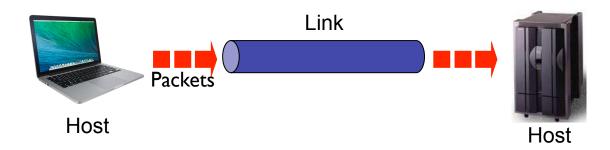
# **Networking Fundamentals**

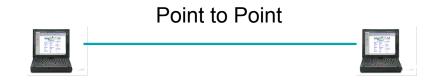


Bowdoin Sean Barker 1

# **Network Connections**



# **Connection Types**

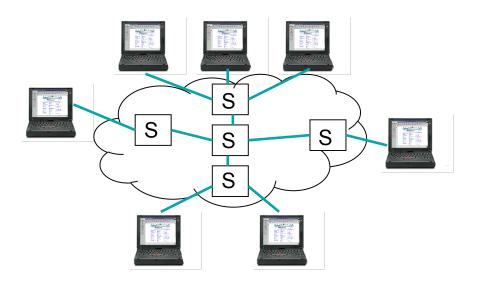


#### Multiple access (broadcast)

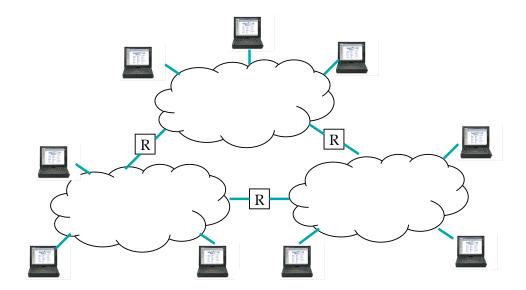


Bowdoin Sean Barker 3

## **Switched Networks**

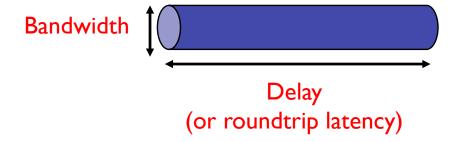


### **Interconnection of Networks (Routers)**



Bowdoin Sean Barker 5

#### **Network Performance**



propagation delay = distance / speed of light
transmit time = message size / bandwidth
queue delay = time spent in router queues

latency = propagation + transmit + queue

## **Latency Examples**

#### **Total Latency for 1 byte object**

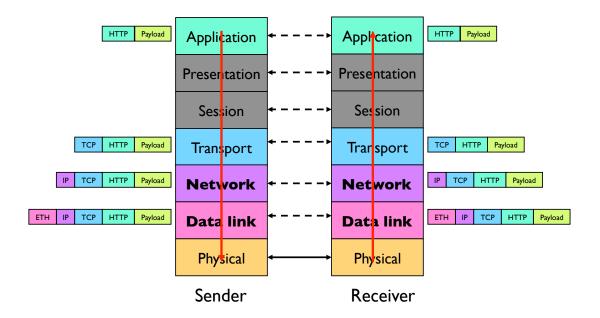
	Prop delay: <b>1 ms</b>	Prop delay: <b>100 ms</b>	
Bandwidth: 1 Mbps	1,008 µs	100,008 µs	
Bandwidth: 100 Mbps	1,000 µs	100,000 μs	

#### **Total Latency for 10 MB object**

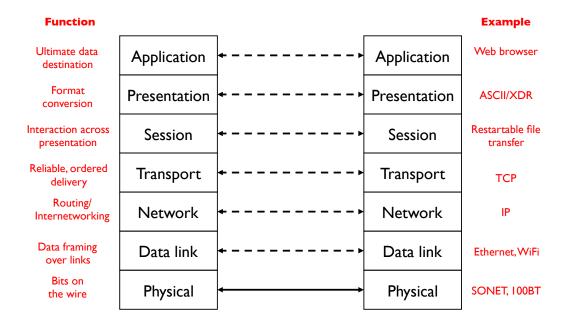
	Prop delay: <b>1 ms</b>	Prop delay: <b>100 ms</b>	
Bandwidth: <b>1 Mbps</b>	80.001 s	80.1 s	
Bandwidth: 100 Mbps	0.801 s	0.9 s	

Bowdoin Sean Barker 7

## **Protocol Encapsulation**

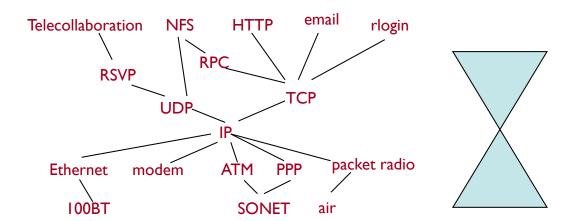


#### **OSI Model**

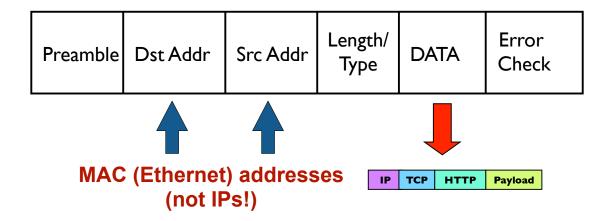


Bowdoin Sean Barker 9

## **IP Hourglass**



### Ethernet (Data Link, Layer 2)



Bowdoin Sean Barker 11

## **Internet Protocol (Network, Layer 3)**

Version	HLen	TOS	Length		
Identification		Flags	Offset		
T	TL	Protocol	Header Checksum		
Source IP Addr					
Destination IP Addr					
Options (variable)			Pad (variable)		
Data TCP HTTP Payload					

Bowdoin Sean Barker 12

#### **Dynamic Host Configuration Protocol (DHCP)**

#### Your computer





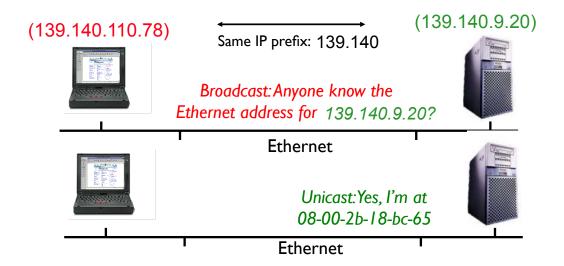
Broadcast: Hi, I'm new to the network!



Hi, I assigned you IP 139.140.235.145, DNS is at 139.140.9.20, gateway router is at 139.140.235.129

Bowdoin Sean Barker 13

#### **Address Resolution Protocol (ARP)**



Bowdoin Sean Barker 14

### **Domain Name System (DNS)**

Your computer (139.140.235.145)

Local DNS server (139.140.9.20)





Oh, you can find it at 74.125.225.83



Bowdoin Sean Barker 15

# Routing

