



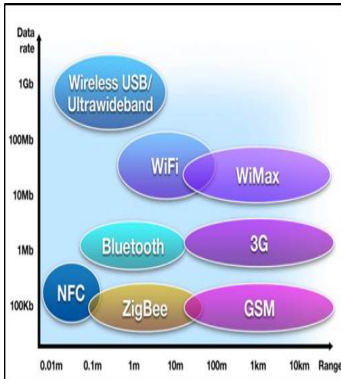
ITWS-II

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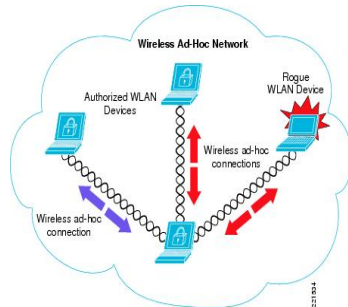
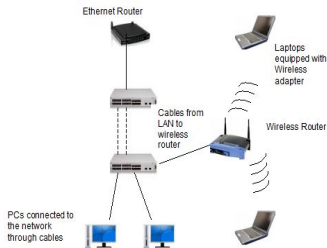
Personal Area Networks - Wi-Fi, Bluetooth and ZigBee



Standard	Family	Downlink (Mbps)	Uplink (Mbps)	Coverage
WiFi	802.11	11/54/150/300		100m
WIMAX	802.16e	144	35	10km
UMTS (3G) /HSPA (3.5G)	3GPP	14.4	5.76	30km
LTE (4G)	3GPP	360	80	30km

Wi-Fi - IEEE 802.11 a/b/g/n

- ▶ Point-to-Multipoint (Access Point) - Infrastructure mode
- ▶ Point-to-Point (Ad hoc)
- ▶ Multipoint-to-Multipoint (Mesh Network)

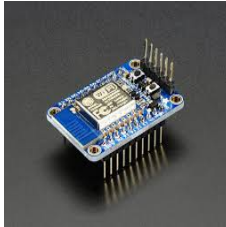


Bluetooth - IEEE 802.15.1

- ▶ Cable replacement
- ▶ Low cost
- ▶ Low power
- ▶ Small size
- ▶ For mobile devices

	Bluetooth (v1)	ZigBee
<i>Protocol Stack</i>	250 kb	< 32 kb (4kb)
<i>Range</i>	10 - 100 meters	30 - 100 meters
<i>Link Rate</i>	1 Mbps	250 kbps
<i>Battery</i>	rechargeable	non-rechargeable
<i>Devices</i>	8	2 ¹⁶
<i>Air Interface</i>	FHSS	DSSS
<i>Usage</i>	frequently	infrequently
<i>Network Join Time</i>	long	short
<i>Extendibility</i>	no	yes
<i>Security</i>	PIN, 64 bit, 128 Bit	128 bit, AES

Communication Aspects - Short Range



Communication Aspects - Wide Area

3G Shield



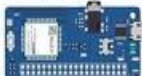
4G/LTE Shield



GPS Shield

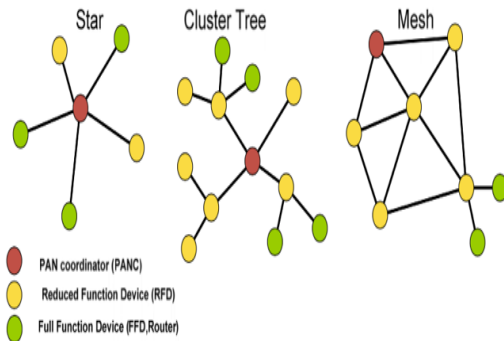


GPRS Shield



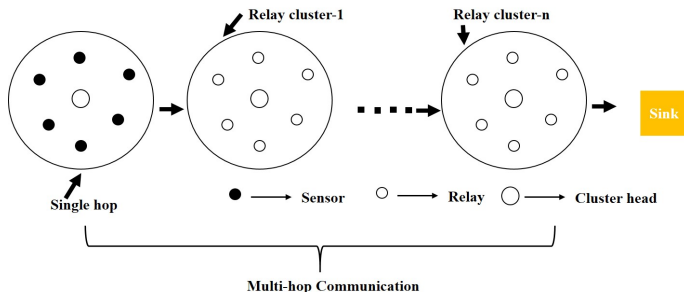
ZigBee - IEEE 802.15.4

- ▶ Low power consumption
- ▶ Simple Design
- ▶ low costs



Single stage and Multi-stage Networks -Wireless Sensor Networks(WSN)

- ▶ MAC (Medium Access Control) layer provides communication for star, mesh, and cluster tree-based topologies
- ▶ The transmission range of the nodes is assumed to be 10 to 100m with data rates of 20 to 250 kbps



ZigBee - IEEE 802.15.4



- ▶ Industrial and Commercial
Monitors, Movement Sensors, Automation
- ▶ Personal Healthcare
Patient monitors, Remote Diagnosis Data loggers
- ▶ Building Automation
Security, Lighting, Fire and Safety systems
- ▶ Automotive
Service controls, Inventory tracking

Cellular

