CS 3873: Net-Centric Computing

Assignment 4: IP and Network Routing

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**[Mandatory]** Declaration: “I warrant that this is my own work.”

Signed by Mahmoud Moustafa

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1. (2 points) IPv6 uses 128-bit addresses. If a block of 1 million addresses is allocated every picosecond, how long will the addresses last? Compare that with the age of our universe (≈ 1010 years).

With 128 bits, there will be 3.4 × 1038 addresses. Allocating 3.4 × 1038 addresses every picosecond 1018, they will last for 1013 years which is 1000 times the age of the universe.

1. (5 points) Consider the network setup in the following figure. Suppose that the ISP

assigns the router the address 24.34.136.211 and that the network prefix of the

home network is 192.168.1.0/24.  
  
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a. Assign addresses to all 3 interfaces in the home network and the network

interface of the router connected to the home network.

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Diagram

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b. Suppose each host has 2 ongoing TCP connections, all to port 80 at host 128.119.40.86. Provide the 6 corresponding entries in the NAT translation table.

|  |  |
| --- | --- |
| NAT Translation table | |
| WAN Side | LAN Side |
| 24.34.136.211, 5050 | 192.168.1.16, 3873 |
| 24.34.136.211, 5051 | 192.168.1.16, 3863 |
| 24.34.136.211, 6074 | 192.168.1.12, 3383 |
| 24.34.136.211, 6073 | 192.168.1.12, 3382 |
| 24.34.136.211, 5007 | 192.168.1.128, 3362 |
| 24.34.136.211, 5008 | 192.168.1.128, 3365 |

1. (1 point) We made a distinction between the forwarding function and the routing

function performed in the network layer. What are the key differences between routing and forwarding?

Routing: network-wide process, route datagrams among routers along and end-to-end path from source host to destination host.

Forwarding: router-local action, forward datagrams (packets) arriving on one of a router’s input links to one of its output links.

1. (4 points) 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:  
   Table

   Description automatically generated  
     
   1. Complete the following forwarding table according to the above setting, assuming longest prefix matching is used to decide where to forward a packet to the correct link interface. Note that the column of network prefix should be presented in the decimal form of a.b.c.d/x. You need to decide how many entries that this table requires.

|  |  |  |
| --- | --- | --- |
| Network Prefix (Decimal) |  | Output Link Interface |
| From | To |  |
| 224.0.0.0/10 | 224.63.255.255/10 | 0 |
| 224.64.0.0/16 | 224.64.255.255/16 | 1 |
| 224.112.0.0/12 | 224.127.255.255/12 | 2 |
| 225.176.0.0/12 | 225.191.255.255/12 | 3 |
| 226.128.0.0/9 | 226.255.255.255/9 | 4 |

* 1. According to the above forwarding table, give the output link interface for each datagram with the following destination addresses:

225.180.128.1, 224.135.1.2, 224.111.0.1

225.180.128.1 🡪 3

224.135.1.2 🡪 2 (NS)

224.111.0.1 🡪 2

1. (3 points) 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 should use addresses in a large block defined by prefix 128.16.0.0/12. You need to further divide this large address block into three smaller **non-overlapping** address blocks for these three subnets. They need to further meet the following conditions:
   1. Subnet 1 is required to support at least 300 interfaces, and the last address for this subnet is 128.31.255.255
   2. Subnet 2 is to support at least 120 interfaces, and the last address for this subnet is 128.16.1.127
   3. Subnet 3 is to support at least 400 interfaces, and the last address for this subnet is 128.17.7.255.

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