

# CS 640 Introduction to Computer Networks

## Lecture 6

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## Today's lecture

- 802.11 wireless LANs
- Network adaptors

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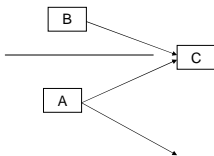
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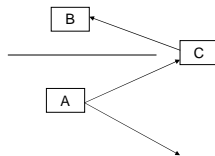
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## Carrier Sense not good for wireless

Hidden terminal  
(can lead to frame loss)



Exposed terminal  
(waste opportunity to send)



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## Wireless LANs (802.11)

- 802.11 uses MACA (collision avoidance)
  - Sender sends Request To Send (RTS) frame
  - Receiver sends a Clear To Send (CTS) frame
  - Sender sends data frame
  - Receiver sends an ACK
  - RTS/CTS are optional (nodes can send data directly and wait for ack)
- 802.11 solves hidden terminal, not exposed terminal

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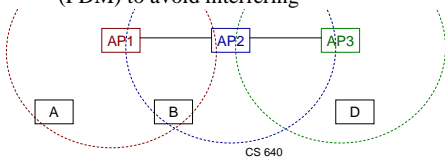
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## Wireless LANs (contd.)

- Power matters
  - Endhosts vs. base stations/access points
  - Range depends on the power levels
  - Access points use multiple frequency bands (FDM) to avoid interfering



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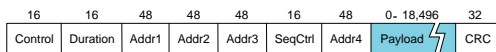
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## 802.11 frame format



- Has space for four 48-bit addresses
  - Not all 4 are used in all frames
  - All 4 needed when transiting distribution system
    - Example: A, AP-1, AP-3, D

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## The 802.11 family

- 802.11b 11 Mbps 2.4 GHz
  - 3 separate channels (frequency bands)
- 802.11a 54Mbps 5 GHz
  - 12 separate channels
- 802.11g 54Mbps 2.4 GHz
  - 3 separate channels

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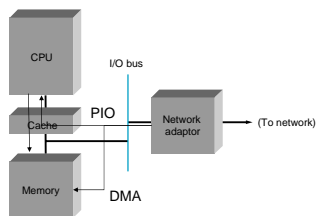
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## Networking at endhosts

What	Where
Application	User space
Layer 3	Kernel
Layer 4	
Layer 2	Adaptor
Layer 1	



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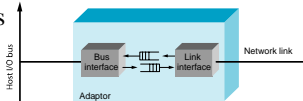
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## Network adaptors

- Device drivers in OS kernel hide details of interaction with network adaptors
- Control interactions
  - Interrupts
  - Registers
- Data transfer
  - Programmed I/O (explicit writes/reads by CPU)
  - Direct memory access (DMA)
  - Data needs not be contiguous in memory



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