

Music & the Internet

MUMT 301

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Plan

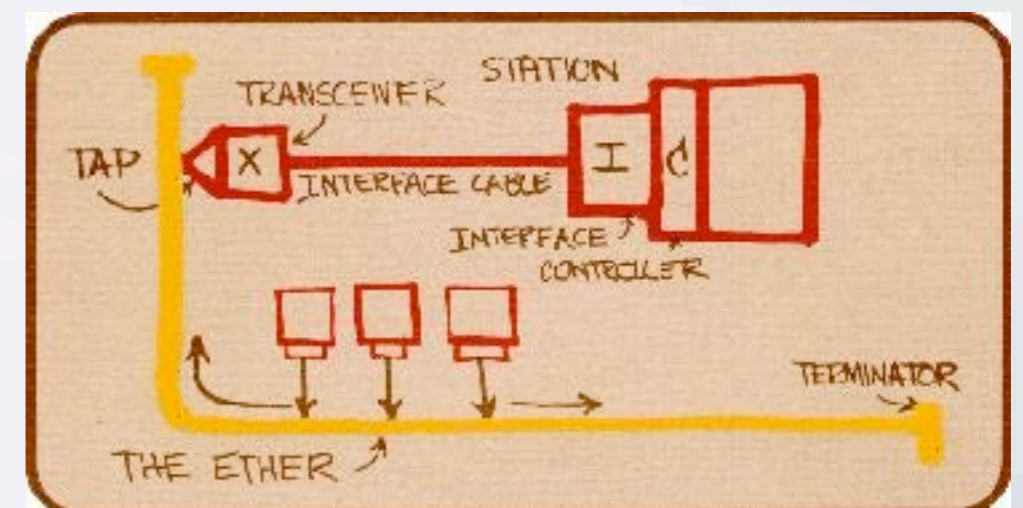
- Review of last class
- Internet technologies
- Review of HTML
 - Setup Komodo Editor
 - Create public_html/mumt301
 - Create basic.html
- CSS

Internet Technologies

- Ethernet
- TCP/IP
- OSI Model
- IP Addresses
- DNS
- DHCP
- FTP
- HTTP
- SSH

Ethernet

- Invented by Bob Metcalf (1972)
- Developed at Xerox PARC (1973–4)
- Competed with Token Ring
- Originally 10Mb (10BASE-T)
- Standardized 1985 as IEEE 802.3
- Each hardware given 48bit MAC address

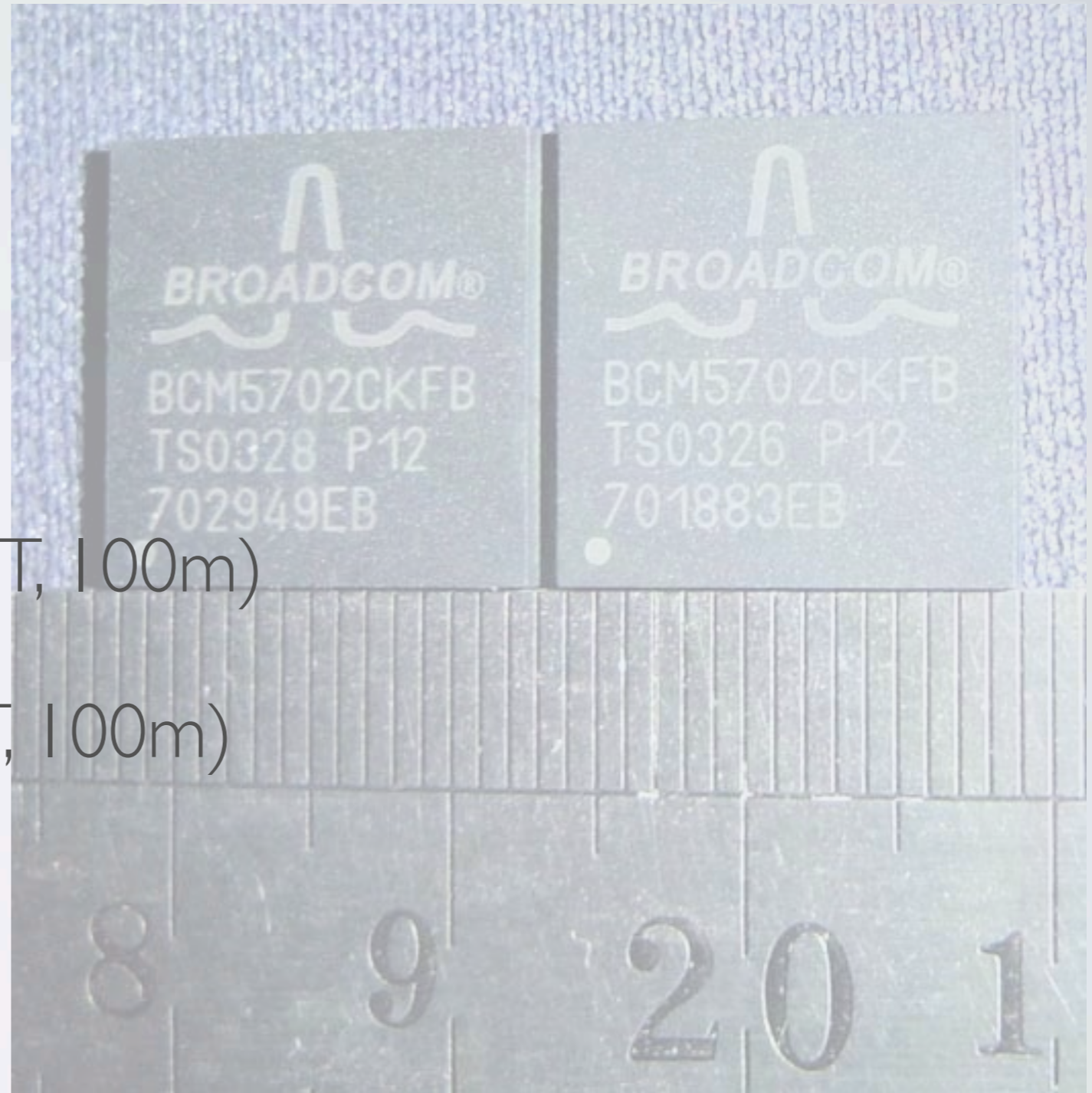


Ethernet standards

Name	Connector	Speed	Distance
10BASE-2	AUI	10 Mbps	500m
10BASE-5	BNC	10 Mbps	200m
10BASE-T	RJ-45	10 Mbps	100m
100BASE-TX	RJ-45	100 Mbps	100m
100BASE-FX	ST, SC, LC	100 Mbps	2000m
1000BASE-T	RJ-45	1 Gbps	100m
1000BASE-X	ST, SC, LC	1 Gbps	2000m
10GBASE-X	ST, SC, LC	10 Gbps	2000m

Ethernet cables and chips

- Cables
 - CAT 5 (up to 1000BASE-T, 100m)
 - CAT-6 (up to 10GBASE-T, 100m)
- [Broadcom BCM5701](#)



Ethernet frame

802.3 Ethernet frame structure

Preamble	Start of frame delimiter	MAC destination	MAC source	802.1Q tag (optional)	Ethertype or length	Payload	Frame check sequence (32-bit CRC)	Interframe gap
7 octets of 10101010	1 octet of 10101011	6 octets	6 octets	(4 octets)	2 octets	46–1500 octets	4 octets	12 octets
		64–1522 octets						
		72–1530 octets						
		84–1542 octets						

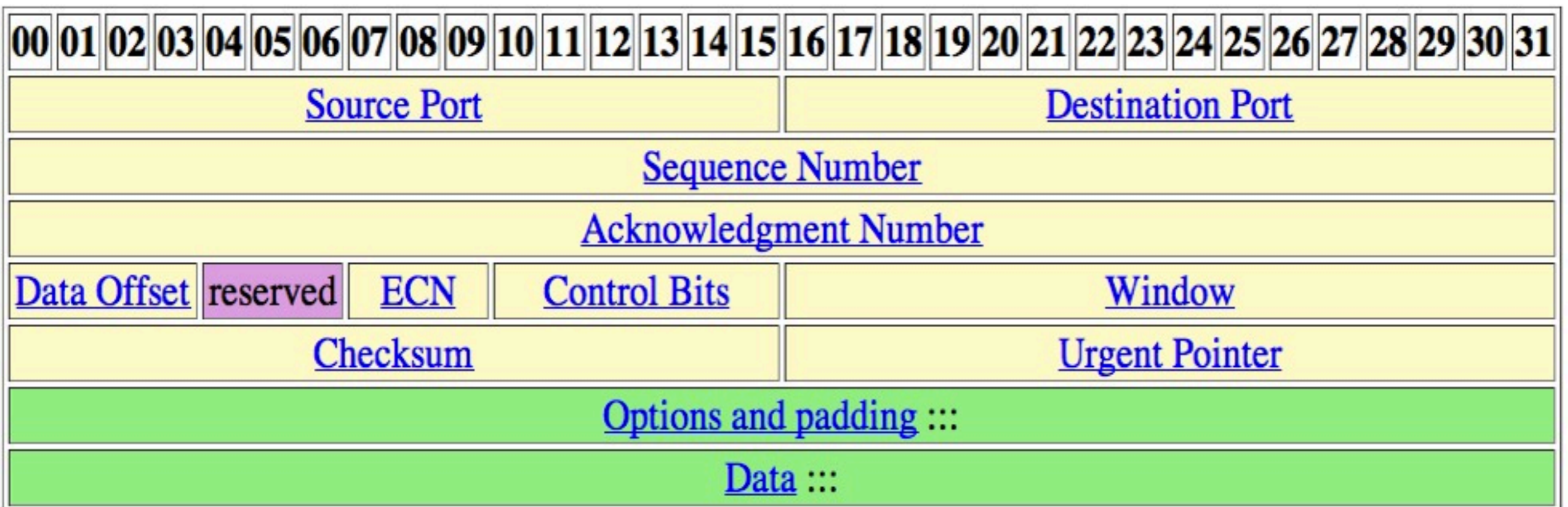
TCP/IP

- Transmission Control Protocol
- Internet Protocol
- Basic communication protocols of the Internet
 - Developed in the 1970's
 - Standardized in 1983
- IP: best effort; unreliable
- UDP (User Datagram Protocol) : data integrity via checksum
- TCP: delivery guarantee via acknowledgement and data ordering

IP Header (20 bytes)

00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
<u>Version</u>				<u>IHL</u>			<u>Differentiated Services</u>					<u>Total length</u>																			
<u>Identification</u>											<u>Flags</u>			<u>Fragment offset</u>																	
<u>TTL</u>					<u>Protocol</u>					<u>Header checksum</u>																					
<u>Source IP address</u>																															
<u>Destination IP address</u>																															
<u>Options and padding</u> :::																															

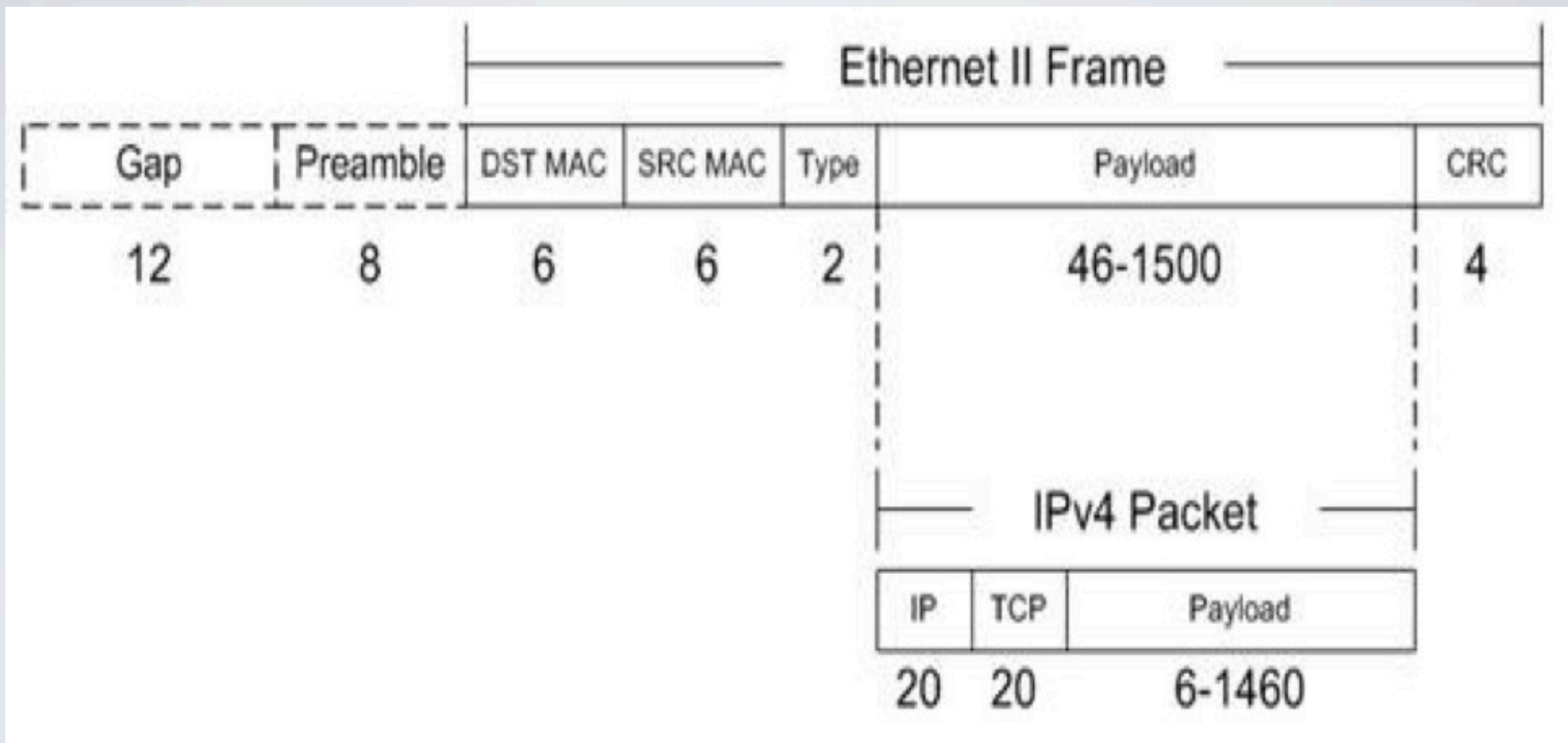
TCP Header (20 bytes)



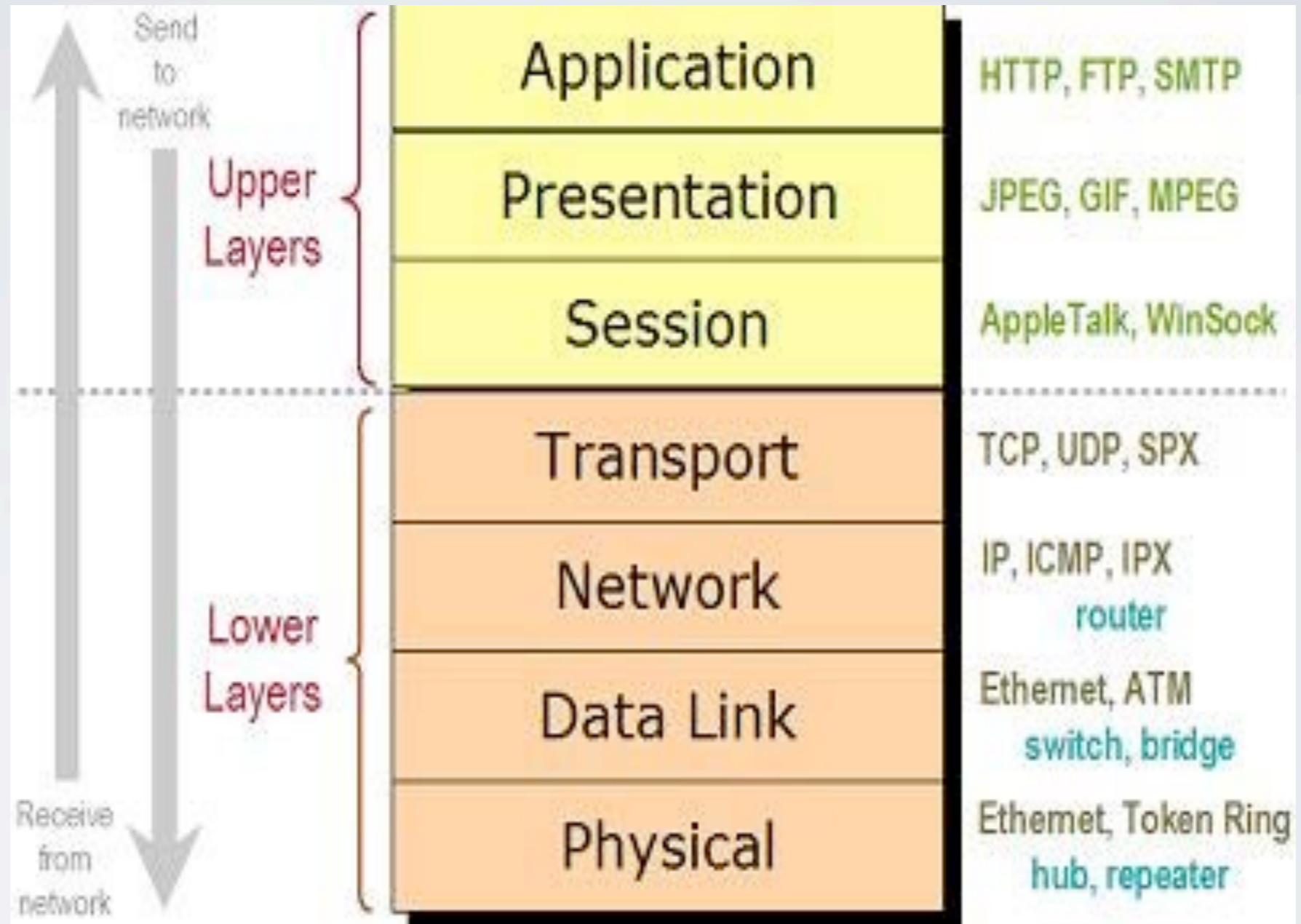
IP Addresses

- IPv4 (32 bits = 4 bytes)
 - 4,294,967,296 possible IP addresses
- IPv6 (128 bits)
 - 340,000,000,000,000,000,000,000,000,000,000,000,000,000,000
 - 340 trillion trillion trillion = 3.4×10^{38}
 - Bacterial cells on Earth = 5×10^{30}
- MAC (Media Access Control):
 - MAC-48: $2^{48} = 281,474,976,710,656$ addresses (281×10^{12} , trillion)
 - All the fish in the ocean = 3.5×10^{12}
 - EUI-64: $2^{64} = 1.8 \times 10^{19}$
 - Insect population = 10^{19}
- Large numbers: http://www.vendian.org/envelope/dir0/grain_feel.html

Complete Ethernet Packet



OSI Model

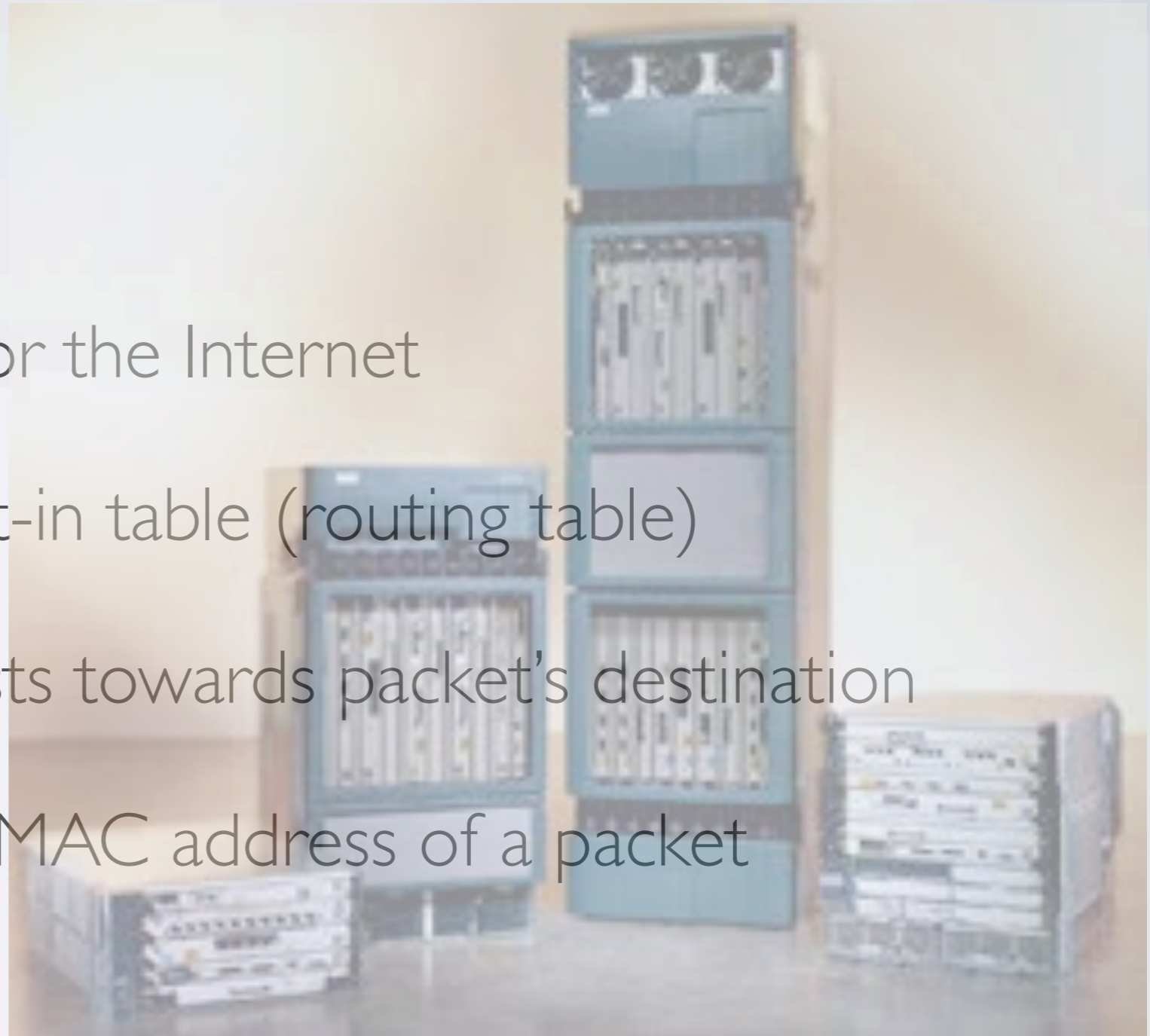


DNS

- Domain Name System
- Domain Names: alias for IP addresses
- Domain name servers translates domain names to IP addresses
- Domain names are registered with corresponding IP addresses and updated throughout the world via network of domain name servers.

Routers

- Traffic control manager for the Internet
- It is a computer with built-in table (routing table)
- Finds the next router/hosts towards packet's destination
- Rewrites the destination MAC address of a packet



How a packet finds its way

- Given a domain name address on a source computer
- Domain name server is queried to find the IP address
- The packet with the destination IP address is sent to the nearest router
- Given the IP address, a router finds, using a routing table, next router to send the packet to. This step is repeated until it reaches the final destination
- If this is an TCP packet, another packet is sent back to the source computer to acknowledge its arrival

DHCP

- Q: “But I move around with my laptop, how does the Internet find me?”
- A: Dynamic Host Configuration Protocol
- Standardized 1993
- DHCP servers assigns IP addresses and default gateway (a router)

FTP

- File Transfer Protocol
- To copy files over the Internet (TCP/IP)
- FTPS (Secure File Transfer Protocol) used at music.mcgill.ca
- The server uses ports 20/21
- Anonymous FTP access (precursor to WWW)

HTTP

- Hypertext Transfer Protocol (~1991)
- Hypertext (1963: Ted Nelson)
- “The first version of the protocol had only one method, namely GET, which would request a page from a server. The response from the server was always an HTML page.”
- Try “lynx google.ca” on music ssh account

SSH

- Secure Shell
- Remote login over TCP/IP network via port 22
- A shell is an interface to an operating system, e.g.:
 - bash (CLI)
 - Finder (GUI)
- What is an operating system?

Review

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- Router
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HTML / CSS

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