

# **Wireless and Mobile Networks**

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طريقة الدخول للمقرر الدراسي  
عبر صفحة الانترنت

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مدرس

تكنولوجيا المعلومات

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أحمد محمد ربيع سيد  
كلية الحاسبات والمعلومات



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## الأبحاث العلمية علي موقع الجامعة

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« توهيدي ماجستير فنون تطبيق

Wireless and Mobile Netwo «

Communication Terchnology «

Inbternet Applications «

Information Security «

## Course Description



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1 - تحميل الملف

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المرفقات:

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## Lecture 1



اقرأ المزيد

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## رابط الموقع الشخصي

<http://staff.du.edu.eg/1058>



# Course Objectives

**By the end of this course the student be able to:**

- 1- Understand and apply the principles and practices of wireless networks.
- 2- Identify the different types of mobile network generations.
- 3- Understand Ad Hoc and mesh networks.
- 4- Provide education and training of mobile edge computing.
- 5- Understand traffic engineering.
- 6- Demonstrate different wireless media.
- 7- Explain mobile networks.
- 8- Understand IEEE technologies.

# Course Contents

Fundamentals of Wireless Communication, Wireless communication system, Wireless media.	1
Wireless Communication Channel Specifications, Types of Wireless Communication Systems.	2
Wireless Network Architecture, Classification of Wireless Networks.	3
Wireless Networking Issues, QoS Management.	4
Mobile and wireless generation networks, IEEE technologies.	5
Wireless Body Area Networks, Network Protocols WBAN Technologies, WBAN Applications	6
Wireless Personal Area Networks, WPAN Components, WPAN Technologies and Protocols, WPAN Applications.	7
Midterm Exam.	8
Cellular network, Principles of cellular network functionalities.	9
Mobile and wireless generation networks, IEEE technologies.	10
Mobile-Edge Computing, Network virtualization technology,	11
Wireless Ad Hoc Networks, Mobile Ad Hoc Networks.	12
Wireless Sensor Networks, Wireless Mesh Networks.	13
Internet of Things, Near-field communication, Near-field communication, Fog networking,	14

## Course References

Wireless and Mobile Networks, Concepts and Protocols, Dr. Sunilkumar S. Manvi, Dr. Mahabaleshwar S. Kakkasageri, WILEY, 2016.

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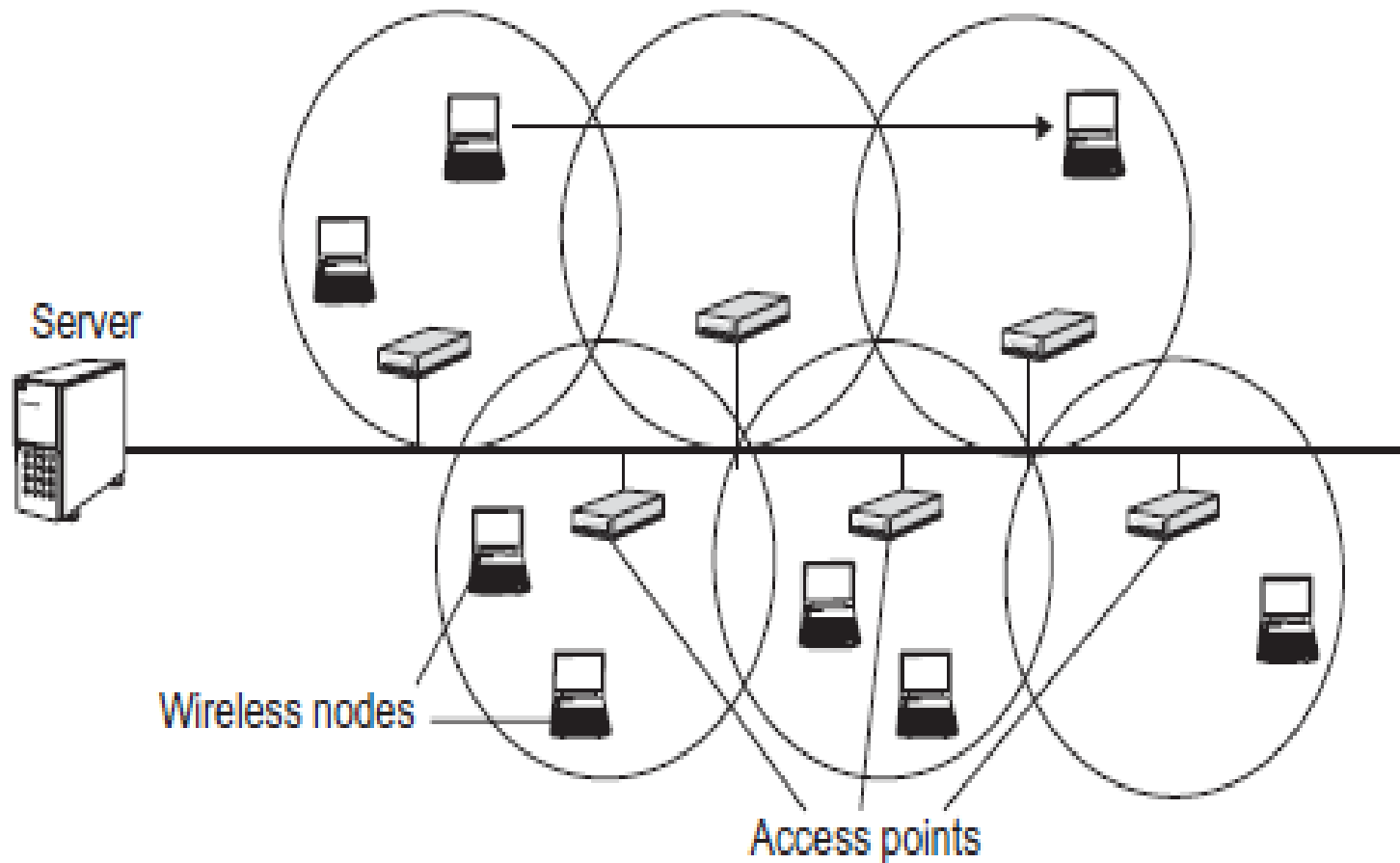
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# Chapter 1

## Basics of Wireless Networks

A **wireless network** is a computer network that **uses wireless data** connections between network nodes. Wireless networking is a method by which homes, telecommunications networks and business installations **avoid the costly process of introducing cables** into a building, or as a connection between various equipment locations.

Admin telecommunications networks are generally implemented and administered **using radio communication**. This implementation takes place at the physical level (layer) of the OSI model network structure. **Examples of wireless networks** include cell phone networks, wireless local area networks (WLANs), wireless sensor networks, satellite communication networks, and terrestrial microwave networks.

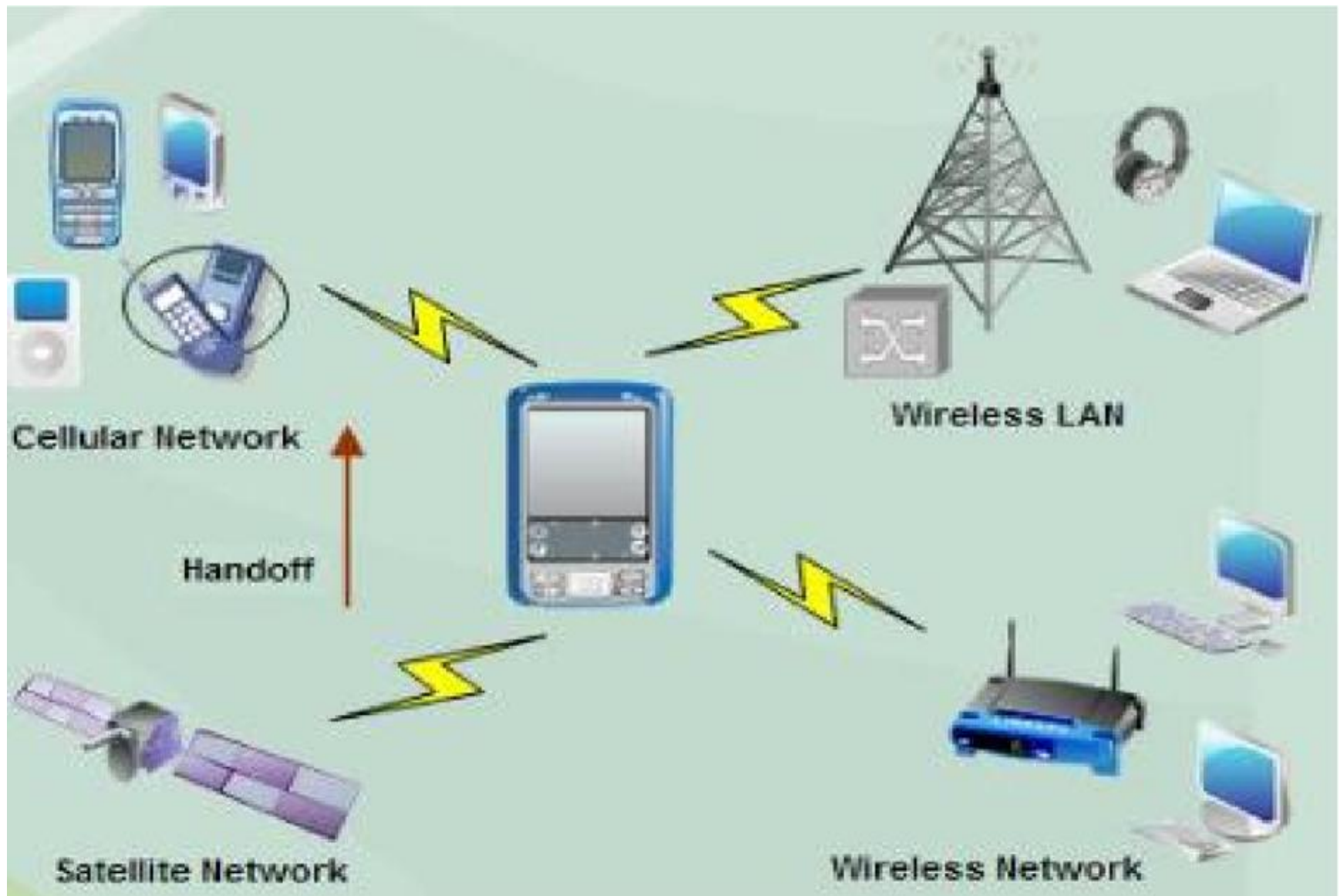


An example of a wireless network.

Activity/Category	Wireless Network	Wired Network
Freedom of movement for users	Users can access network from anywhere within range.	Users location limited by need to use cable and/or connect to a port.
Sharing Files	Easier with wireless network as you do not need to be cabled to network, though transfer speeds may be slower.	Generally less convenient as you have to be cabled in, but transfer speeds often faster.
Cables	Far less complicated, disruptive, and untidy cabling needed.	Lots of cables and ports needed which can be a headache.
Business	For businesses dealing with public, customers like and often expect wireless, so wireless can increase income.	Wired networks are not convenient for public use, but sometimes acceptable for a traditional office.
Connection speeds	Usually slower than wired.	Usually faster than wireless.
Security	Less secure than wired. Both bandwidth and information can sometimes be accessed.	More secure than wireless.
Set up	Upgrading to a wireless network can be difficult and expensive.	Can also be difficult and expensive to set up.



**Cellular phones** are part of **huge wireless network** systems. People use these phones daily to communicate with one another. Sending information overseas is possible through wireless network systems by using satellites and other signals to communicate across the world. Wireless networks are **restricted by distance**.

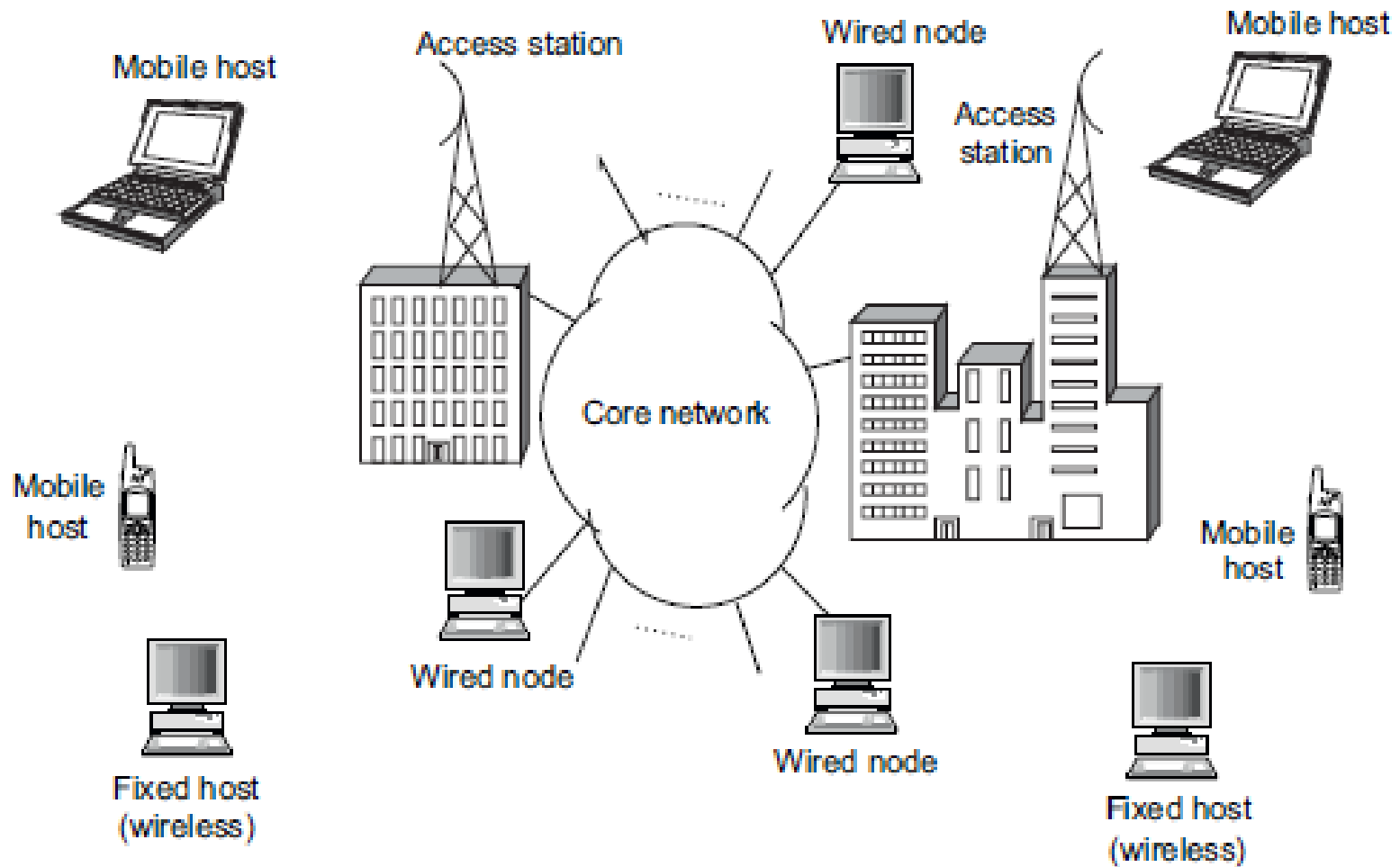


Wireless network allows you to connect your computer to a network **using radio waves** instead of wires. As long as you are within range of a wireless coverage area, you can move your computer from one place to another while maintaining access to networked resources. This can make networking extremely portable.

The major function of the communication system is to **convert information into a format appropriate for the transmission medium** and to modulate analog signals or bits for transmission over channel.

The channel (either wireless or wired medium) **propagates** the electromagnetic waves (signals) and the intended receiver **picks** the signal.

A **wireless network architecture** defines the elements of a wireless network that participate in communication across the geographically distributed areas. A typical wireless network architecture It comprises **mobile hosts, fixed hosts,** access network consisting of **access stations,** and a **core network** that supports mobility and switching.



Wireless network architecture.

A **mobile host** could be a mobile phone, laptop, note book computers, etc. Mobile hosts are capable of **moving** from one place to another by maintaining wireless connection with the network. They can move from one access area (covered by a access station) to another. **Fixed wireless host** is immobile, that is, it **cannot move**. Examples of fixed wireless hosts are wireless web servers, printers, etc.

Access network comprises several **access stations** that cover a certain geographical area and are responsible for **providing communication services to all the hosts** within its coverage area.

Access station is sometimes referred to as the base station or access point or wireless router.



The **core network** comprises active components that **perform data switching** (either circuit or packet switched) between different access stations and **provide location and mobility services** to facilitate communication from one mobile host to another mobile host, mobile host to wired node, fixed host to wired node, fixed host to mobile host, etc.

# **Wireless Networking Standards**

802.11a

802.11b

802.11g

802.11n

Frequency used

5 GHz

2.4 GHz

2.4 GHz

2.4 GHz  
5 GHz

Transmission Speed

54 Mbps

11 Mbps

54 Mbps

600 Mbps

Distance

45 Meters

91 Meters

91 Meters

300 Meters

Compatibility

—

g

b

a/b/g

**802.11ac**

Frequency used

**5 GHz**

Transmission Speed

**1 Gbps**

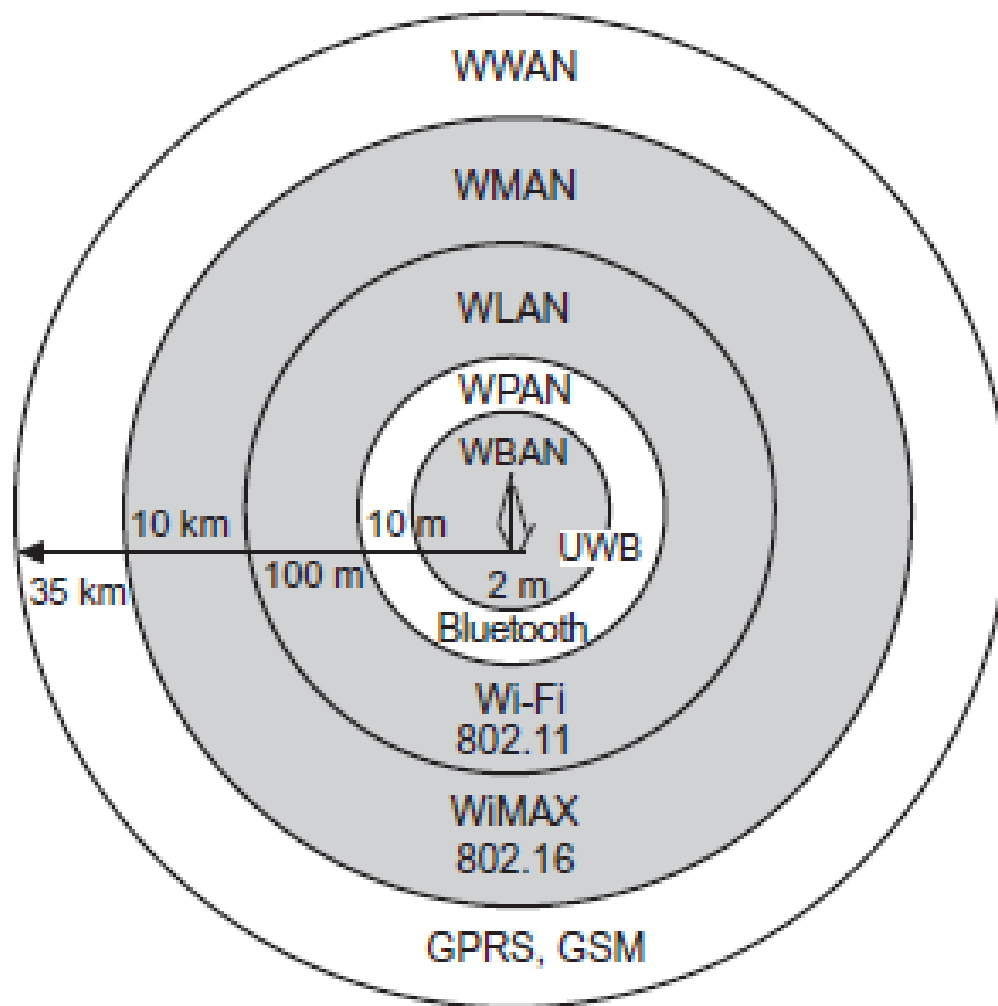
Distance

**300 Meters**

Summary of wireless networking standards

<i>Name</i>	<i>Frequency band</i>	<i>Bit rate</i>	<i>Signal range</i>	<i>Modulation</i>	<i>Applications</i>
Bluetooth (IEEE 802.15)	2, 4 GHz	1, 2 Mbps	10 m	GMSK; device-to-device	Peer-to-peer
UWB (IEEE 802.15.3)	4, 8–10 GHz	480 Mbps	10 m	OFDM	Health monitoring
ZigBee (IEEE 802.15.4)	2, 4 GHz	250 kbps	10 m	O-QPSK	Control and automation
IEEE 802.11a	5 GHz	54 Mbps	100 m, outdoor; 30 m, indoor	OFDM, BPSK, QPSK, 16 QAM, 64 QAM	Wireless LAN
IEEE 802.11b	2, 4 GHz	11 Mbps	110 m, outdoor; 35 m, indoor	BPSK, QPSK, 64 QAM, CCK	Wireless LAN
IEEE 802.11g	2, 4 GHz	54 Mbps	110 m, outdoor; 35 m, indoor	OFDM, BPSK, QPSK, 16 QAM, 64 QAM	Military applications; example: high energy RADAR
IEEE 802.11n	2, 4/5 GHz	150 Mbps	160 m, outdoor; 70 m, indoor	MIMO	Wireless LAN
IEEE 802.16	10–66 GHz	134 Mbps	5 km	QPSK, 16 QAM, 64 QAM	Wireless MAN
IEEE 802.16a	2–11 GHz	75 Mbps	10 km	BPSK, QPSK, 16 QAM, 64 QAM	Network access for line-of-sight applications
IEEE 802.16d	2–11 GHz	75 Mbps	8 km	BPSK, QPSK, 16 QAM, 64 QAM	Last mile connectivity applications
IEEE 802.16e	2–6 GHz	30 bps; downlink/ uplink	5 km	BPSK, QPSK, 16 QAM, 64 QAM	Mobile and wireless applications, WMAN

# **Classification of Wireless Networks**

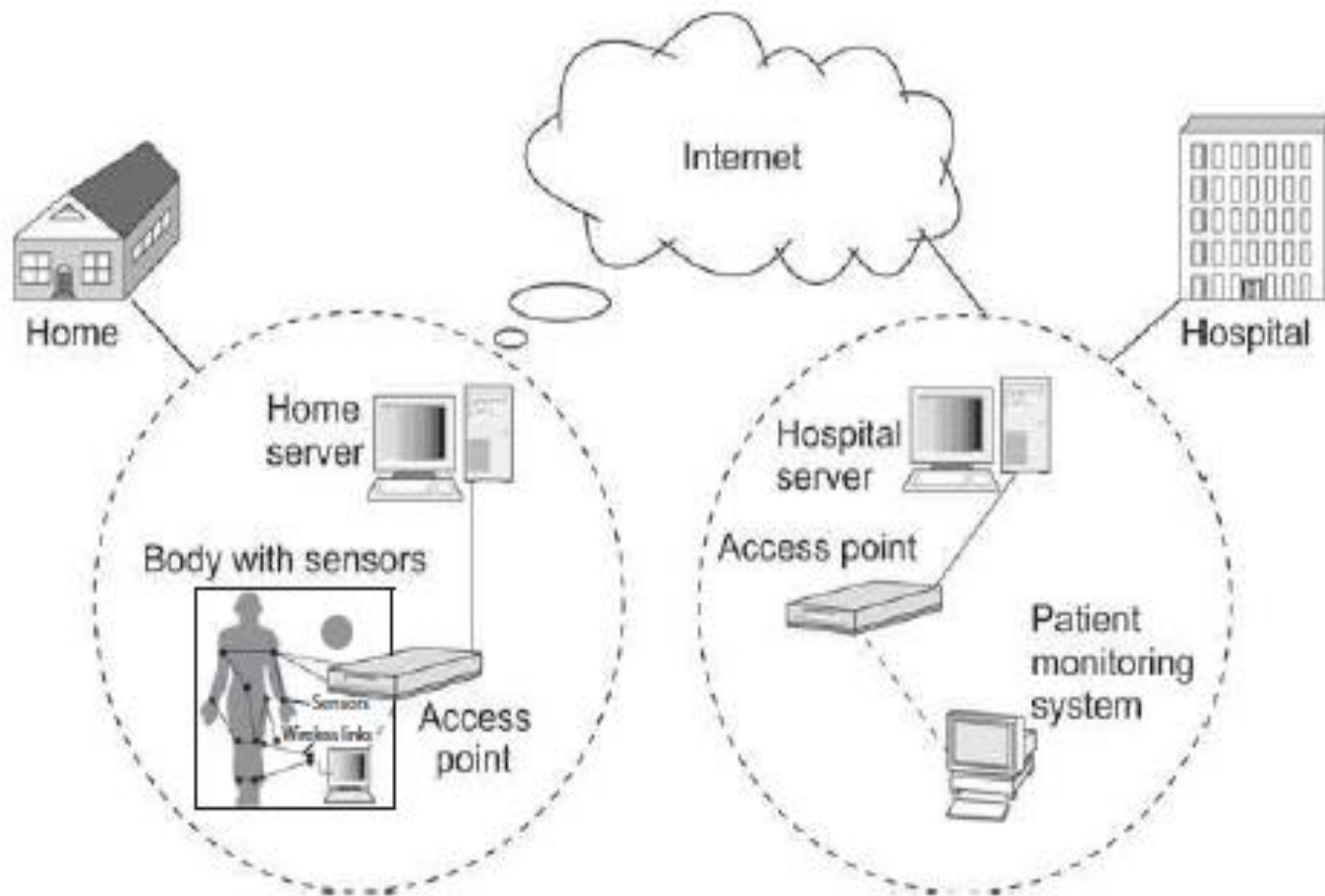


Classification of wireless networks.

**Wireless networks** are most frequently classified into five specific groups. The areas of application and the signal range are the main criteria for this division.

The first group, Wireless Body Area Networks (WBANs), defines wireless networks that have a maximal signal range of 2 m and these networks are used for interconnecting the respective devices to one another within the surface of the body.





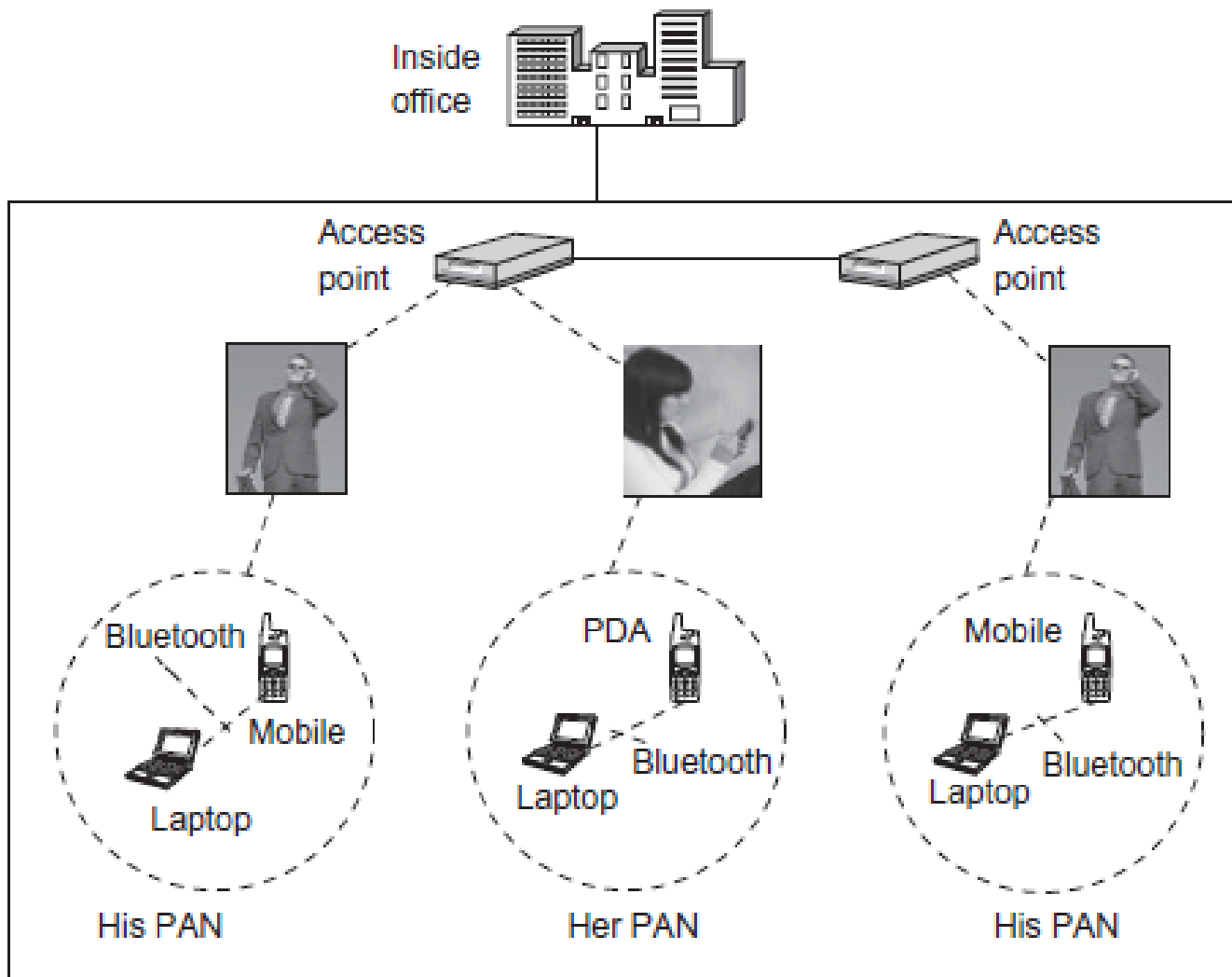
Wireless body area network application scenario.

**WBAN** consists of a set of **mobile** and compact intercommunicating **sensors**, either **wearable** or implanted into **the human body**, which monitor vital body parameters and movements. These devices, communicating through wireless technologies, **transmit data from the body to a home base station**, from where the **data can be forwarded to a hospital**, clinic, or elsewhere, in real time.

The basic concept of **WBAN** in such applications is the fusion of a set of mobile, compact units that enable **transfer of vital parameters between the patient's location and the clinic or the doctor.** The vital signs data flow passes a chain of WBAN modules from each sensor to a main body station, which consolidates the data streams of all sensor modules attached. It transmits the data to a home base station, from where they can be forwarded via telephone line or Internet.

Patient at home is monitored and the important parameters are stored at home server through access point; if any variations happen in the monitored parameters, the information is passed onto the hospital server and patient monitoring system. This will facilitate the attention of nurses and doctors at the hospital for further treatment of the patient. Other applications of this technology include sports, military, or security. Extending the technology to new areas could also assist communication by seamless exchanges of information among individuals or between individual and machines.

The second group, Wireless Personal Area Networks (WPANs), defines wireless networks that have a maximal signal range of **10 m** and these networks are used for interconnecting the respective devices to one another. WPAN is a computer network used for communication among computer devices (including telephones and PDAs) close to **one person**.



Wireless personal area network application scenario.




The reach of a WPAN is typically a few meters. WPAN can be used for communication **among the personal devices themselves** (intrapersonal communication), or for connecting to a higher level network and the Internet (an uplink). From one WPAN to another **WPAN**, the wireless communication is made possible with the help of access points which use **Wi-Fi** as a communication standard.

**WPAN** is made possible with network technologies, such as **infrared data association** (IrDA), **Bluetooth**, **UWB**, and **ZigBee**. The IrDA defines physical specifications of communication protocol standards for the short-range exchange of data over infrared light, for typical use in WPANs.



**Bluetooth** is an industrial specification for WPANs, also known as IEEE 802.15.1. Bluetooth is a radio standard and communications protocol primarily designed for **low power consumption**, with a short range (power class dependent: **1, 10, and 100 m**) based around low-cost transceiver microchips in each device.

**Ultra-Wide Band (UWB)** is a radio technology that can be used at very low energy levels for **short-range, high-bandwidth** communications by using a large portion of the radio spectrum. **ZigBee** is the name of a specification for a suite of **high-level communication** protocols using small, low-power digital radios based on the **IEEE 802.15.4** standard for WPANs, such as wireless headphones connecting with cell phones via short-range radio.

TECHNOLOGY	DATA RATE
  	<p data-bbox="1340 605 1528 668"><math>\geq 1</math>Gbps</p> <p data-bbox="1319 786 1547 849">1-3 Mbps</p> <p data-bbox="1331 986 1555 1049">250 Kbps</p>