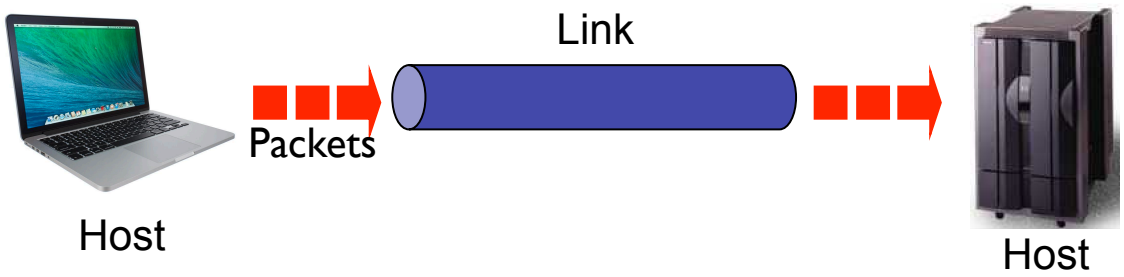
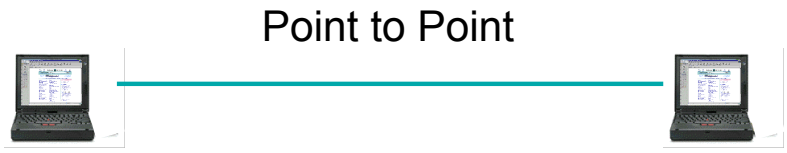
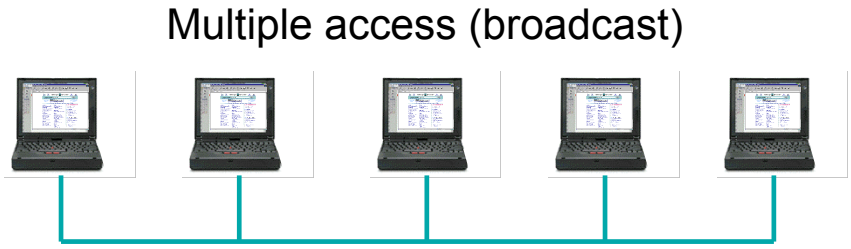
Networking Fundamentals

Network Connections

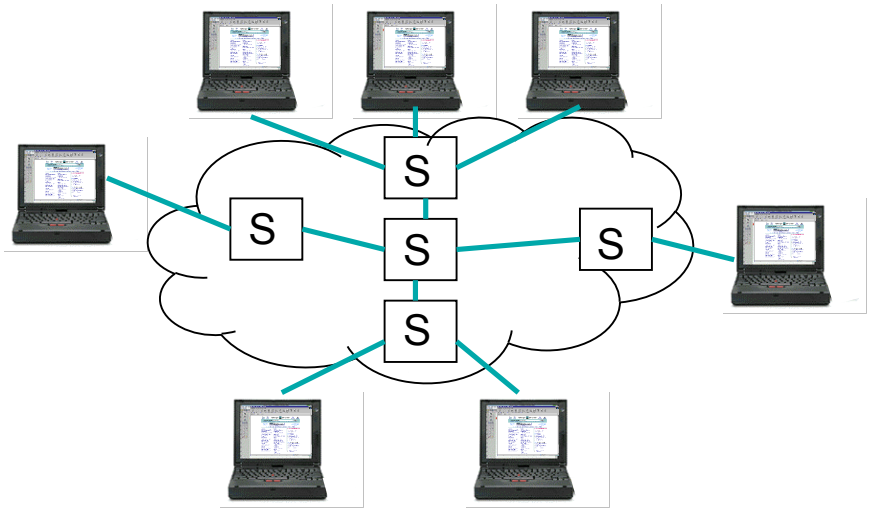


Connection Types

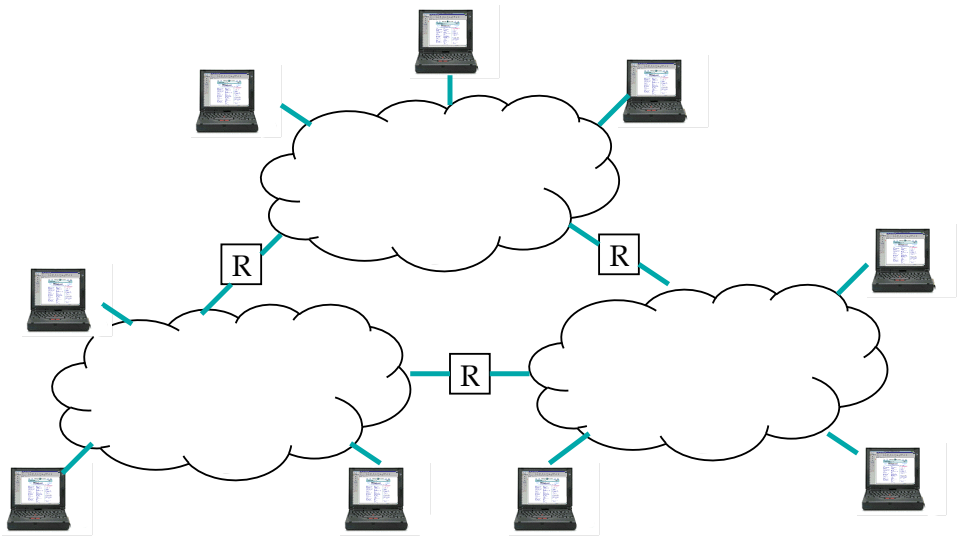




Switched Networks



Interconnection of Networks (Routers)



Network Performance

Delay
(or roundtrip latency)

propagation delay = distance / speed of light

transmit time = message size / bandwidth

queue delay = time spent in router queues

latency = propagation + transmit + queue

Latency Examples

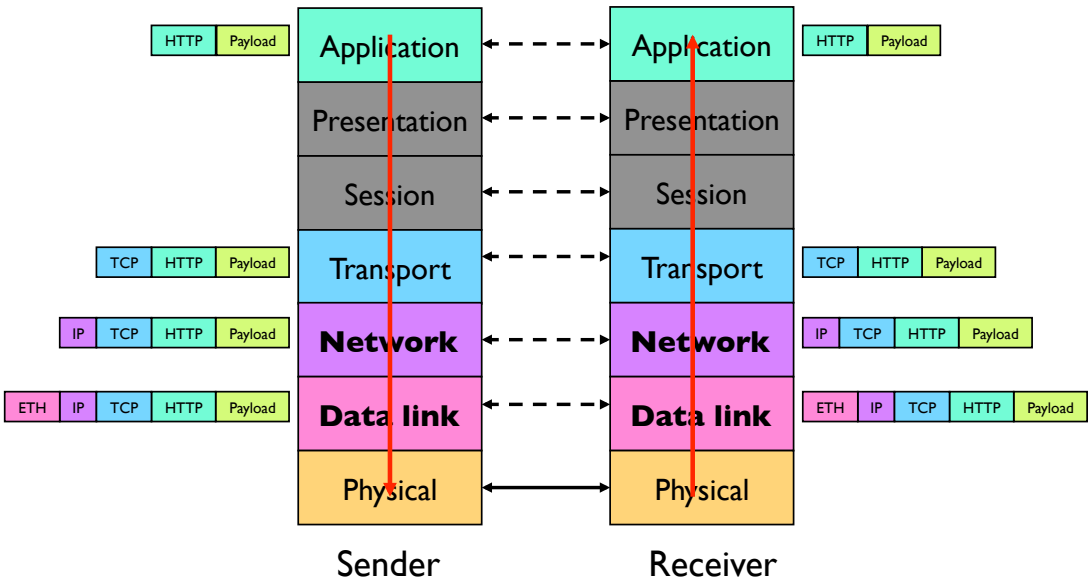
Total Latency for 1 byte object

	Prop delay: **1 ms**	Prop delay: **100 ms**
Bandwidth: **1 Mbps**	**1,008 µs**	**100,008 µs**
Bandwidth: **100 Mbps**	**1,000 µs**	**100,000 µs**

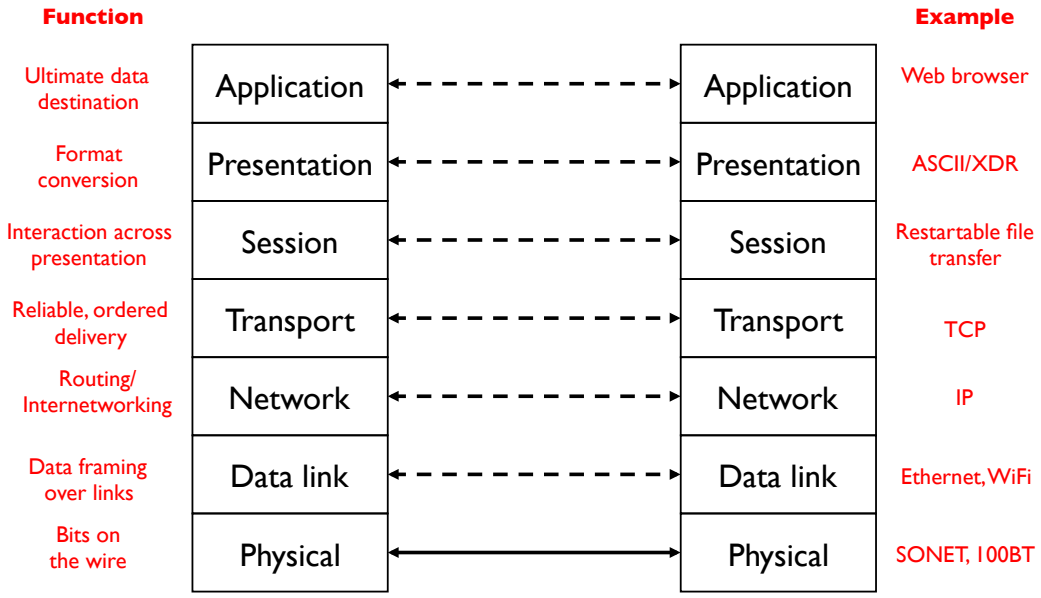
Total Latency for 10 MB object

	Prop delay: **1 ms**	Prop delay: **100 ms**
Bandwidth: **1 Mbps**	**80.001 s**	**80.1 s**
Bandwidth: **100 Mbps**	**0.801 s**	**0.9 s**

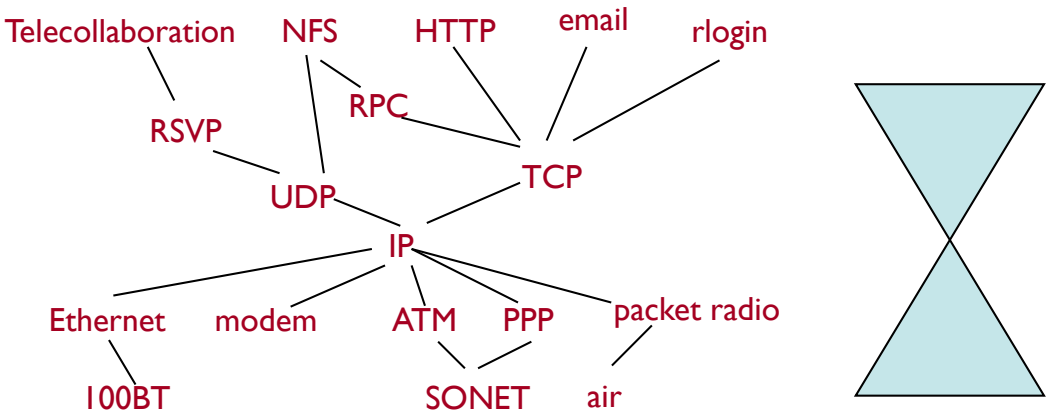
Protocol Encapsulation



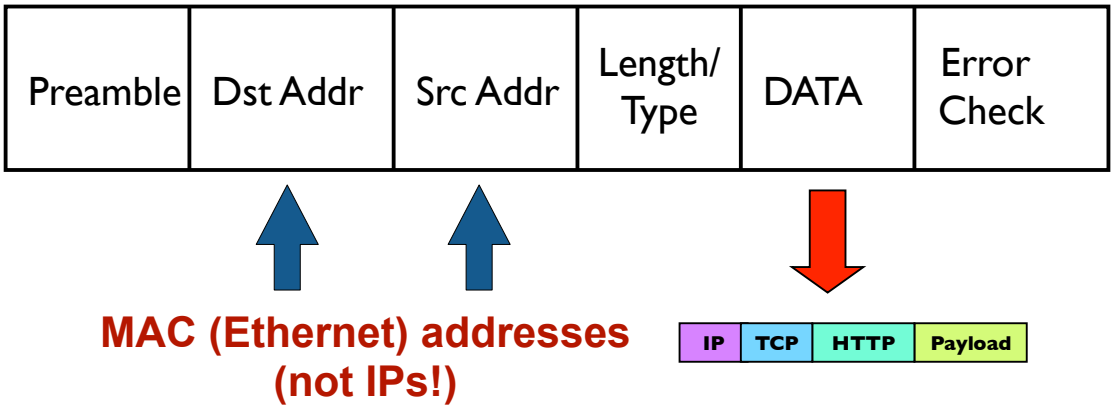
OSI Model



IP Hourglass



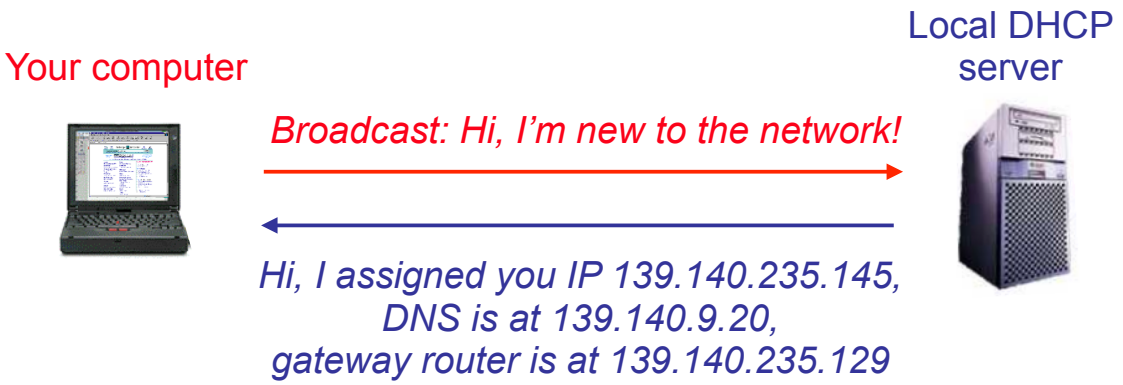
Ethernet (Data Link, Layer 2)



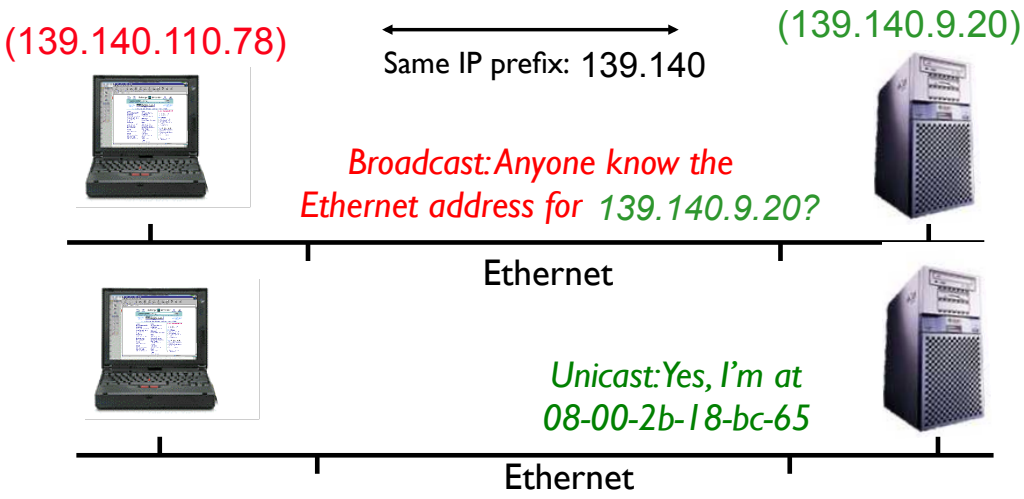
Internet Protocol (Network, Layer 3)

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

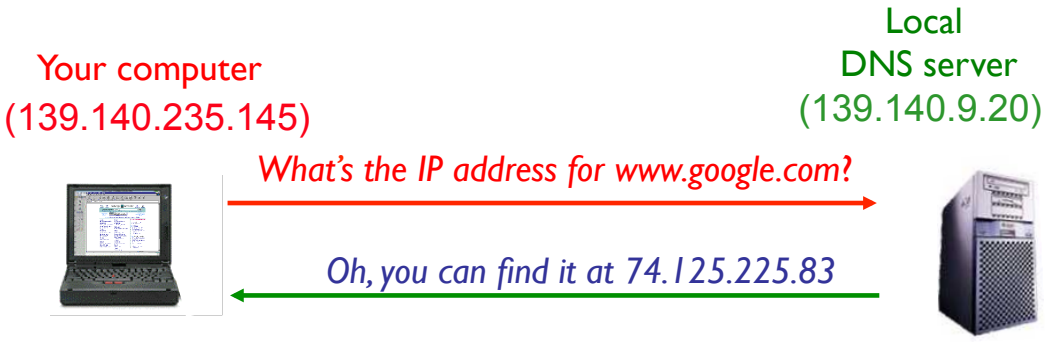
Dynamic Host Configuration Protocol (DHCP)



Address Resolution Protocol (ARP)



Domain Name System (DNS)



Routing