

Computer Networks Fall 2016

Problem Sheet #2

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1 Problem 2.1

Consider the network topology shown on the problem sheet.

1.1 Problem 2.1.a) Compute the spanning tree for the red VLAN.

1.1.1 Determine the root bridge

B1 is the root bridge.

1.1.2 Compute the distance of all ports to the root and determine the root port for each bridge.

P2.1 = 3

P2.2 = 1

→ B2 has root port P2.2

P3.1 = blue VLAN only

P3.2 = ∞

P3.3 = 2

P3.4 = 2

→ B3 has root port P3.3

P4.1 = 3

P4.2 = 3

P4.3 = 1

→ B4 has root port P4.3

P5.1 = 2

P5.2 = 2

→ B5 has root port P5.1

P6.1 = 1

P6.2 = 3

P6.3 = blue VLAN only

P6.4 = ∞

→ B6 has root port P6.1

1.1.3 For each segment, compute the root port.

Segment A = P2.1 Segment B = P1.2 Segment C = P6.2 Segment D = P1.1
Segment E = P4.1 Segment F = P1.3 Segment G = P4.2

1.1.4 Shut off all unused ports.

Shut down ports P3.1, P3.4, P5.2, P6.3 for red VLAN traffic.

1.2 Problem 2.1.b) Which segments carry traffic from B to C?

The segments E, B, F as well as the segments containing B and C carry red VLAN traffic between them.

1.3 Problem 2.1.c) Compute the spanning tree for the blue VLAN.

1.3.1 Determine the root bridge

B1 is the root bridge.

1.3.2 Compute the distance of all ports to the root and determine the root port for each bridge.

P2.1 = 3
P2.2 = 1
→ B2 has root port P2.2
P3.1 = ∞
P3.2 = red VLAN only
P3.3 = 2
P3.4 = 2
→ B3 has root port P3.3
P4.1 = 3
P4.2 = ∞
P4.3 = 1
→ B4 has root port P4.3
P5.1 = 2
P5.2 = ∞
→ B5 has root port P5.1
P6.1 = red VLAN only
P6.2 = 3
P6.3 = ∞
P6.4 = red VLAN only
→ B6 has root port P6.2

1.3.3 For each segment, compute the root port.

Segment A = P2.1 Segment B = P1.2 Segment C = P5.2 Segment D = P1.1
Segment E = P4.1 Segment F = red VLAN only Segment G = P4.2

1.3.4 Shut off all unused ports.

Shut down port 3.4 for blue VLAN traffic.

1.4 Problem 2.1.d) Which segments carry traffic from A to D?

The segments C, G, E as well as the segments containing A and D carry red VLAN traffic between them.

2 Problem 2.2

Assume that you have been assigned the 203.0.113.0/24 network prefix that needs to be further divided into subnets.

2.1 2.2.a) Define the length of the longest possible network prefix that allows the creation of 20 hosts on each subnet.

The prefix 203.0.113.0/27 allows to create exactly 30 hosts / subnet, whereas the prefix 203.0.113.0/28 only allows the creation of 14 hosts / subnet. Thus the answer to the question is 27.

2.2 2.2.b) What is the maximum number of hosts that can be assigned to each subnet? What is the maximum number of such subnets that can be defined?

The maximal number that can be assigned to a subnet is 126 (prefix length 25). There are exactly two such subnets, one fixing the first 25th bit to zero and one to one.

2.3 2.2.c) Specify the subnets of 203.0.113.0/24 in dotted-decimal prefix notation

There are subnets of 6 different lengths that can be chosen. For prefix length 25, we can choose exactly 1 bit, i.e. we have two choices:

- 203.0.113.0/25
- 203.0.113.128/25

For length 26 we have four different choices:

- 203.0.113.0/26
- 203.0.113.64/26
- 203.0.113.128/26
- 203.0.113.192/26

For length 27 we have eight different choices:

- 203.0.113.0/27
- 203.0.113.32/27
- 203.0.113.64/27
- 203.0.113.96/27
- 203.0.113.128/27
- 203.0.113.160/27
- 203.0.113.192/27
- 203.0.113.224/27

For length 28 we have 16 different choices:

- 203.0.113.0/28
- 203.0.113.16/28
- 203.0.113.32/28
- 203.0.113.48/28
- 203.0.113.64/28
- 203.0.113.80/28
- 203.0.113.96/28
- 203.0.113.112/28
- 203.0.113.128/28
- 203.0.113.144/28
- 203.0.113.160/28
- 203.0.113.176/28
- 203.0.113.192/28
- 203.0.113.208/28
- 203.0.113.224/28
- 203.0.113.240/28

For length 29 we have 32 different choices:

- 203.0.113.0/29
- 203.0.113.8/29
- 203.0.113.16/29
- 203.0.113.24/29

- 203.0.113.32/29
- 203.0.113.40/29
- 203.0.113.48/29
- 203.0.113.56/29
- 203.0.113.64/29
- 203.0.113.72/29
- 203.0.113.80/29
- 203.0.113.88/29
- 203.0.113.96/29
- 203.0.113.104/29
- 203.0.113.112/29
- 203.0.113.120/29
- 203.0.113.128/29
- 203.0.113.136/29
- 203.0.113.144/29
- 203.0.113.152/29
- 203.0.113.160/29
- 203.0.113.168/29
- 203.0.113.176/29
- 203.0.113.184/29
- 203.0.113.192/29
- 203.0.113.200/29
- 203.0.113.208/29
- 203.0.113.216/29
- 203.0.113.224/29
- 203.0.113.232/29
- 203.0.113.240/29
- 203.0.113.248/29

For length 30 we have 64 different choices:

- 203.0.113.0/30

- 203.0.113.4/30
- 203.0.113.8/30
- 203.0.113.12/30
- 203.0.113.16/30
- 203.0.113.20/30
- 203.0.113.24/30
- 203.0.113.28/30
- 203.0.113.32/30
- 203.0.113.36/30
- 203.0.113.40/30
- 203.0.113.44/30
- 203.0.113.48/30
- 203.0.113.52/30
- 203.0.113.56/30
- 203.0.113.60/30
- 203.0.113.64/30
- 203.0.113.68/30
- 203.0.113.72/30
- 203.0.113.76/30
- 203.0.113.80/30
- 203.0.113.84/30
- 203.0.113.88/30
- 203.0.113.92/30
- 203.0.113.96/30
- 203.0.113.100/30
- 203.0.113.104/30
- 203.0.113.108/30
- 203.0.113.112/30
- 203.0.113.116/30
- 203.0.113.120/30

- 203.0.113.124/30
- 203.0.113.128/30
- 203.0.113.132/30
- 203.0.113.136/30
- 203.0.113.140/30
- 203.0.113.144/30
- 203.0.113.148/30
- 203.0.113.152/30
- 203.0.113.156/30
- 203.0.113.160/30
- 203.0.113.164/30
- 203.0.113.168/30
- 203.0.113.172/30
- 203.0.113.176/30
- 203.0.113.180/30
- 203.0.113.184/30
- 203.0.113.188/30
- 203.0.113.192/30
- 203.0.113.196/30
- 203.0.113.200/30
- 203.0.113.204/30
- 203.0.113.208/30
- 203.0.113.212/30
- 203.0.113.216/30
- 203.0.113.220/30
- 203.0.113.224/30
- 203.0.113.228/30
- 203.0.113.232/30
- 203.0.113.236/30
- 203.0.113.240/30

- 203.0.113.244/30
- 203.0.113.248/30
- 203.0.113.252/30

For length 31 we have 128 different choices.

- 203.0.113.0/31
- 203.0.113.2/31
- 203.0.113.4/31
- 203.0.113.6/31
- 203.0.113.8/31
- 203.0.113.10/31
- 203.0.113.12/31
- 203.0.113.14/31
- 203.0.113.16/31
- 203.0.113.18/31
- 203.0.113.20/31
- 203.0.113.22/31
- 203.0.113.24/31
- 203.0.113.26/31
- 203.0.113.28/31
- 203.0.113.30/31
- 203.0.113.32/31
- 203.0.113.34/31
- 203.0.113.36/31
- 203.0.113.38/31
- 203.0.113.40/31
- 203.0.113.42/31
- 203.0.113.44/31
- 203.0.113.46/31
- 203.0.113.48/31
- 203.0.113.50/31

- 203.0.113.52/31
- 203.0.113.54/31
- 203.0.113.56/31
- 203.0.113.58/31
- 203.0.113.60/31
- 203.0.113.62/31
- 203.0.113.64/31
- 203.0.113.66/31
- 203.0.113.68/31
- 203.0.113.70/31
- 203.0.113.72/31
- 203.0.113.74/31
- 203.0.113.76/31
- 203.0.113.78/31
- 203.0.113.80/31
- 203.0.113.82/31
- 203.0.113.84/31
- 203.0.113.86/31
- 203.0.113.88/31
- 203.0.113.90/31
- 203.0.113.92/31
- 203.0.113.94/31
- 203.0.113.96/31
- 203.0.113.98/31
- 203.0.113.100/31
- 203.0.113.102/31
- 203.0.113.104/31
- 203.0.113.106/31
- 203.0.113.108/31
- 203.0.113.110/31

- 203.0.113.112/31
- 203.0.113.114/31
- 203.0.113.116/31
- 203.0.113.118/31
- 203.0.113.120/31
- 203.0.113.122/31
- 203.0.113.124/31
- 203.0.113.126/31
- 203.0.113.128/31
- 203.0.113.130/31
- 203.0.113.132/31
- 203.0.113.134/31
- 203.0.113.136/31
- 203.0.113.138/31
- 203.0.113.140/31
- 203.0.113.142/31
- 203.0.113.144/31
- 203.0.113.146/31
- 203.0.113.148/31
- 203.0.113.150/31
- 203.0.113.152/31
- 203.0.113.154/31
- 203.0.113.156/31
- 203.0.113.158/31
- 203.0.113.160/31
- 203.0.113.162/31
- 203.0.113.164/31
- 203.0.113.166/31
- 203.0.113.168/31
- 203.0.113.170/31

- 203.0.113.172/31
- 203.0.113.174/31
- 203.0.113.176/31
- 203.0.113.178/31
- 203.0.113.180/31
- 203.0.113.182/31
- 203.0.113.184/31
- 203.0.113.186/31
- 203.0.113.188/31
- 203.0.113.190/31
- 203.0.113.192/31
- 203.0.113.194/31
- 203.0.113.196/31
- 203.0.113.198/31
- 203.0.113.200/31
- 203.0.113.202/31
- 203.0.113.204/31
- 203.0.113.206/31
- 203.0.113.208/31
- 203.0.113.210/31
- 203.0.113.212/31
- 203.0.113.214/31
- 203.0.113.216/31
- 203.0.113.218/31
- 203.0.113.220/31
- 203.0.113.222/31
- 203.0.113.224/31
- 203.0.113.226/31
- 203.0.113.228/31
- 203.0.113.230/31

- 203.0.113.232/31
- 203.0.113.234/31
- 203.0.113.236/31
- 203.0.113.238/31
- 203.0.113.240/31
- 203.0.113.242/31
- 203.0.113.244/31
- 203.0.113.246/31
- 203.0.113.248/31
- 203.0.113.250/31
- 203.0.113.252/31
- 203.0.113.254/31

For length 32 we have 256 different choices.

- 203.0.113.0/32
- 203.0.113.1/32
- 203.0.113.2/32
- 203.0.113.3/32
- 203.0.113.4/32
- 203.0.113.5/32
- 203.0.113.6/32
- 203.0.113.7/32
- 203.0.113.8/32
- 203.0.113.9/32
- 203.0.113.10/32
- 203.0.113.11/32
- 203.0.113.12/32
- 203.0.113.13/32
- 203.0.113.14/32
- 203.0.113.15/32
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- 203.0.113.20/32
- 203.0.113.21/32
- 203.0.113.22/32
- 203.0.113.23/32
- 203.0.113.24/32
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- 203.0.113.252/32
- 203.0.113.253/32
- 203.0.113.254/32
- 203.0.113.255/32

Thus there is a total of 510 subnets.

2.4 2.2.d) List the range of host addresses that can be assigned in the second subnet. What is the broadcast address used in the third subnet?

The subnet 203.0.113.128/25 has addresses 203.0.113.128 - 203.0.113.255. The subnet 203.0.113.0/26 has broadcast address 203.0.113.63.