Wireless and Mobile Networks

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Lecture 20

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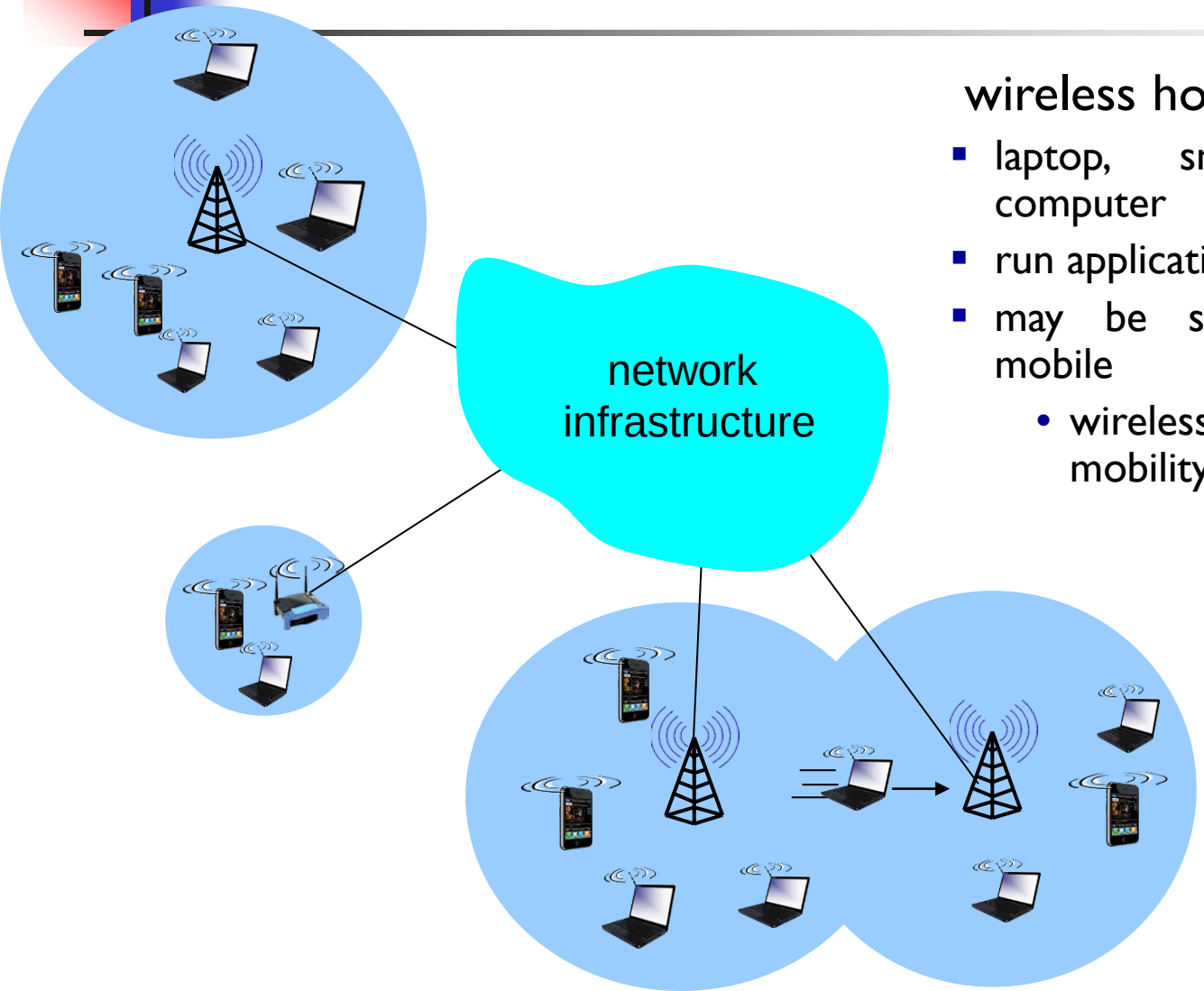
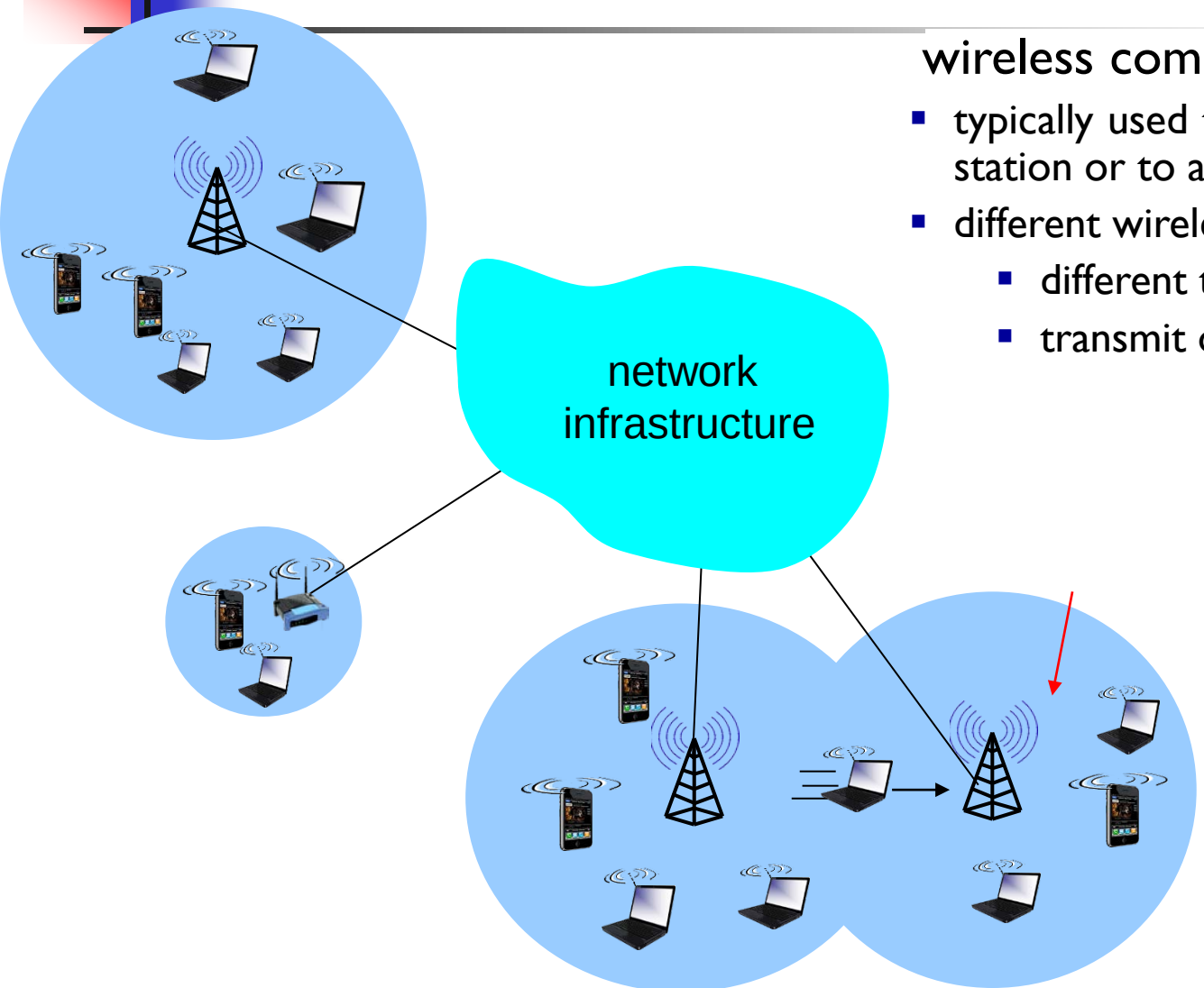
Introduction



wireless hosts

- laptop, smartphone or desktop computer
- run applications
- may be stationary (non-mobile) or mobile
  - wireless does *not* always mean mobility

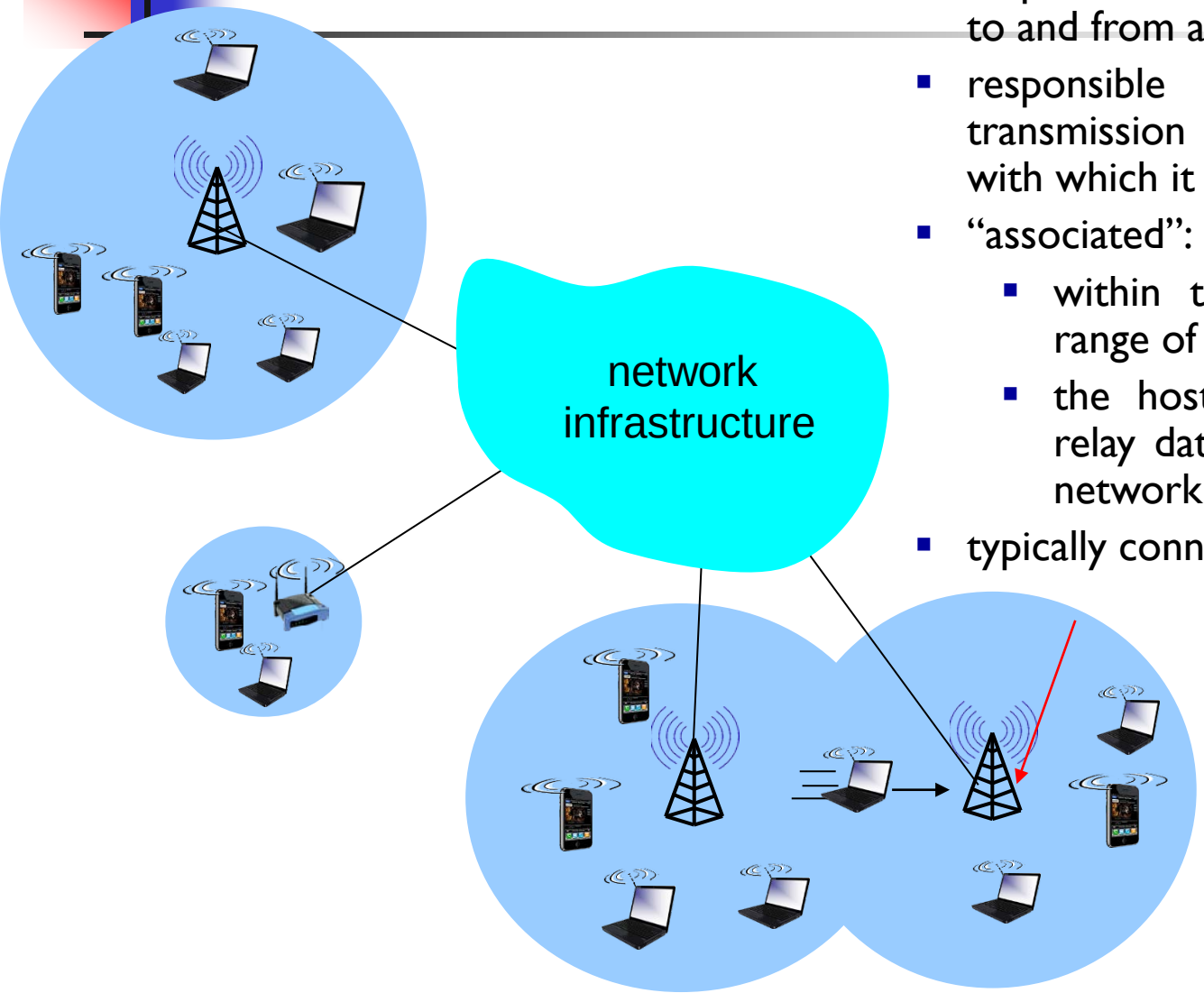
Introduction



wireless communication link

- typically used to connect mobile(s) to base station or to another wireless host
- different wireless link tech
  - different trans. rates
  - transmit over different distances

Introduction



base station 

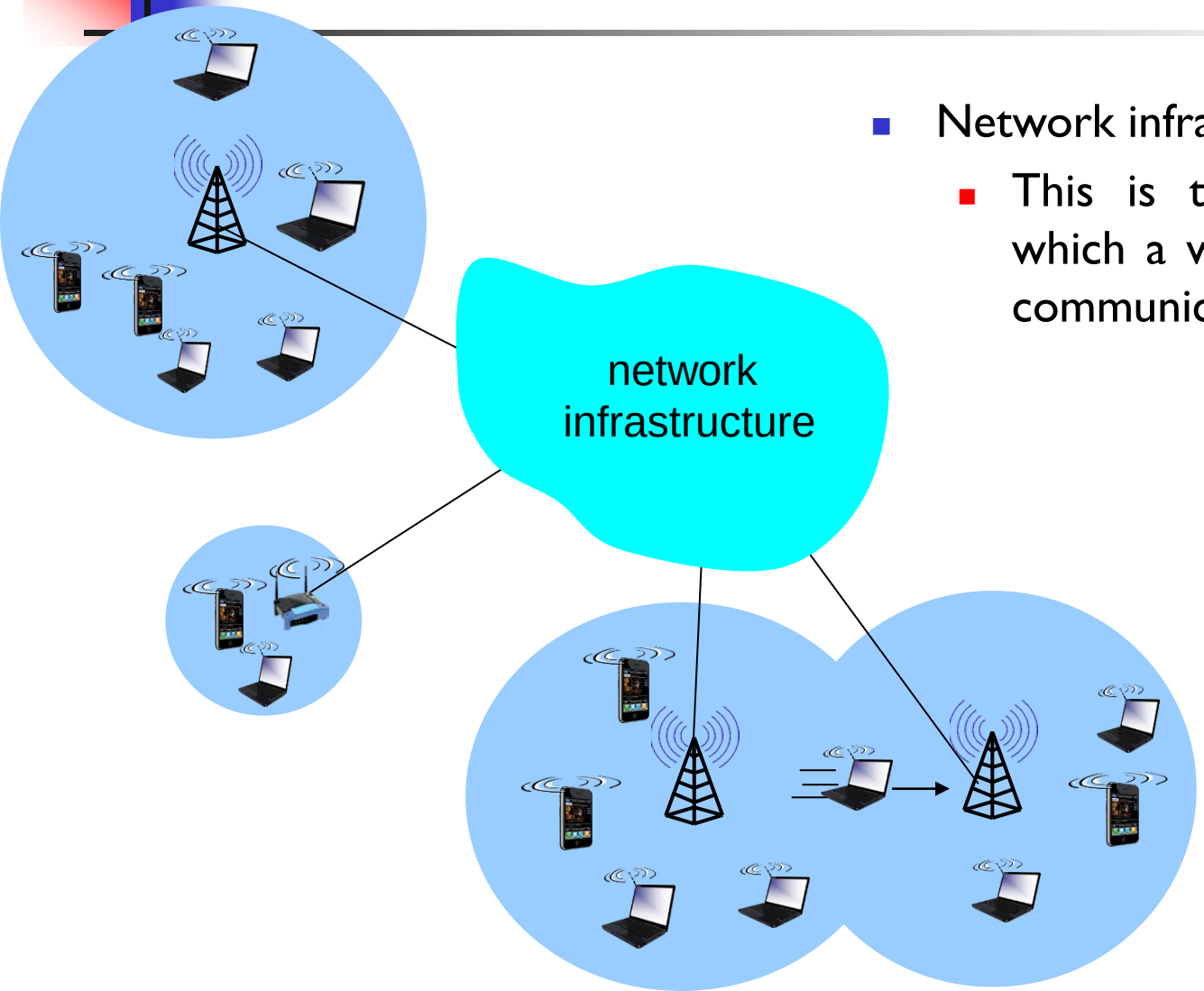
- responsible for sending and receiving data to and from a wireless host
- responsible for coordinating the transmission of multiple wireless hosts with which it is associated
- "associated":
  - within the wireless communication range of the base station
  - the host uses the base station to relay data between it and the larger network
- typically connected to wired network

Introduction

- Hosts associated with a base station are often referred to as operating in ***infrastructure mode***
  - all traditional network services (e.g., address assignment and routing) are provided by the network to which a host is connected via the base station.

- In ***ad hoc networks***, wireless hosts have no such infrastructure with which to connect.
  - the hosts themselves must provide for services such as routing, address assignment, and more.

Introduction



- Network infrastructure.
  - This is the larger network with which a wireless host may wish to communicate.

Introduction

- At the highest level we can classify wireless networks according to two criteria:
  - (i) whether a packet in the wireless network crosses exactly one wireless hop or multiple wireless hops.
  - (ii) whether there is infrastructure such as a base station in the network.

Single-hop, Infrastructure-based

- These networks have a base station that is connected to a larger wired network (e.g., the Internet).
- Furthermore, all communication is between this base station and a wireless host over a single wireless hop.
- Example: the 802.11 networks you use in the classroom, café, or library.

Single-hop, Infrastructure-less

- In these networks, there is no base station that is connected to a wireless network.
- However, one of the nodes in this single-hop network may coordinate the transmissions of the other nodes.
- Bluetooth networks and 802.11 networks in ad hoc mode are single-hop, infrastructure-less networks.

Multi-hop, Infrastructure-based

- In these networks, a base station is present that is wired to the larger network.
- However, some wireless nodes may have to relay their communication through other wireless nodes in order to communicate via the base station.
- Some wireless sensor networks and so-called wireless mesh networks fall in this category.

Multi-hop, Infrastructure-less

- There is no base station in these networks, and nodes may have to relay messages among several other nodes in order to reach a destination.
- Nodes may also be mobile, with connectivity changing among nodes—a class of networks known as mobile ad hoc networks (MANETs).
- If the mobile nodes are vehicles, the network is a vehicular ad hoc network (VANET).
- As you might imagine, the development of protocols for such networks is challenging and is the subject of much ongoing research.

Wireless Links and Network Characteristics

- Let's begin by considering a simple wired network, say a home network, with a wired Ethernet switch interconnecting the hosts.

- If we replace the wired Ethernet with a wireless 802.11 network, a wireless network interface would replace the host's wired Ethernet interface, and an access point would replace the Ethernet switch, but virtually no changes would be needed at the network layer or above.

- This suggests that we focus our attention on the link layer when looking for important differences between wired and wireless networks.

Wireless Links and Network Characteristics

- Indeed, we can find a number of important differences between a wired link and a wireless link:
  - Decreasing signal strength
    - Electromagnetic radiation attenuates as it passes through matter (e.g., a radio signal passing through a wall).
    - Even in free space, the signal will disperse, resulting in decreased signal strength (sometimes referred to as path loss) as the distance between sender and receiver increases.

Wireless Links and Network Characteristics

- Indeed, we can find a number of important differences between a wired link and a wireless link:
  - Interference from other sources
    - Radio sources transmitting in the same frequency band will interfere with each other.
    - In addition to interference from transmitting sources, electromagnetic noise within the environment (e.g., a nearby motor, a microwave) can result in interference.

Wireless Links and Network Characteristics

- Indeed, we can find a number of important differences between a wired link and a wireless link:
  - Multipath propagation
    - Multipath propagation occurs when portions of the electromagnetic wave reflect off objects and the ground, taking paths of different lengths between a sender and receiver.
    - This results in the blurring of the received signal at the receiver.
    - Moving objects between the sender and receiver can cause multipath propagation to change over time.