CMSC417 Spring 2016 Lecture #8 2/24/2016

Agenda!

⇒ adminstrivia
- p2 out
- p1 grades coming
- exam dates moved back one class day (sample exams)
- office hours
- Eric teaching monday (DNS)

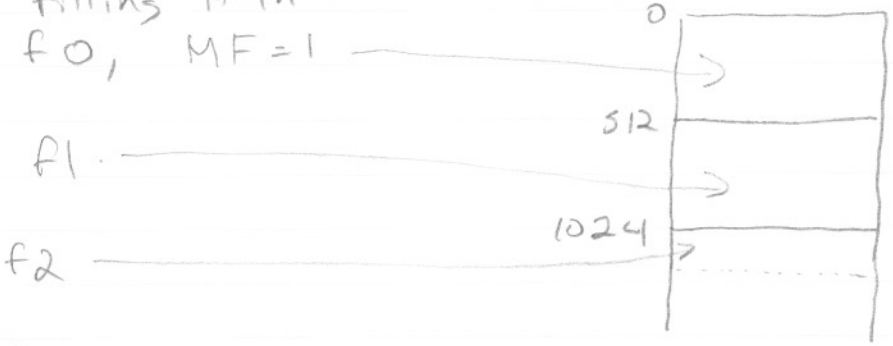
⇒ IP cont'd
- fragmentation reassembly
- addressing

CMSC 417 Spring 2016 Lecture #8 2/24/2016

Reassembly

⇒ on getting a packet with MF=1 or offset != 0, allocate space and start filling it in

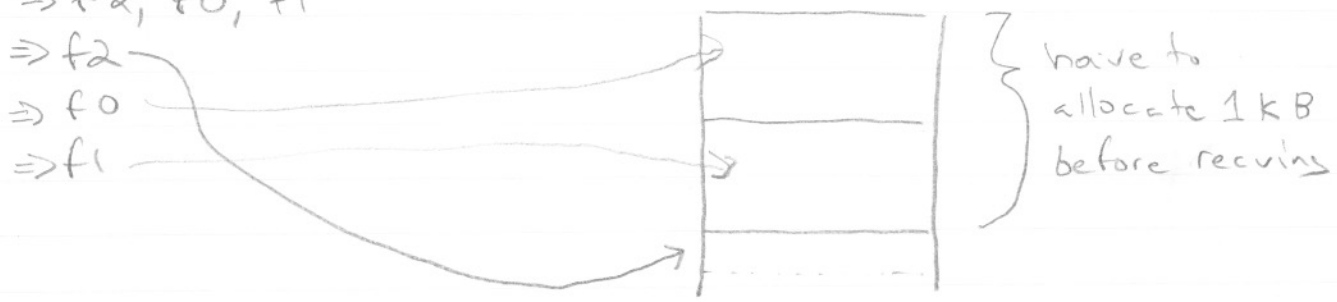
⇒ f0, MF=1



⇒ f2 has MF=0, so we're done and can release the packet to the application

Packets can arrive out of order

⇒ f2, f0, f1



⇒ can send a 1 byte packet with offset = 64KB - 8 and force a host to allocate 64 KB of RAM
- memory exhaustion attack

Other Bad Things w/ Fragmentation

⇒ more headers → more overhead
⇒ partially lost packets → can't reclaim buffers
⇒ avoid fragmentation in general
⇒ do path MTU discovery (we'll cove it in TCP)

CMSC 417 Spring 2016 Lecture # 8 2/24/2016

IP addresses

⇒ 32 bits

⇒ dotted quad <byte1-in-decimal>.<byte2-dec>.<byte3-dec>.<byte4>

⇒ 0000 0001 0000 0010 0000 0011 0000 0100

1 . 2 . 3 . 4

1.2.3.4

⇒ IPs are split into two parts
- network
- host

⇒ can't use a static split of bits efficiently b/c networks will vary in # of hosts

⇒ solution is address classes

first byte	class	bits	# hosts/net
0-127	A	0 | 7-bit net | 24-bit host	$2^{24} \approx 16$ million
128-191	B	10 | 14-bit net | 16-bit host	$2^{16} \approx 65{,}000$
192-223	C	110 | 21-bit net | 8-bit host	$2^8 = 256$ hosts
224-239	D	1110 | multicast-addr	
240-255	F	1111 | reserved	

⇒ IP will get it to the network address, e.g., class A, B or C
- assume the link layer can deliver it to the right host
- using Ethernet + DU, LS or whatever

⇒ assumes the network address uniquely IDs a physical network with ≥ 1 router

CMSC417 Spring 2016 Lecture #8 2/24/2016

Forwarding Protocol

```
if net(dest) is on a local interface (port)
    send out that interface (port)
if net(dest) is in the routing table
    send to next hop
else
    send to default route
```

Backbone routers have no default route, i.e. they know how to reach everyone

End hosts typically only have a default route
e.g., in your project 1

Special addresses

"private" address space

class A: 10.x.x.x
B: 172.16.x.x - 172.31.x.x
C: 192.168.x.x

CMSC 417 Spring 2016 Lecture #8 2/24/2016

Subnetting

⇒ turn a single class A, B, or C network int multiple sub networks (subnets)

⇒ Why?
- smaller networks → lower overhead (less broadcast)
- many networks were logically smaller networks
  - 2 hosts → class C
  - 257 hosts → class B

IP: <network-id><host-id>

↓

<network-id><subnet-id><host-id>

"borrows" bits from net host-id

⇒ can allocate addresses internally w/o respect to the class of yon network