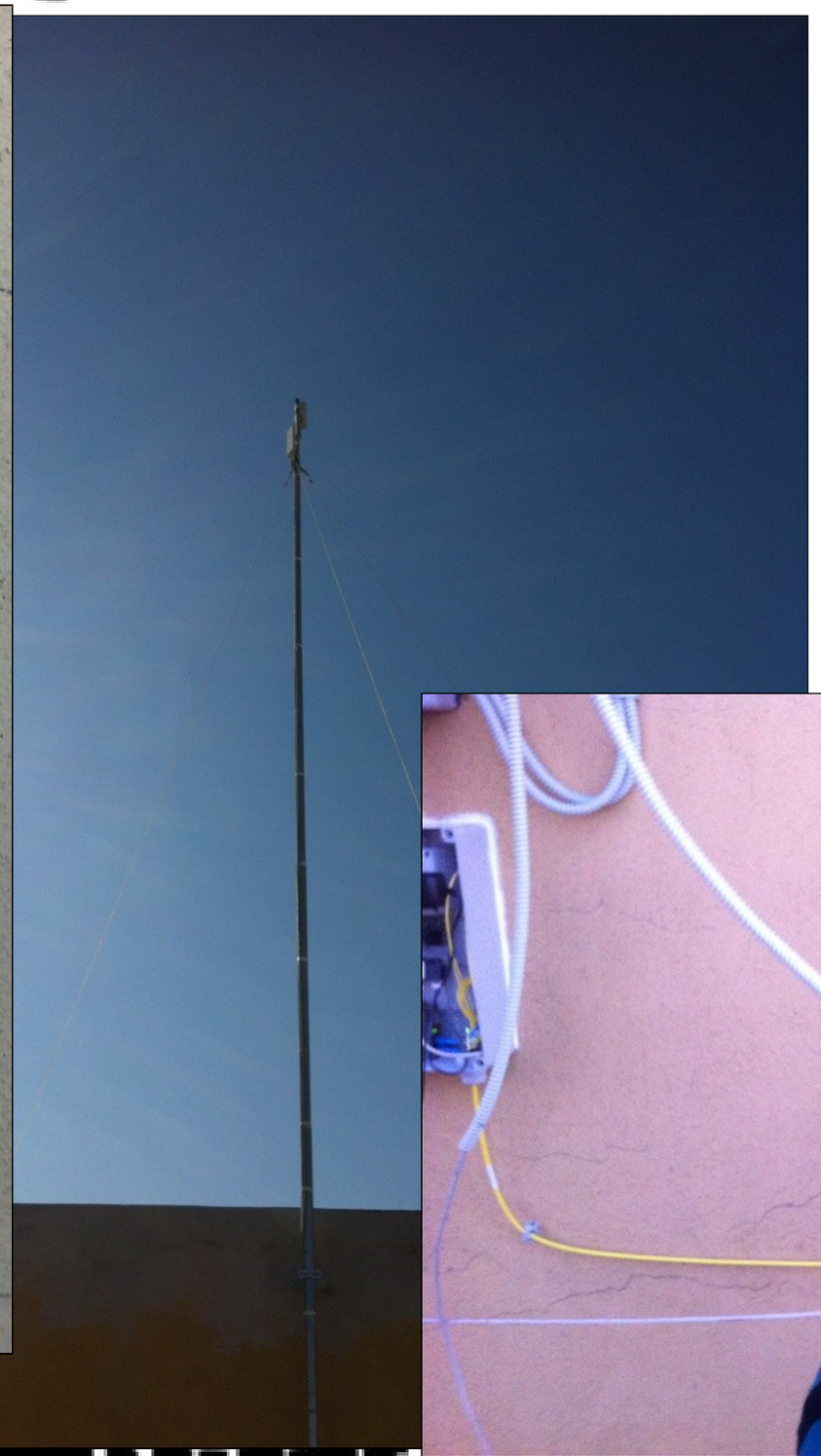


Signal Strength:	-71 dBm
Horizontal / Vertical:	-73 / -75 dBm
Noise Floor:	-92 dBm
Transmit CCQ:	100 %
TX/RX Rate:	180.0 Mbps / 180.0 Mbps
AirMax:	Enabled
AirMax Quality:	68 %
AirMax Capacity:	55 %

IPv6 Autonomous System



- IPv6
- BGP (ASN 197835)

ninux.org

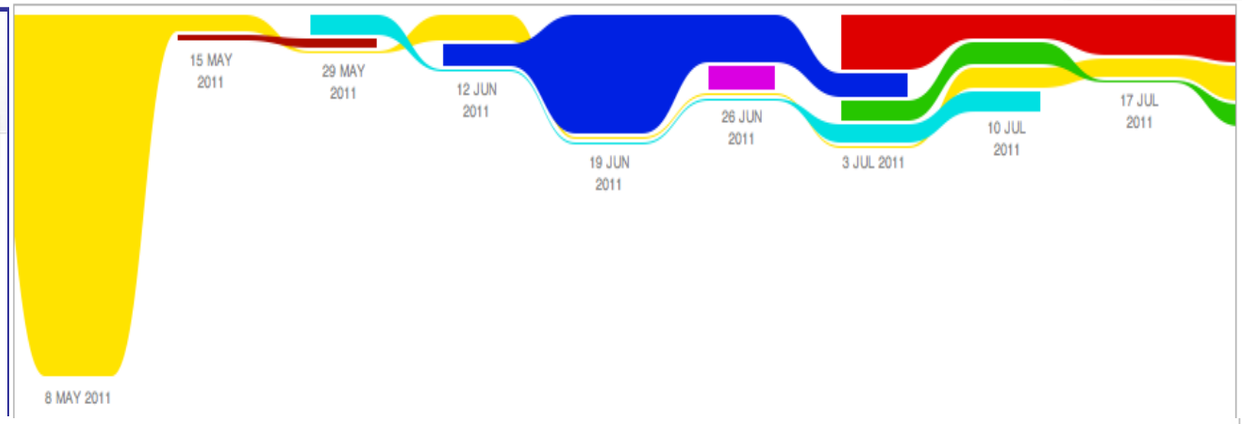
Internal Services

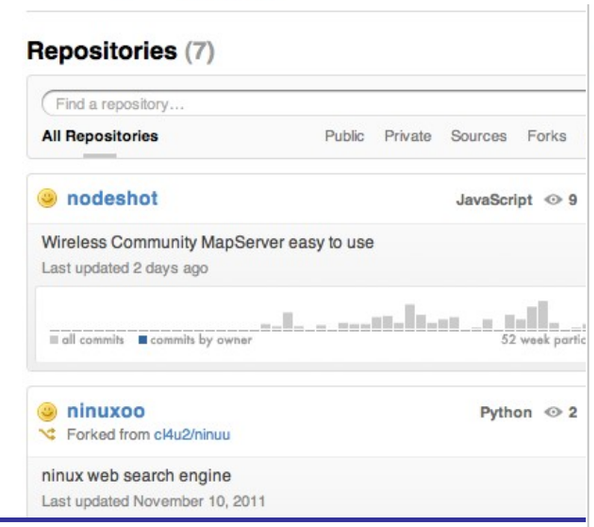
XMPP

NINUXOO!

Ricerca: go!

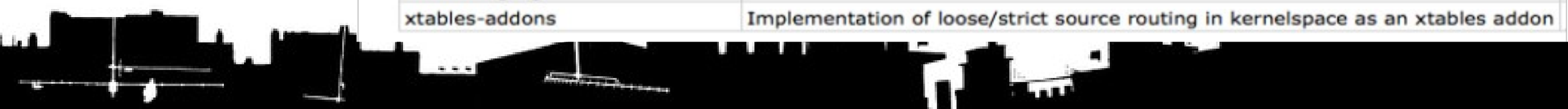
Software Projects



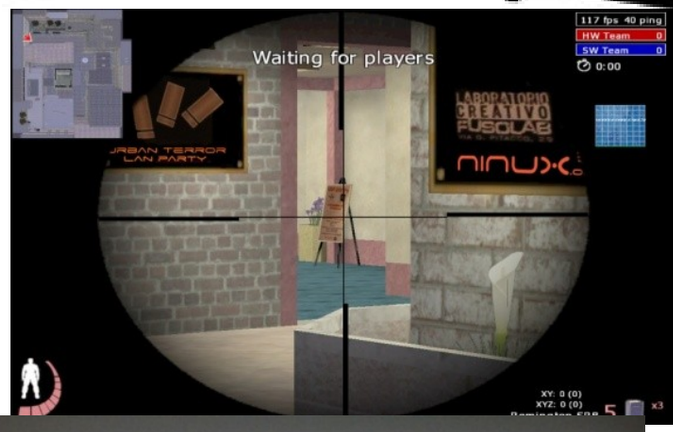


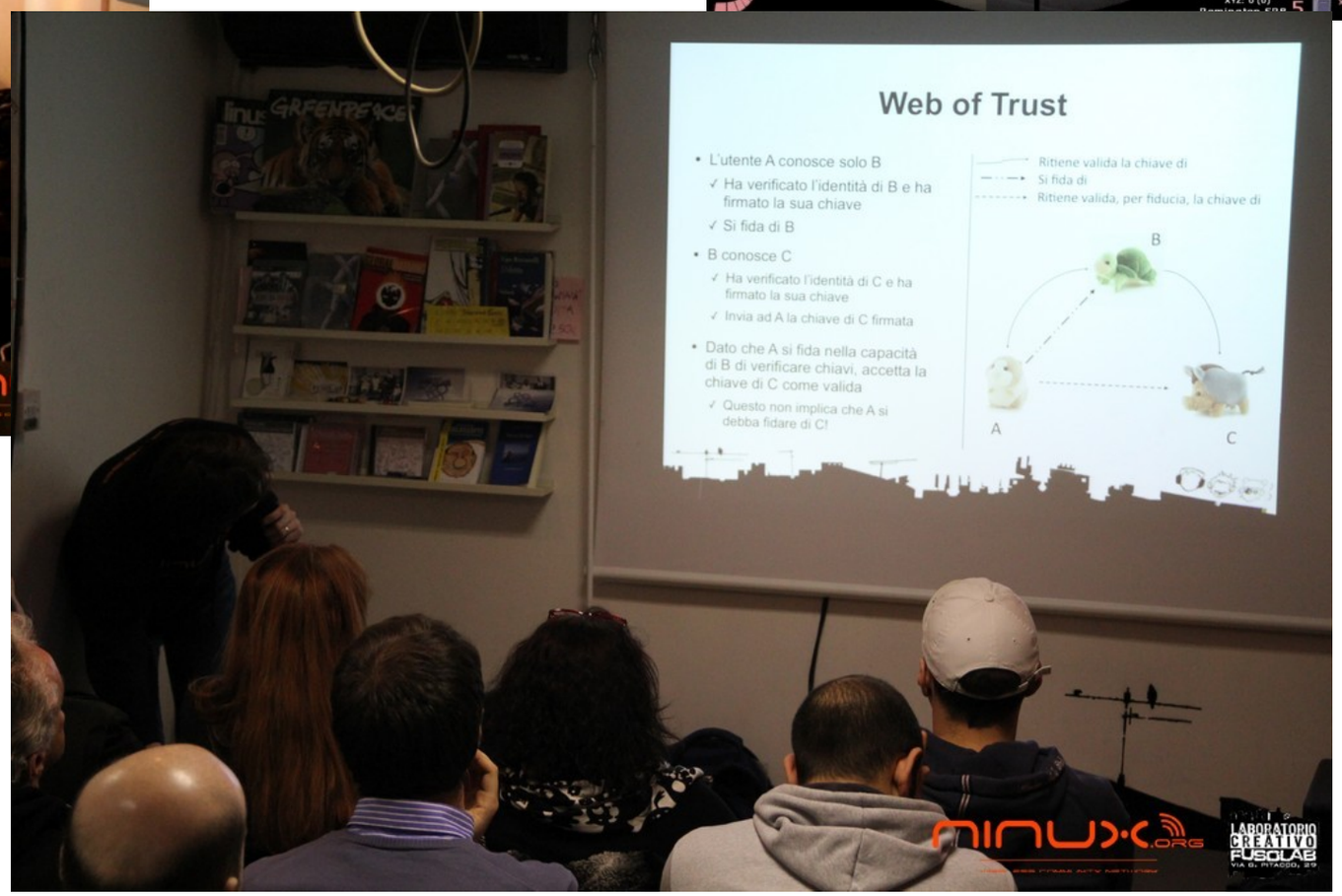
List of hosted projects

Project Name	*Description*
autoconf	
cafone	
facebook-bot	
freenux	Scripts to share with neighbors an ADSL connection, using packet schedulers
graphics	Misc graphic stuff of ninux
irss	A moinmoin plug-in to have an rss feed related to a page
merpa	Mesh Routing Probe Analyser
ninuxdyndns	Ninux Dynamic DNS
obamp-netkitlab	
openpursuit	A web-based nerd game using Django platform
packages/ninux-ipkg-webiftheme	Ninux.org Community Webif Theme Packag
packages/nowolfsplash	A captive portal written in LUA
packages/olrs-ninux	Olsr deamon for ninux mesh network
packages/sar	Strong Anonymous Router
packages/zzz-ninux-ipkg-<arch>	Meta package to recompile ninux firmware
pgp-pp	PGP Permanent Party
say	mDns repeater
Tracker2GMaps	Draw data sent by the TZ-GT01 on the web with Google Maps
wardriving-ng	
xtables-addons	Implementation of loose/strict source routing in kernelspace as an xtables addon



Events

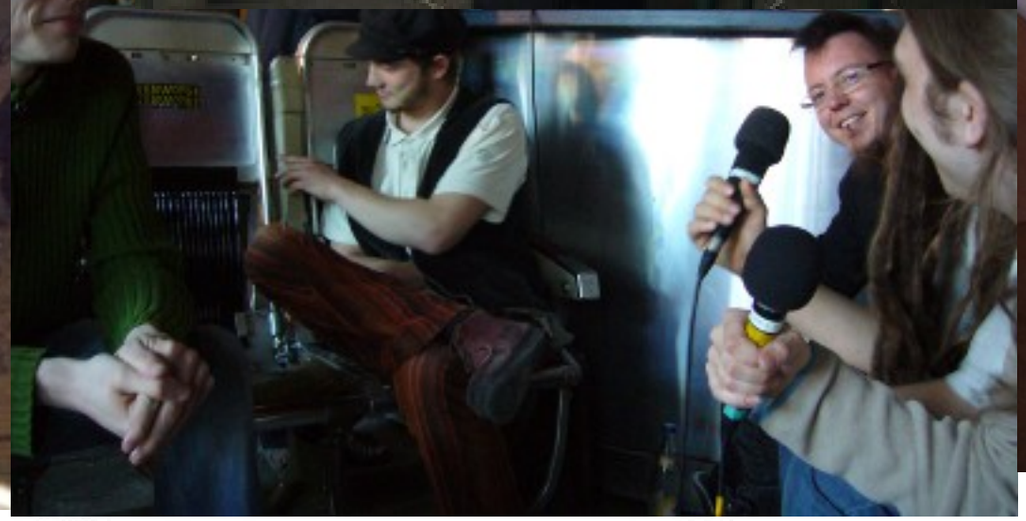




LABORATORIO CREATIVO FUSOLAB
VIA G. PITACCO, 29

Wireless Community Weekend

- **Wireless Community Weekend**
  - Yearly event
  - **C-base, Berlin**, Terra
  - Community networks enthusiasts
  - Developers
  - Barbecue!



Wireless Battlemesh

- **Wireless BattleMesh**
  - Paris, Brussels, Italy, Catalunya, Athens. Next: Denmark
  - **Challenge between routing protocols**
  - Developers, WCN activists, enthusiasts

- www.ninux.org
- contatti@ninux.org
- map.ninux.org
- twitter: @ninuxorg
- github.com/ninuxorg
- www.battlemesh.org
- www.freifunk.net
- www.funkfeuer.at
- www.guifi.net
- www.awmn.net
- ...