

WLAN – Wireless LAN (1/6)

1

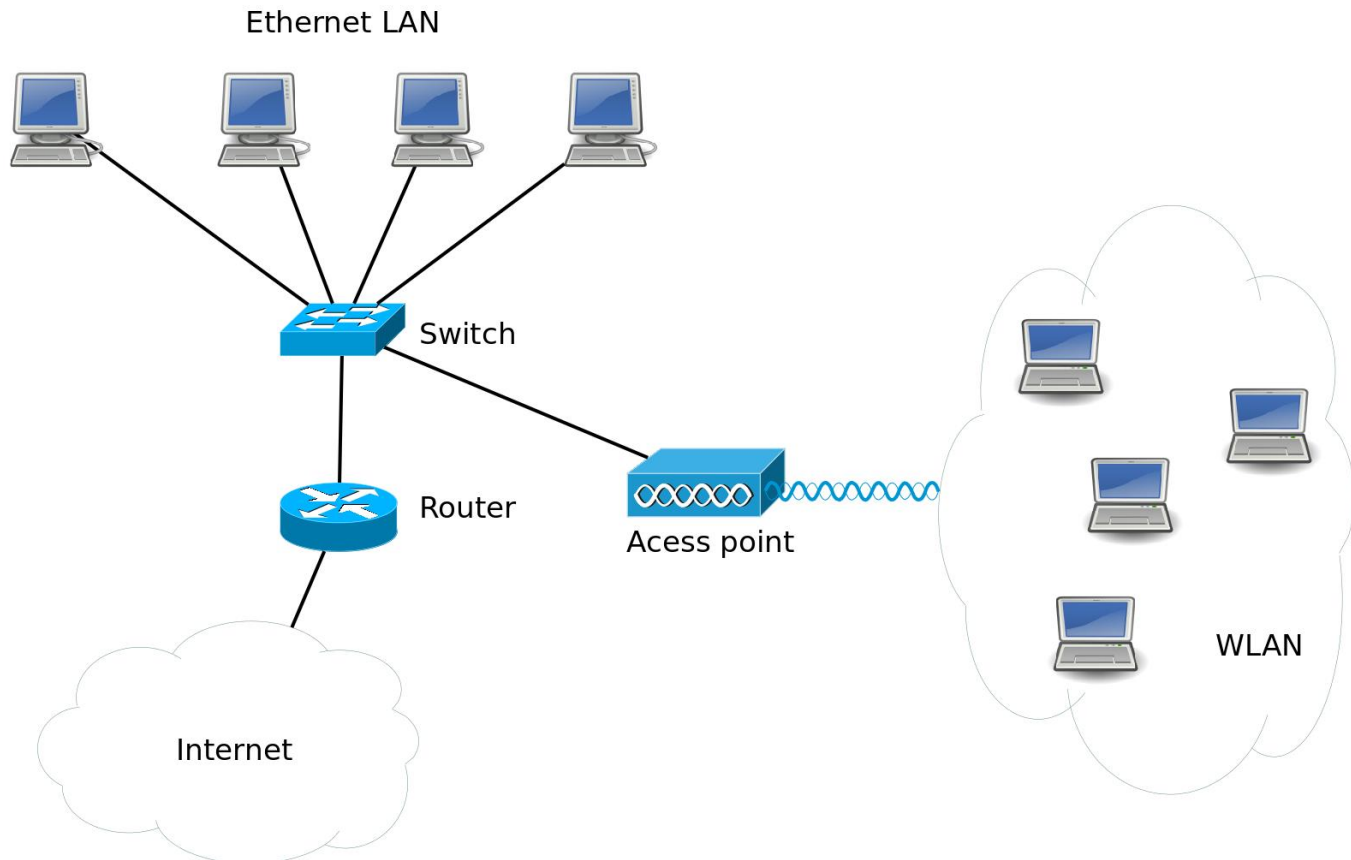
Radio-based networks – **Wireless LANs, WLANs** – have become more and more popular

- WLANs allow ubiquitous computing – “anytime and anywhere”
- Historical origin: ALOHAnet (1971) – radio network for linking the main islands of Hawaii with a central computer (9.600 bps)
- WLANs follow a star topology – central base stations – **access points** - facilitate the forwarding of the data packets to the reachable computers
- IEEE 802.11 specifies WLAN standards, e.g.
 - 802.11a – 54 Mbps in the 5 GHz frequency band
 - 802.11b – 11 Mbps in the 2,4 GHz frequency band
 - 802.11i – improvement in security

WLAN – Wireless LAN (2/6)

2

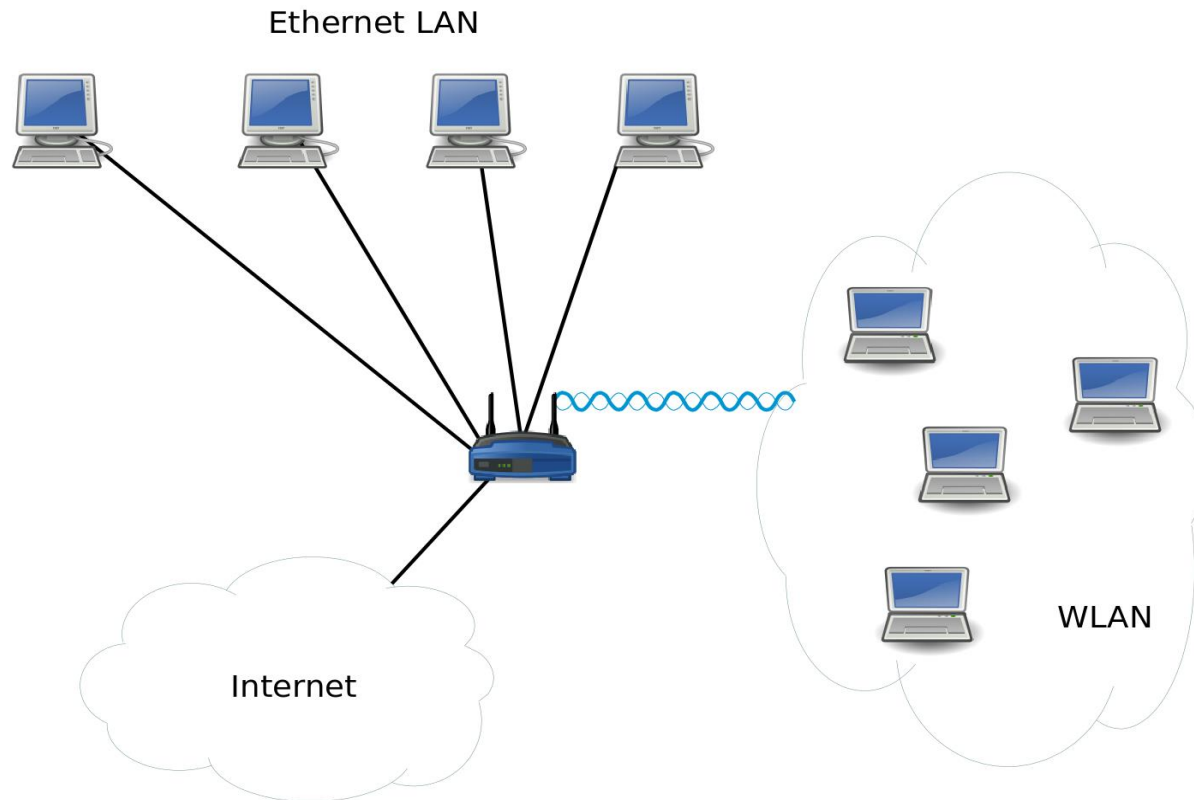
Connection of Ethernet Network with Wireless LAN:



WLAN – Wireless LAN (3/6)

3

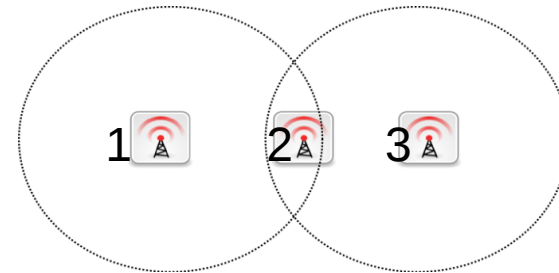
Nowadays, one all-in-one device (*WLAN-Router*) is often used instead of 3 connected devices (*Access Point*, *Switch* and *Router*):



WLAN – Wireless LAN (4/6)

4

- Multiple access regulation proceeds in a way similar to CSMA/CD in the Ethernet. However, collisions are still possible, e.g. in case of *hidden node problem*:
 - Nodes 1 and 3 can reach node 2, but are hidden from each other
 - Node 2 meets collisions of signals from nodes 1 and 3
- Multiple Access with Collision Avoidance for Wireless (MACAW) is used to elaborate this issue
 - “Request for Request to send” is used in addition to RequestToSend / ClearToSend frames



WLAN – Wireless LAN (5/6)

5

Security Aspects in WLAN (1/2):

- Due to the nature of the transmission medium the security level in radio-based networks is considerably less than in wired networks
- Physical contact is not necessary to eavesdrop or carry out unauthorized use
- Discovering WLANs is also not difficult – “parking lot attacks”
- Attacks on WLANs
 - Passive attacks to eavesdrop and decrypt data traffic based on statistical analysis
 - Active attacks ...

WLAN – Wireless LAN (6/6)

6

Security Aspects in WLAN (2/2):

- To protect WLANs, originally the encryption protocol **WEP** – Wired Equivalent Privacy – was defined in IEEE 802.11b
- WEP protocol is based on a secret symmetric key that is agreed on between the AP and the participating computers
- **Caution:**
 - WEP is based on the unsafe encryption RC4 algorithm and can easily be cracked
 - Therefore in WLANs today it is preferable to use WPA, or even better WPA2 (AES), as the encryption protocol
 - But, if Wi-Fi Protected Setup (WPS) is used, it allows attacker to perform a brute-force attack to get WPS PIN and therefore makes WPA/WPA2 unsafe

PAN – Personal Area Network

7

Interest is growing rapidly in wireless transmission technology in the range of a few meters for networking data communication-enabled end devices like printers, headsets, PCs ...

PAN – Personal Area Network – spatially limited data communication area. Wireless PAN is regulated in IEEE 802.15

Transmission methods in the WPAN:

- **Infrared** – Coupling via infrared communication port (IrDA) – visual contact needed
- **Bluetooth** – radio-based communication in the 2,4 GHz ISM frequency range, transmission rates up to 3 Mbps (BT 2.0 + EDR)
- **Z-Wave** – radio-based communication for home automation systems
- ...

IEEE 802 Standardization (1/2)

8

Nr.	Designation	Content
802.1	High Level Interface	Treats common aspects of all LANs according to IEEE 802, such as addressing, management, internetworking
802.2	Logical Link Control	Defines the LLC protocol (TCP/IP layer 2)
802.3	CSMA/CD	Ethernet protocol standard
802.4	Token Passing Bus	Token Bus protocol
802.5	Token Passing Ring	Token Ring protocol
802.6	MAN	Treats Metropolitan Area Network Standard
802.7	Broadband Technical Advisory Group	Advices the other IEEE 802 groups in the area of broadband technology
802.8	Fiber Optical Technical Advisory Group	Advices the other IEEE 802 groups in the area of fiber optic technology
802.9	Integrated Voice and Data Networks	Treats LAN variants that can handle data and voice equally (Isochronous Ethernet)

IEEE 802 Standardization (2/2)

9

Nr.	Designation	Content
802.10	Network Security	Treats security in LANs
802.11	Wireless LAN	Treats wireless local networks
802.11g	<i>Wireless LAN</i>	<i>up to 54 Mbps</i>
802.11n	<i>Wireless LAN</i>	<i>from 54 up to 600 Mbps</i>
802.12	100 Base VG AnyLAN	Faster LAN standard, in competition with Fast Ethernet
802.14	Cable Data Modem	Treats implementation of cable networks for data communication
802.15	Wireless PAN	Treats wireless networks over short distances
802.16	Broadband Fixed Wireless	Wireless networks without mobility(MAN)
802.16a	<i>WiMAX</i>	<i>up to 70 Mbps</i>
802.16m	<i>WiMAX Release 2</i>	<i>up to 1 Gbps</i>
802.17	Resilient Packet Rings	Optimal transport via optical fiber rings
802.20	Wireless Mobility	Wireless broadband networks
802.21	Media Independent Handover	Media independent (seamless) handover
802.22	WRAN	Wireless Regional Area Network