MONTANA STATE UNIVERSITY

Chapter 6: Link Layer

Mountains & Minds

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Travel example

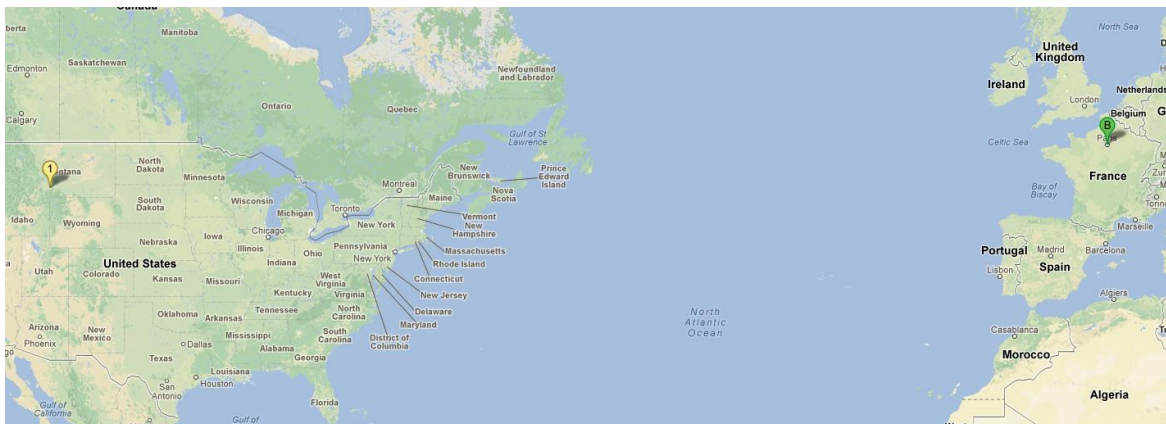**MONTANA STATE UNIVERSITY**

- How many different transportation technologies would you use to get from our classroom to the Eiffel Tower?

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Types of link layer technologies

Broadcast channels

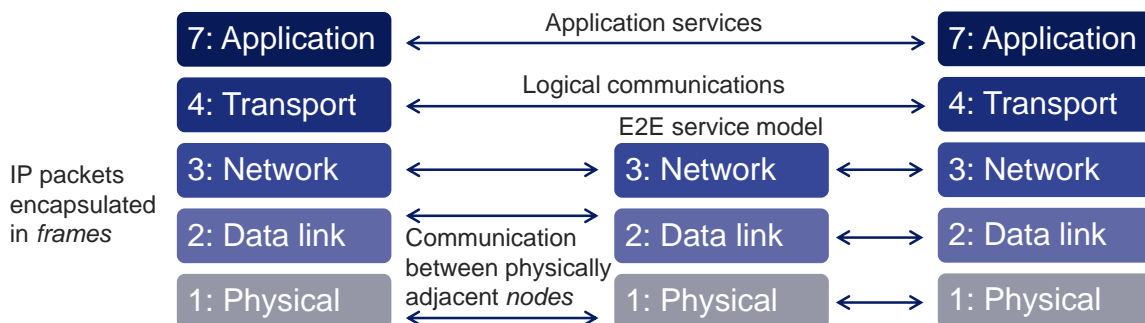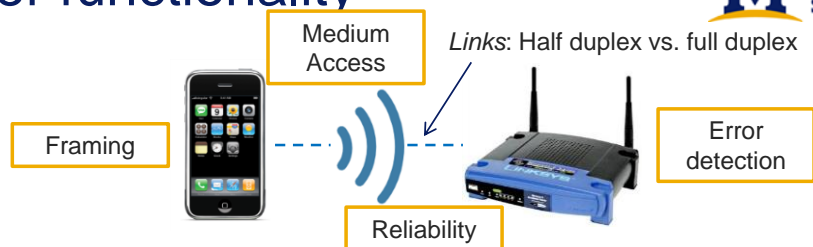Point-to-point channels

Optical fiber   Microwave

Twisted pair

Voice Analogy:

Voice Analogy:

DSL

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Link layer functionality

Medium Access

Links: Half duplex vs. full duplex

Framing

Error detection

Reliability

	Application services	
7: Application		7: Application
4: Transport	Logical communications	4: Transport
3: Network	E2E service model	3: Network
2: Data link	Communication between physically adjacent *nodes*	2: Data link
1: Physical		1: Physical

IP packets encapsulated in *frames*
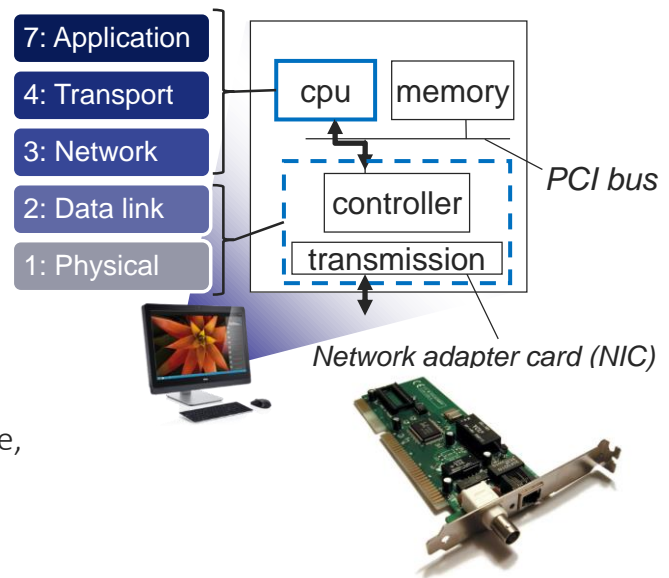
3: Network

2: Data link

1: Physical

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Where is the link layer implemented?

- On each and every host
- Link layer implemented in "adapter" (aka network interface card NIC) or on a chip
  - Ethernet card, 802.11 card
  - Implements link, physical layer
- Attaches into host's system buses
- Combination of hardware, software, firmware

| 7: Application |
| 4: Transport |
| 3: Network |
| 2: Data link |
| 1: Physical |

cpu   memory

PCI bus

controller

transmission

Network adapter card (NIC)

Link layer protocol design

- I will divide you into 4 breakout sessions
- Each breakout session will have one **sender** and one **receiver**

- When I say *go*, your job is to correctly transmit a series of bits between sender and receiver over the broadcast 'voice' channel (no visual signals, no chat, no SMS)
- Come up with a protocol for your **sender** and **receiver** to get data through

Lessons from MAC protocol design

- What problems did you face?
  – Addressing
  – Collisions on the shared (broadcast) medium
  – Random errors

- What solutions did you apply?
  – Different frequencies
  – Retransmission
  – Built in redundancy

- Overall lessons?
  – Taking turns would increase channel efficiency
  – Higher datarate transmissions more prone to errors

A cacophony!

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