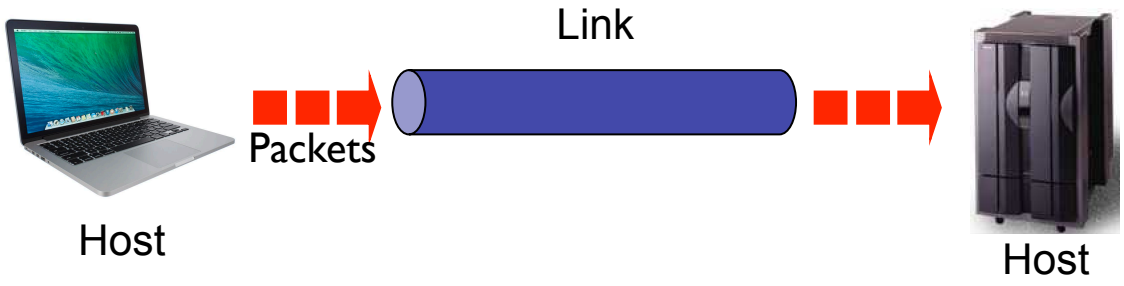
Networking Fundamentals

Network Connections

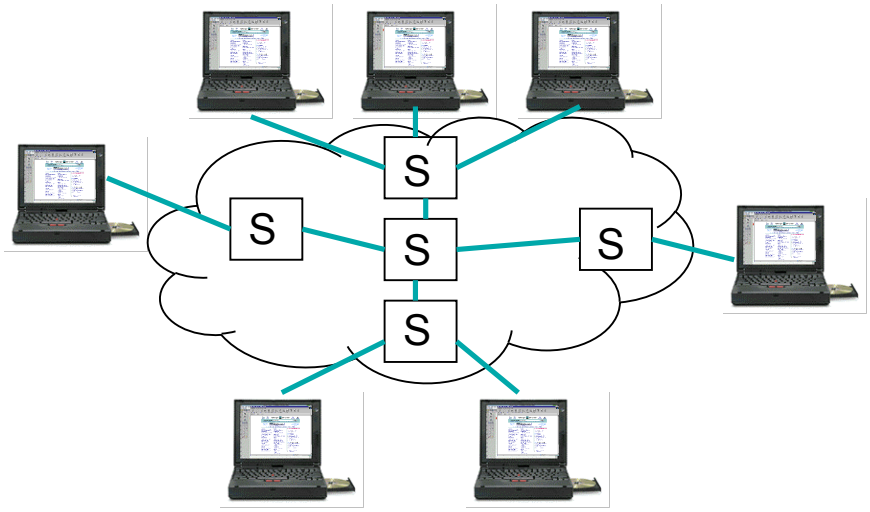


Connection Types

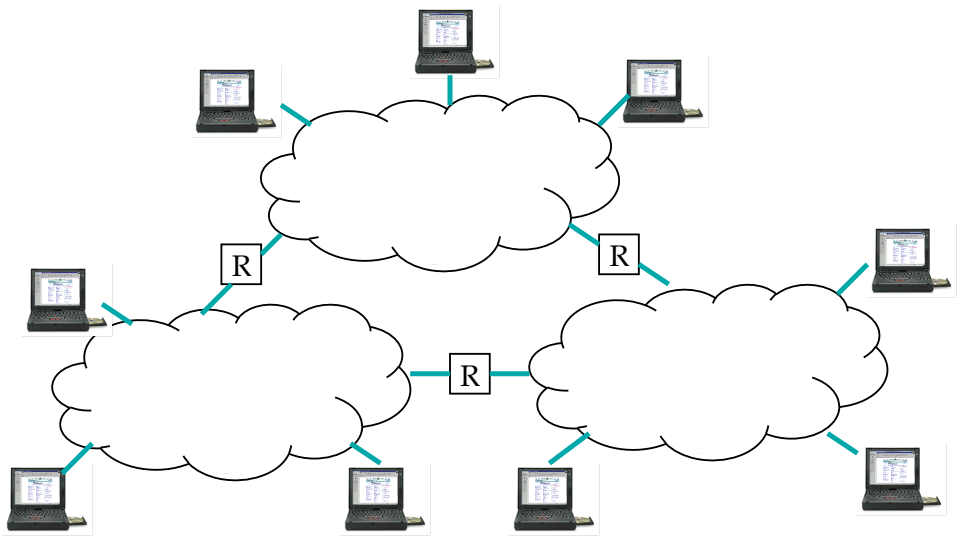
Point to Point

Multiple access (broadcast)

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

Bandwidth vs. Latency

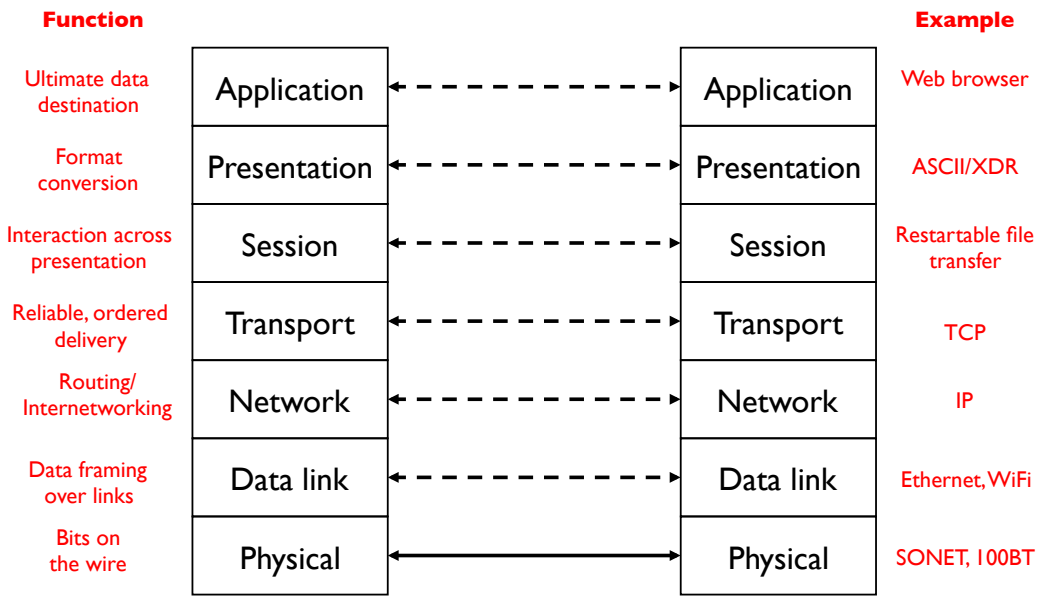
1 Byte Object

	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

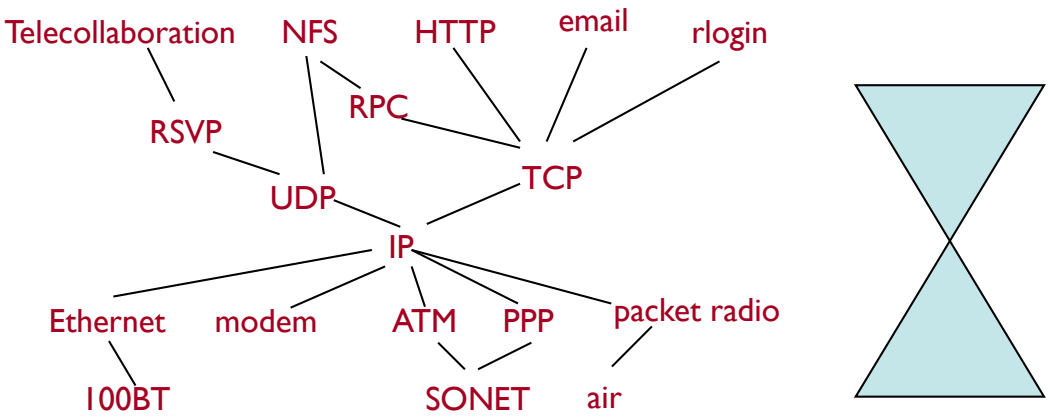
10 MB Object

	Prop delay: 1 ms	Prop delay: 100 ms
Bandwidth: 1 Mbps	80.001 s	80.1 s
Bandwidth: 100 Mbps	.801 s	.9 s

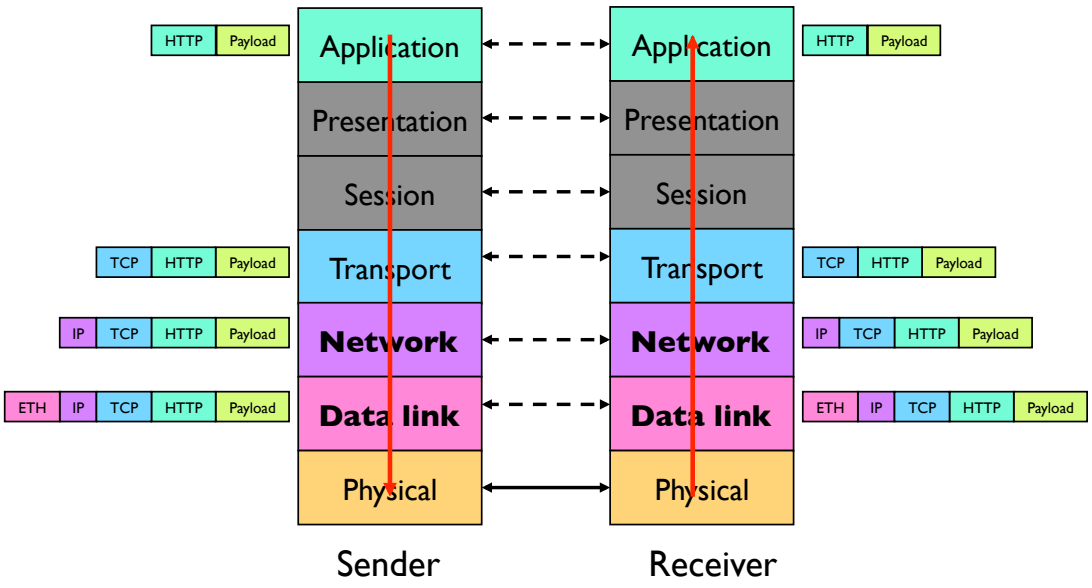
OSI Model



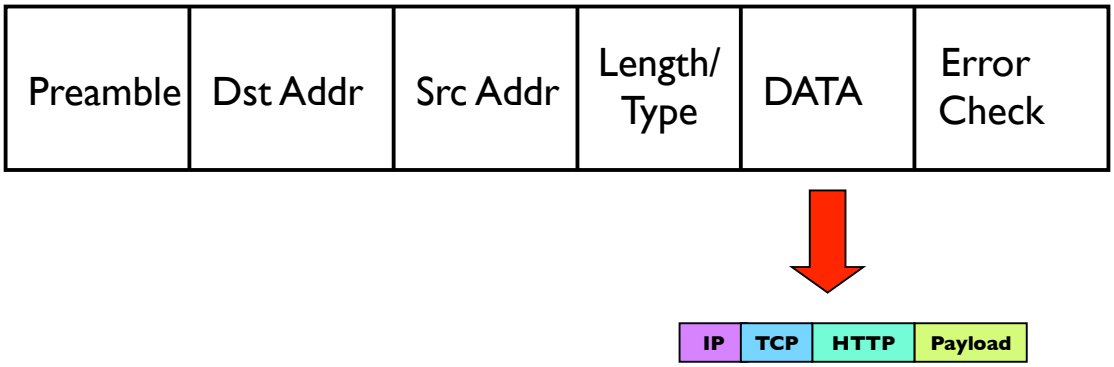
IP Hourglass



Protocol Encapsulation



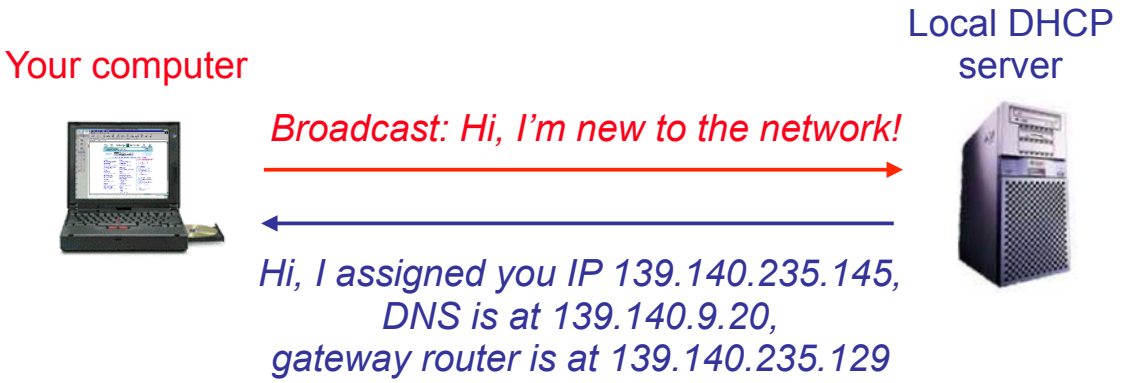
Ethernet/Wifi (Data Link, Layer 2)



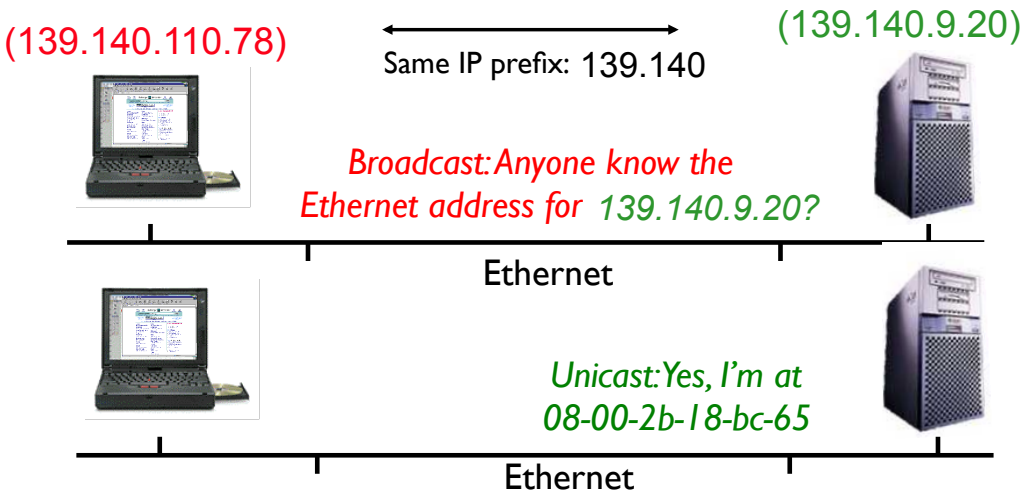
Internet Protocol (Network, Layer 3)

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	

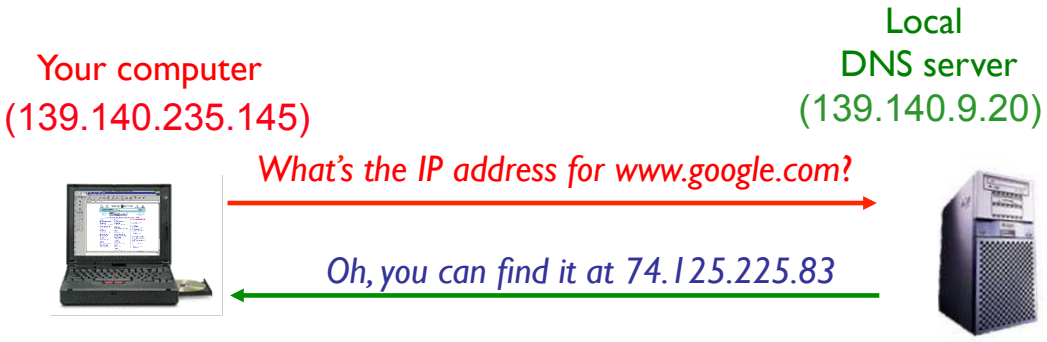
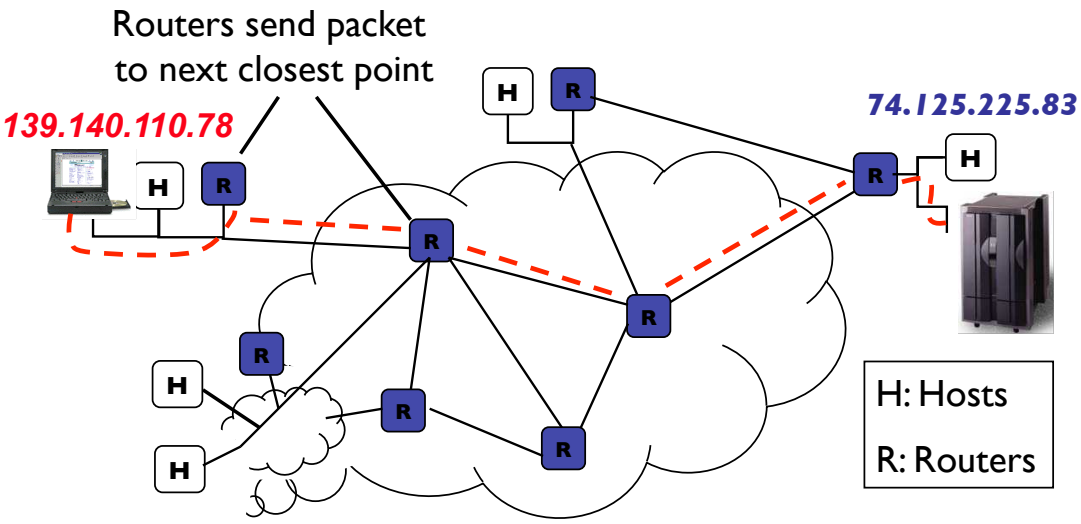
Dynamic Host Configuration Protocol (DHCP)



Address Resolution Protocol (ARP)



Domain Name System (DNS)



Routing