NTNU
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TTM4100
Communication – Services and Networks

Assignment for Chapter 4: "Network Layer"

Deadline of submission: **23.02.2012**

The assignment questions are chosen from the Problems of Chapter 4 in the textbook: J. F. Kurose and K. W. Ross. *Computer Networking: A Top-Down Approach (International Edition, 5/e)*. Pearson 2010.

The following selected questions should be answered and the answers should be submitted to the Its Learning System. For these selected questions, two or more choices are provided for each of their sub-questions, and one of them is correct.

1. Review Questions R18, R12 and R14, Chapter 4, pp. 448-449.

1.a) What is the 32-bit binary equivalent of the IP address 223.1.3.27? (Review Questions R18, page 449**)**

1.a.1 **11111011 10000000 11000000 00111000**
1.a.2 **11011111 00000001 00000011 00011011**

1.b) Do routers have IP addresses? If so, how many? (Review Questions R12, page 448**)**

1.b.1 Yes, they have one IP address for each interface.
1.b.2 Yes, they only have one IP address.
1.b.3 No

1.c) Suppose there are four routers between a source host and a destination host. Ignoring fragmentation, an IP datagram sent from the source host to the destination host will travel over how many interfaces? (Review Questions R14 first part**)**

1.c.1 4
1.c.2 6
1.c.3 8
1.c.4 10

1.d) Suppose there are four routers between a source host and a destination host. How many forwarding tables will be indexed to move the datagram from the source to the destination? (Review Questions R14 second part**)**

1.d.1 4
1.d.2 5
1.d.3 6
1.d.4 8

2. Consider a datagram network using 32-bit host addresses. Suppose a router has five links, numbered 0 through 4, and packets are to be forwarded to the link interfaces as follows: (pp. 452-453. Problem P8, Chapter 4**).**

Destination Address Range	**Link Interface**
11100000 00000000 000000000 00000000 through 11100000 00000000 111111111 11111111	0
11100000 00000001 000000000 00000000 through 11100000 00000001 111111111 11111111	1
11100000 00000010 000000000 00000000 through 11100000 11111111 111111111 11111111	2
11100001 00000000 000000000 00000000 through 11100001 11111111 111111111 11111111	3
Otherwise	4

2.a) Provide a forwarding table that has FIVE entries, uses longest prefix matching, and forwards packets to the correct link interfaces. (P8.a. Note a slight change.**)**

2.a.1

Prefix Match	**Link Interface**
11100000 00000000	0
11100000 00000001	1
11100000	2
11100001	3
otherwise	4

2.a.2

Prefix Match	**Link Interface**
11100000 00000000	0
11100000 00000001	1
11100000 00000010	2
11100001	3
otherwise	4

2.a.3

Prefix Match	**Link Interface**
11100000 00000000	0
11100000 00000001	1
11100000 11111111	2
11100001	3
otherwise	4

2.a.4

Prefix Match	Link Interface
11100000 00000000	0
11100000 00000001	1
11100000 11111111	2
11100001 11111111	3
otherwise	4

2.b) Describe how your forwarding table determines the appropriate link interface for datagrams with destination addresses: (P8.b for the first destination address *11001000 10010001 01010001 01010101*)

2.b.1 interface 0
2.b.2 interface 1
2.b.3 interface 2
2.b.4 interface 3
2.b.5 interface 4

2.c) Describe how your forwarding table determines the appropriate link interface for datagrams with destination addresses: (P8.b for the second destination address *11100000 10101101 11000011 00111100*)

2.c.1 interface 0
2.c.2 interface 1
2.c.3 interface 2
2.c.4 interface 3
2.c.5 interface 4

2.d) Describe how your forwarding table determines the appropriate link interface for datagrams with destination addresses: (P8.b for the third destination address 11100001 10000000 00010001 01110111)

2.d.1 interface 0
2.d.2 interface 1
2.d.3 interface 2
2.d.4 interface 3
2.d.5 interface 4

3. Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 220.2.240/20. Also suppose that Subnet 1 is required to support up to 2000 interfaces, and Subnet 2 and 3 are each required to support up to 1000 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints. (Page: 453. Problem P10, Chapter 4**).**

3.a	*220.2.240.0/21*	*220.2.248.0/22*	*220.2.252.0/22*
3.b	*220.2.240.0/21*	*220.2.240.0/22*	*220.2.240.0/23*

4. Suppose datagrams are limited to 1,500 bytes (including header) between source Host A and destination Host B. Assuming a 20-byte IP header, how many datagrams would be required to send an MP3 consisting of 3 million bytes? (Page: 455. Problem P19, Chapter 4**).**

4.a 1
4.b <2000
4.c 2000
4.d >2000

5. Consider the network setup in Figure 4.22 (that is copied below). Suppose that the ISP instead assigns the router address 126.13.89.67 and that the network address of the home network is 192.168/16. (Page: 454. Problem P15, Chapter 4**).**

5.a) Assign addresses to all interfaces in the home network. (P15.a**)**

5.a.1 The three host interface addresses: 192.168.0.1, 192.168.0.2, 192.168.0.3 with the router interface being 192.168.0.4
5.a.2 The three host interface addresses: 192.168.0.1, 192.168.0.2, 192.168.0.3 with the router interface being 126.13.89.67.
5.a.3 The three host interface addresses: 10.0.0.1, 10.0.0.2, 10.0.0.3 with the router interface being 192.168.0.4.
5.a.4 The three host interface addresses: 10.0.0.1, 10.0.0.2, 10.0.0.3 with the router interface being 10.0.0.4.

5.b) Suppose each host has two ongoing TCP connections, all to port 80 at host 128.119.40.86. Provide the six corresponding entries in the NAT translation table. (P15.b**)**

5.b.1 Cannot be decided from the given information.

5.b.2 The NAT translation table looks like:

WAN Side	LAN Side
126.13.89.67,4000	192.168.0.1,3345
126.13.89.67,4001	192.168.0.1,3346
126.13.89.67,4002	192.168.0.2,3445
126.13.89.67,4003	192.168.0.2,3446
126.13.89.67,4004	192.168.0.3,3545
128.13.89.67, 4005	192.168.0.3, 3546

5.b.3 The NAT translation table looks like:

WAN Side	LAN Side
128.119.40.86, 4000	10.0.0.1, 3345
128.119.40.86, 4001	10.0.0.1, 3346
128.119.40.86, 4002	10.0.0.2, 3445
128.119.40.86, 4003	10.0.0.2, 3446
128.119.40.86, 4004	10.0.0.3, 3545
128.119.40.86, 4005	10.0.0.3, 3546

5.b.4 All above are incorrect.

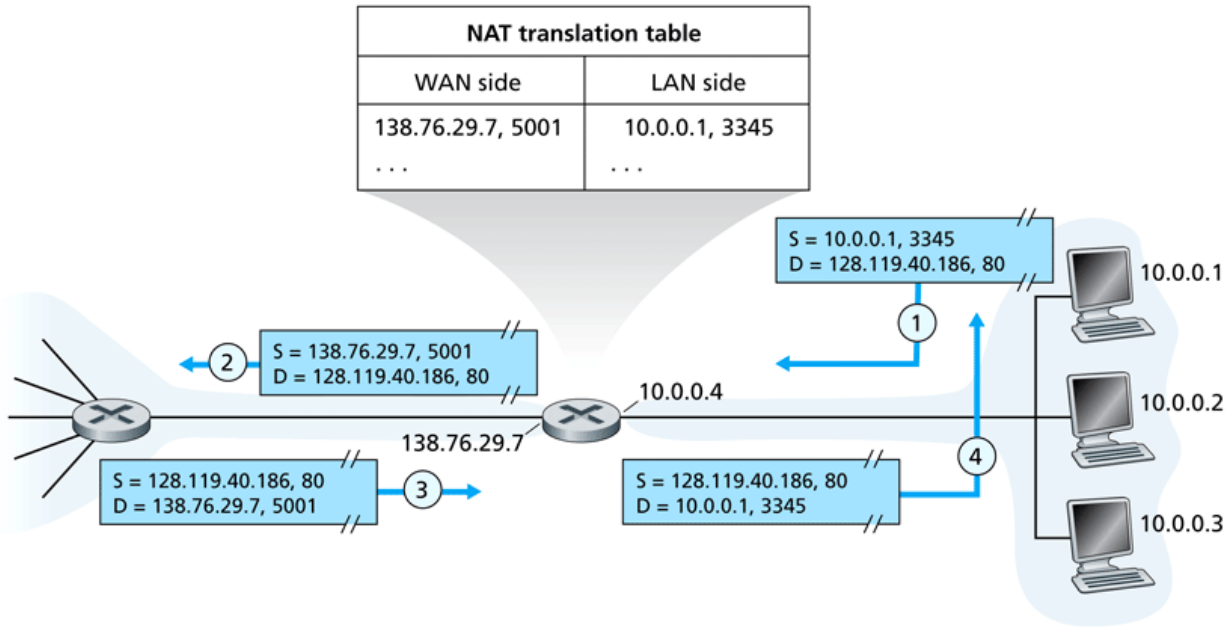

Figure 4.22 ♦ Network address translation