

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

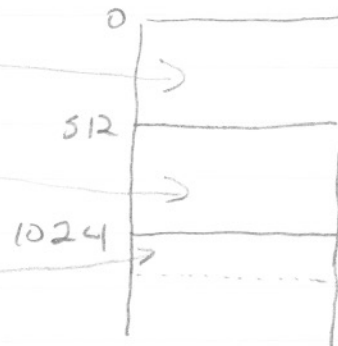
Reassembly

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

⇒ f_0 , $MF=1$

f_1

f_2



⇒ f_2 has $MF=0$, so we're done and can release the packet to the application

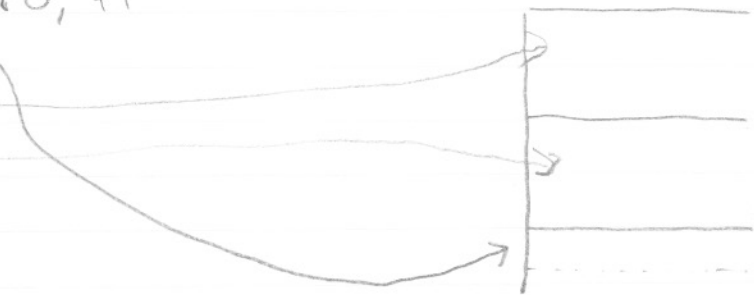
Packets can arrive out of order

⇒ f_2 , f_0 , f_1

⇒ f_2

⇒ f_0

⇒ f_1



} have to allocate 1 KB before receiving

⇒ can send a 1 byte packet with offset = $64\text{KB} - 8$ and force a host to allocate 64 KB of RAM
D 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 cover it in TCP)

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IP addresses

⇒ 32 bits

⇒ dotted quad $\langle \text{byte1-in-decimal} \rangle . \langle \text{byte2-dec} \rangle . \langle \text{byte3-dec} \rangle . \langle \text{byte4} \rangle$

⇒ 0000 0001 0000 0010 0000 0011 0000 0100
 1 2 3 4

1.2.3.4

⇒ IPs are split into two parts

 D network

 D 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	$2^{24} \approx 16 \text{ million}$
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	$2^8 = 256 \text{ hosts}$
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

 D assume the link layer can deliver it to
 the right host

 D using Ethernet + DU, LS or whatever

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

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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

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Subnetting

⇒ turn a single class A, B, or C network into 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 and/or host id

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

subnet mask 255.255.255.128

subnet number 128.96.34.0

