

Chapter 5

The Network Layer (cont.)

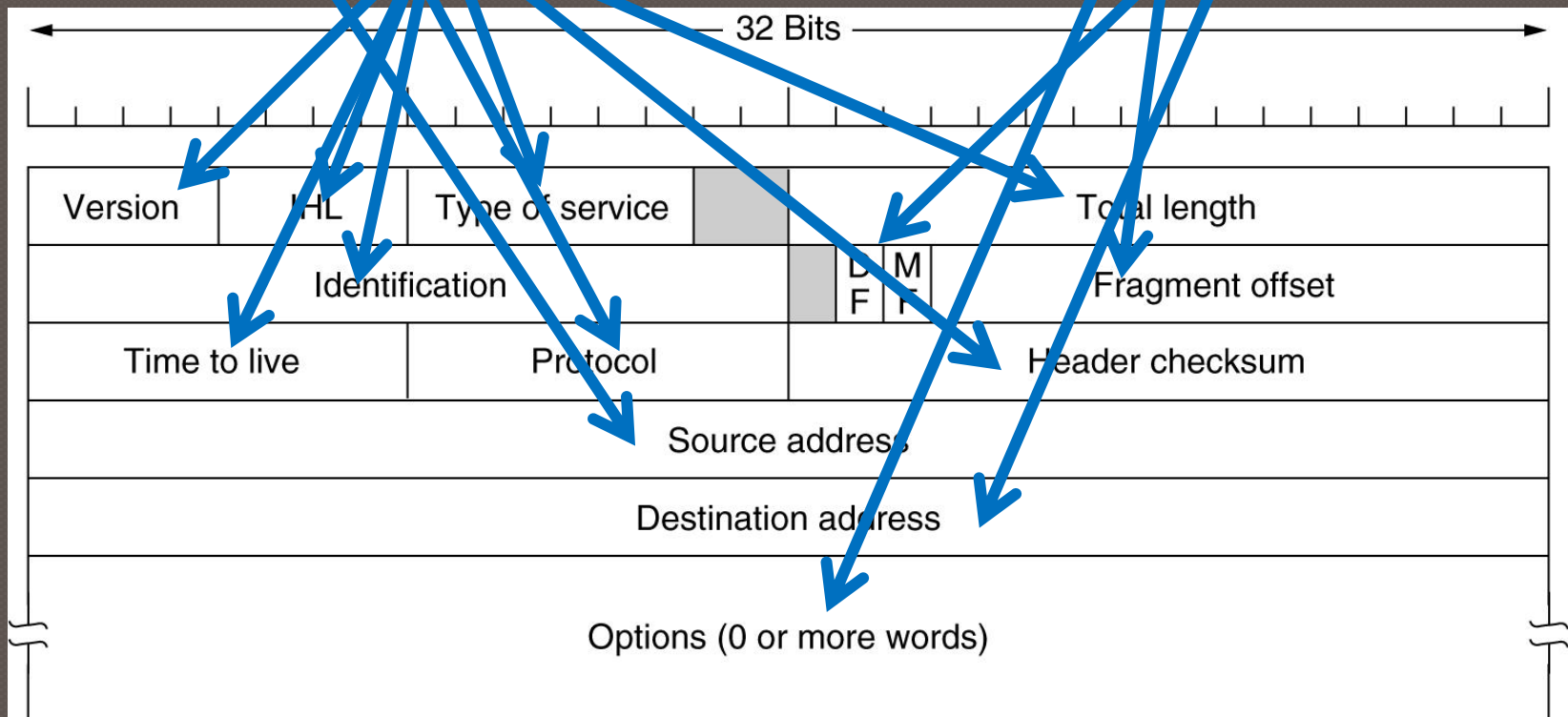
The Network Layer in the Internet

- The IP Protocol
- IP Addresses

DF/MF (3 bits (1 byte) used)
 Offset (13 bits (1 byte) used)
 Version (4 bits (1 byte) used)

Some fragments may have different versions of
 the same data, which may be used as a path
 between two nodes. The path is determined by
 the version number and the offset.
 and the offset is the offset of the fragment in the packet.

- All fragments have it except the last



The IP Protocol (2)

Some of the IP options.

Option	Description
Security	Specifies how secret the datagram is
Strict source routing	Gives the complete path to be followed
Loose source routing	Gives a list of routers not to be missed
Record route	Makes each router append its IP address
Timestamp	Makes each router append its address and timestamp

IP Addresses

. IP address formats

	← 32 Bits →			
				Range of host addresses
Class				
A	0	Network	Host	1.0.0.0 to 127.255.255.255
B	10	Network	Host	128.0.0.0 to 191.255.255.255
C	110	Network	Host	192.0.0.0 to 223.255.255.255
D	1110	Multicast address		224.0.0.0 to 239.255.255.255
E	1111	Reserved for future use		240.0.0.0 to 255.255.255.255

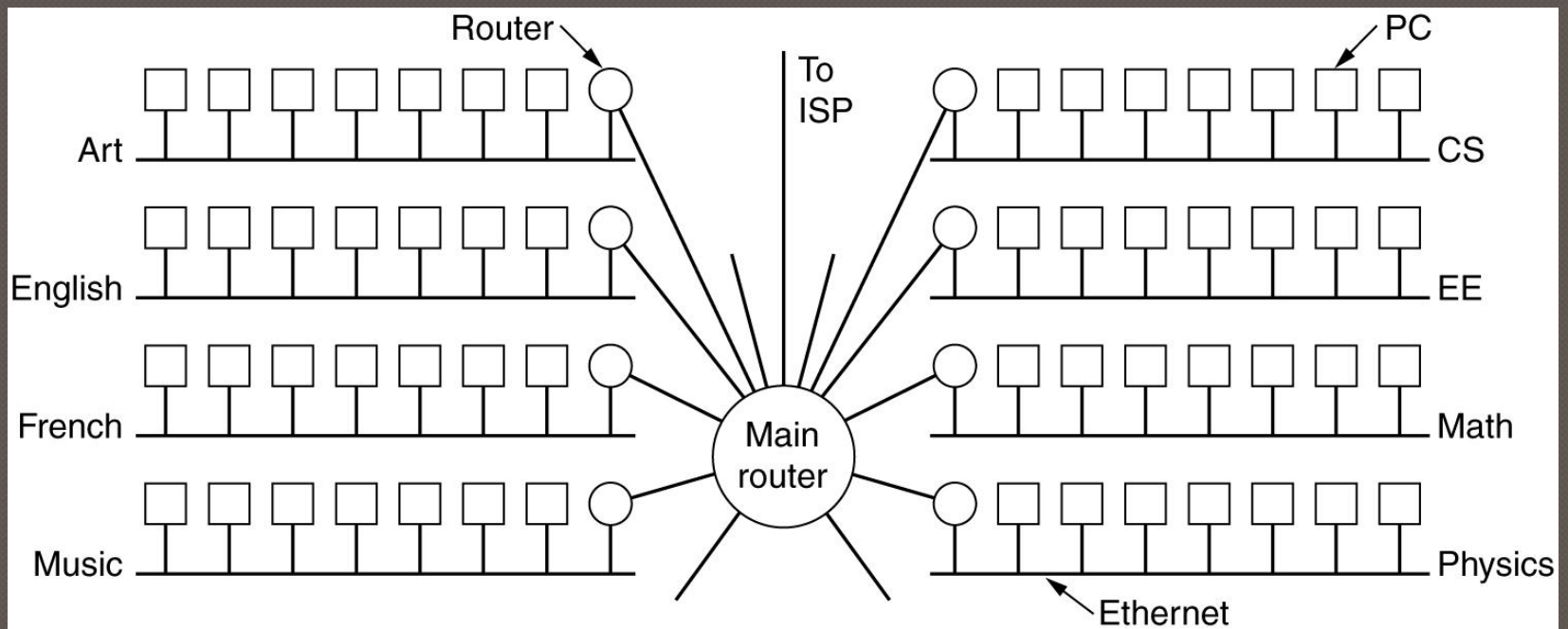
IP Addresses (2)

Special IP addresses.

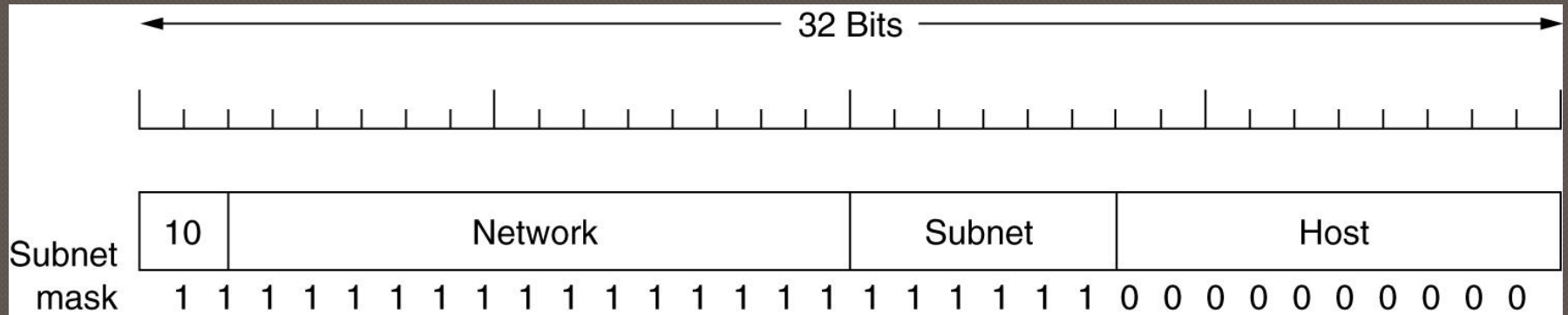
0 0																														This host										
0 0										...										0 0										Host	A host on this network									
1 1																														Broadcast on the local network										
Network										1 1 1 1										...										1 1 1 1										Broadcast on a distant network
127										(Anything)																				Loopback										

Subnets

A campus network consisting of LANs for various departments.



Subnets (2)



A class B network subnetted into 64 subnets.

A subnet mask is used to reconstruct the address.

CDR – Classless InterDomain Routing

A set of IP address assignments.

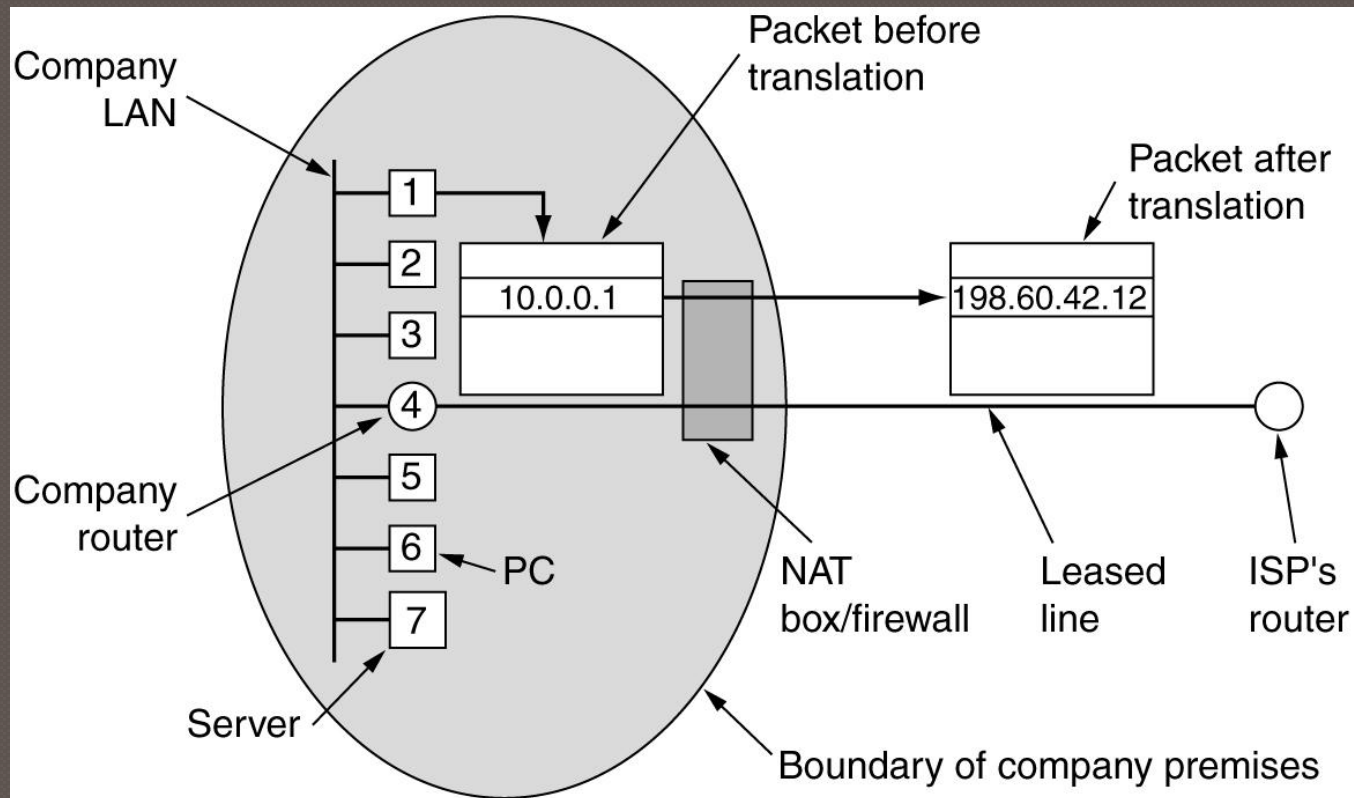
University	First address	Last address	How many	Written as
Cambridge	194.24.0.0	194.24.7.255	2048	194.24.0.0/21
Edinburgh	194.24.8.0	194.24.11.255	1024	194.24.8.0/22
(Available)	194.24.12.0	194.24.15.255	1024	194.24.12/22
Oxford	194.24.16.0	194.24.31.255	4096	194.24.16.0/20

The AND of the subnet mask with the address provides address identification.

Aggregating addresses reduce table size

NAT – Network Address Translation

Placement and operation of a NAT box.



Next Time

- ◉ The internet routing protocol