Exercises in ETSF10

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1 Network diameter

What is the diameter of the network in Figure 1? What is the smallest value that can be used as infinity? RIP is assumed, thus hop count is the cost metric.

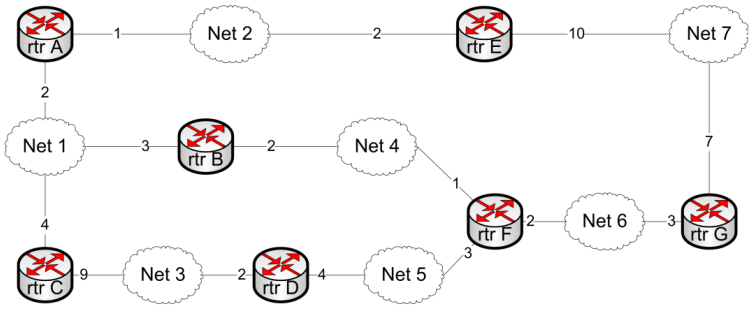

Figure 1: A network.

2 Three Node Count to Infinity

Show that Spit Horizon does not eliminate the Count to Infinity problem in a three node network shown in Figure 2. RIP is assumed.

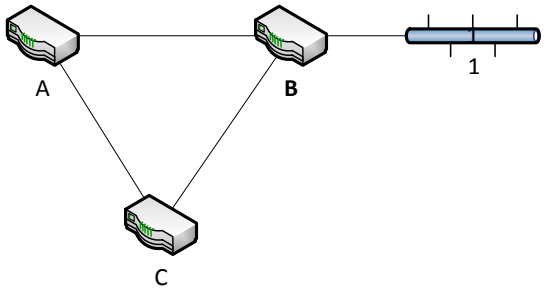

Figure 2: A 3 node network.

3 Route aggregation

It is good practice to perform route aggregation whenever possible. Given these routes in a routing table aggregate as much as possible.

```
10.10.2.0/23
192.168.1.192/26
10.10.0.0/23
192.168.1.0/25
10.10.4.0/22
192.168.2.0/24
10.10.8.0/22
```

4 Route aggregation

In classless routing you can aggregate network ids, often called prefixes, into bigger prefixes. Consider parts of a routing table (not all columns are shown):

```
Network id Net mask
10.0.4.192 255.255.255.192
10.0.0.128 255.255.255.128
10.0.0.0 255.255.255.128
10.0.1.0 255.255.255.0
10.0.5.0 255.255.255.0
10.0.6.0 255.255.255.0
10.0.4.0 255.255.255.0
10.0.10.0 255.255.255.0
10.0.2.0 255.255.254.0
10.0.8.0 255.255.254.0
```

Which prefixes will this router announce after applying maximal possible prefix aggregation?

5 Routing table

Given the following routing table:

```
Network id Net mask Interface
10.0.1.0 255.255.255.0 eth0
10.0.0.0 255.255.0.0 eth1
10.1.0.0 255.255.248.0 eth2
10.1.0.0 255.255.254.0 eth3
10.2.0.0 255.255.255.0 eth4
10.3.0.0. 255.255.248.0 eth5
```

For the interfaces, specify the destination address space for packets sent out from each interface. The answer shall be in the form a.b.c.d - x.y.z.w. Hint: Consider overlapping routes and "longest match".

6 Routing table

In a fictive routing table these two entries are found among others:

```
Network id Net mask Interface
192.168.1.0  255.255.255.0  f1/0
192.168.1.0  255.255.255.192 f1/3
```

Explain why these entries are valid. How many host addresses are possible on each LAN connected to the two interfaces?

7 NAT

A network device performing pure NAT has two global addresses assigned on its outside interface. How many of the hosts connected to the inside interface can connect to the same remote host at the same time? Motivate.

8 NAT

A LAN is connected to the Internet via a NAT device. On the LAN you find two servers, one hosting a web service on port 80 and the other hosting an SMTP service on port 25. Both servers also host ssh on port 22. The outside interface of the NAT performing device only has one global address assigned to it. Assign entries to a port forwarding table so that all services are reachable from the Internet.

9 Bandwidth-Delay Product

Given a 100 km long fibre optic link. Maximum bit-rate on the link is 1 Tbps. What is the bandwidth-delay product for the link. Approximate the speed of light in an optic fibre to be 200 000 km/sec.

10 Bandwidth-Delay Product

How much data is actually on the fly on a link from Europe to US east coast given the link maximum capacity i 1 Gbps and the delay approximately 100 ms? If we try to send TCP segments in 1500 byte IP datagrams, what would the minimum sender window size be if we want to utilise the link to the fullest?

11 Bandwidth-Delay Product

A 4GB USB memory stick ways about 10 grams. We load 10^4 kg of these memory sticks on an airplane with a maximum speed of 1000 km/h. What is the bandwidth-delay product for this constellation if the airplane has to transport the memory sticks over a distance of 5000 km?