

# Wireless Communication

## Lecture 12

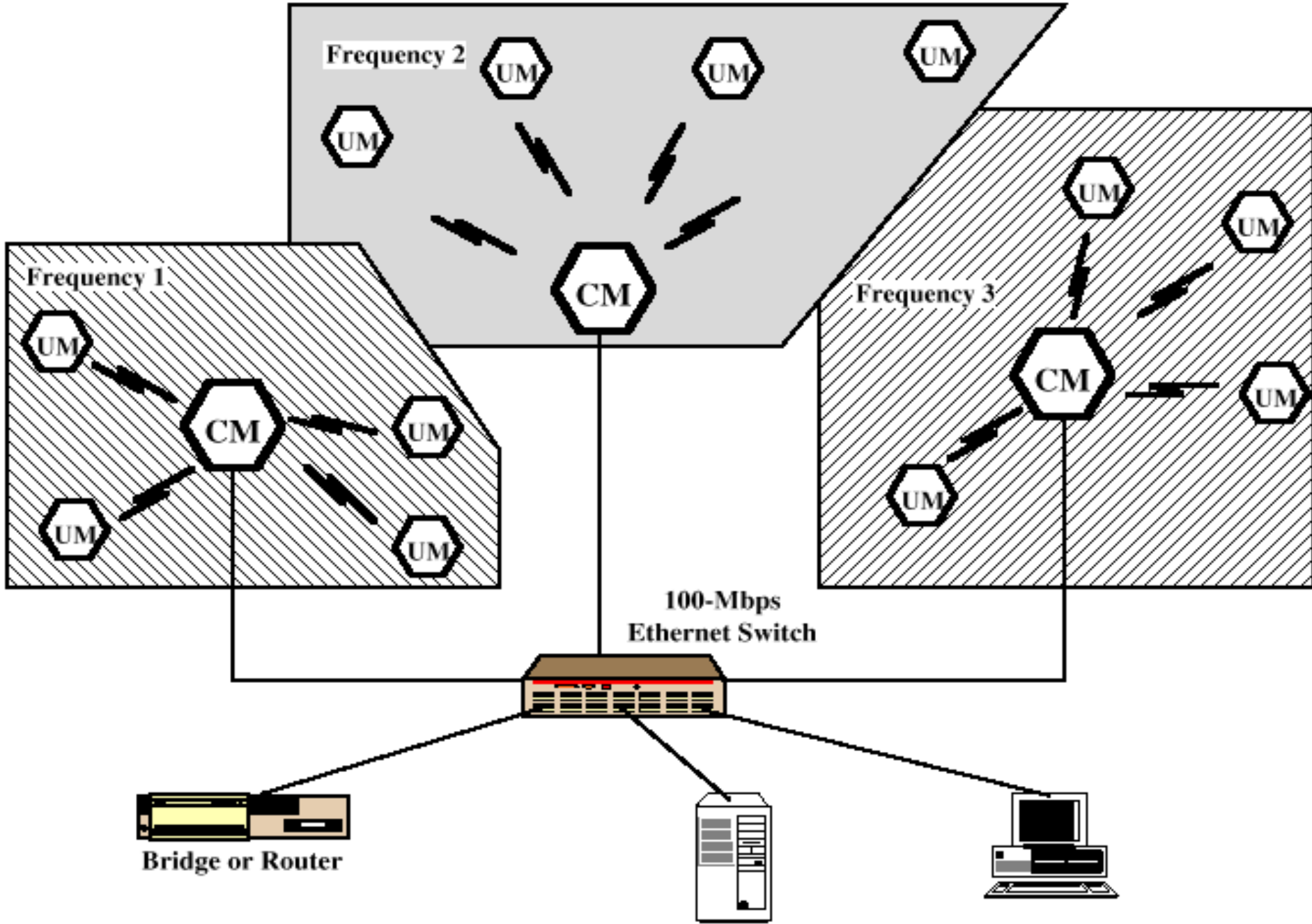
### Wireless LAN Technology

# Wireless LAN Applications

- LAN Extension
- Cross-building interconnect
- Nomadic Access
- Ad hoc networking

# LAN Extension

- Wireless LAN linked into a wired LAN on same premises
  - Wired LAN
    - Backbone
    - Support servers and stationary workstations
  - Wireless LAN
    - Stations in large open areas
    - Manufacturing plants, stock exchange trading floors, and warehouses



**Figure 13.2 Example Multiple-Cell Wireless LAN Configuration**

# Cross-Building Interconnect

- Connect LANs in nearby buildings
  - Wired or wireless LANs
- Point-to-point wireless link is used
- Devices connected are typically bridges or routers

# Nomadic Access

- Wireless link between LAN hub and mobile data terminal equipped with antenna
  - Laptop computer or notepad computer
- Uses:
  - Transfer data from portable computer to office server
  - Extended environment such as campus

# Ad Hoc Networking

- Temporary peer-to-peer network set up to meet immediate need
- Example:
  - Group of employees with laptops convene for a meeting; employees link computers in a temporary network for duration of meeting

# Wireless LAN Requirements

- Throughput
- Number of nodes
- Connection to backbone LAN
- Service area
- Battery power consumption
- Transmission robustness and security
- Collocated network operation
- License-free operation
- Handoff/roaming
- Dynamic configuration



# Wireless LAN Categories

- Infrared (IR) LANs
- Spread spectrum LANs
- Narrowband microwave

# Strengths of Infrared Over Microwave Radio

- Spectrum for infrared virtually unlimited
  - Possibility of high data rates
- Infrared spectrum unregulated
- Equipment inexpensive and simple
- Reflected by light-colored objects
  - Ceiling reflection for entire room coverage
- Doesn't penetrate walls
  - More easily secured against eavesdropping
  - Less interference between different rooms

# Drawbacks of Infrared Medium

- Indoor environments experience infrared background radiation
  - Sunlight and indoor lighting
  - Ambient radiation appears as noise in an infrared receiver
  - Transmitters of higher power required
    - Limited by concerns of eye safety and excessive power consumption
  - Limits range

# IR Data Transmission Techniques

- Directed Beam Infrared
- Ominidirectional
- Diffused

# Directed Beam Infrared

- Used to create point-to-point links
- Range depends on emitted power and degree of focusing
- Focused IR data link can have range of kilometers
  - Cross-building interconnect between bridges or routers

# Ominidirectional

- Single base station within line of sight of all other stations on LAN
- Station typically mounted on ceiling
- Base station acts as a multiport repeater
  - Ceiling transmitter broadcasts signal received by IR transceivers
  - IR transceivers transmit with directional beam aimed at ceiling base unit

# Diffused

- All IR transmitters focused and aimed at a point on diffusely reflecting ceiling
- IR radiation strikes ceiling
  - Reradiated omnidirectionally
  - Picked up by all receivers

# Spread Spectrum LAN Configuration

- Multiple-cell arrangement (Figure 13.2)
- Within a cell, either peer-to-peer or hub
- Peer-to-peer topology
  - No hub
  - Access controlled with MAC algorithm
    - CSMA
  - Appropriate for ad hoc LANs



# Spread Spectrum LAN Configuration

- Hub topology
  - Mounted on the ceiling and connected to backbone
  - May control access
  - May act as multiport repeater
  - Automatic handoff of mobile stations
  - Stations in cell either:
    - Transmit to / receive from hub only
    - Broadcast using omnidirectional antenna

# Narrowband Microwave LANs

- Use of a microwave radio frequency band for signal transmission
- Relatively narrow bandwidth
- Licensed
- Unlicensed

# Licensed Narrowband RF

- Licensed within specific geographic areas to avoid potential interference
- Motorola - 600 licenses in 18-GHz range
  - Covers all metropolitan areas
  - Can assure that independent LANs in nearby locations don't interfere
  - Encrypted transmissions prevent eavesdropping

# Unlicensed Narrowband RF

- RadioLAN introduced narrowband wireless LAN in 1995
  - Uses unlicensed ISM spectrum
  - Used at low power (0.5 watts or less)
  - Operates at 10 Mbps in the 5.8-GHz band
  - Range = 50 m to 100 m