EECS 489 Discussion 6

Announcements

- Project 2 due next week
- Midterm next week
- Discussion cancelled next week

Q1 Fragmentation

Suppose a TCP message containing 2048 bytes of data and 20 bytes of TCP header is passed to IP for delivery across two networks of the Internet. The first network uses a 14-byte link layer header and has an MTU of 1024 bytes; the second uses a 8-byte link layer header with an MTU of 512 bytes. Give the sizes and offsets of the sequence of fragments delivered to the network layer at the destination host. Assume IP options are not used in all cases, and an IP header is 20 bytes.

Q1 Fragmentation (after first network)

Before going into first network,
IP datagram = 2048 + 20 (TCP header) + 20 (IP header) = 2088 bytes
IP payload = 2068 bytes

Fragment 1: IP header of 20 bytes, and data of 1000 bytes. Offset is 0
Fragment 2: IP header of 20 bytes, and data of 1000 bytes. Offset is 1000/8=125
Fragment 3: IP header of 20 bytes, and data of 68 bytes. Offset is 2000/8=250

Q1 Fragmentation (after second network)

MTU of second network = 512
Max payload in fragment is 488 (not 492 because it is not divisible by 8)
Fragment 1 now needs fragmentation

Fragment 4: IP header of 20 bytes, data of 488 bytes. Offset is 0
Fragment 5: IP header of 20 bytes, data of 488 bytes. Offset is 488/8=61
Fragment 6: IP header of 20 bytes, data of (1000 - 488*2)=24. Offset is 122

Q1 Fragmentation (after second network)

MTU of second network = 512
Max payload in fragment is 488 (not 492 because it is not divisible by 8)
Fragment 2 needs fragmentation

Fragment 7: IP header of 20 bytes, data of 488 bytes. Offset is 125
Fragment 8: IP header of 20 bytes, data of 488 bytes. Offset is 125+61=186
Fragment 9: IP header of 20 bytes, data of (1000 - 488*2)=24. Offset is 125+122=247

Fragment 3 can go through as is (no need for fragmentation)
Fragments 4,5,6,7,8,9,3 reach destination.

Q2 Forwarding Table

Consider a datagram network using 32-bit host addresses. Suppose a router has four links, numbered 0 through 3, and packets are to be forwarded to the link interfaces as follows:

Destination address range	Link interface
`11100000 00000000 00000000 00000000` through `11100000 00111111 11111111 11111111`	0
`11100000 01000000 00000000 00000000` through `11100000 01000000 11111111 11111111`	1
`11100000 01000001 00000000 00000000` through `11100001 01111111 11111111 11111111`	2
otherwise	3

Provide a forwarding table that has five entries, uses longest prefix matching, and forwards packets to the correct link interfaces

Q2 Forwarding Table

Destination Address Range	Link Interface
11100000 00(/10)	0
11100000 01000000 (/16)	1
11100000 (/8)	2
11100001 0 (/9)	2
otherwise	3

Q3 More Forwarding Tables

Consider a datagram network using 8-bit host addresses. Suppose a router uses longest prefix matching and has the following forwarding table:

Prefix Match	Interface
00	0
010	1
011	2
10	2
11	3

Q3 More Forwarding Tables

Consider a datagram network using 8-bit host addresses. Suppose a router uses longest prefix matching and has the following forwarding table:

Prefix Match	Interface	Range
00	0	0000 0000 to 0011 1111 (63)
010	1	0100 0000 (64) to 0101 1111(95)
011	2	0110 0000 (96) to 0111 1111(127)
10	2	1000 0000 (128) to 1011 1111 (191)
11	3	1100 0000 (192) to 1111 1111 (255)