

## 12. Sub- & Supernetting

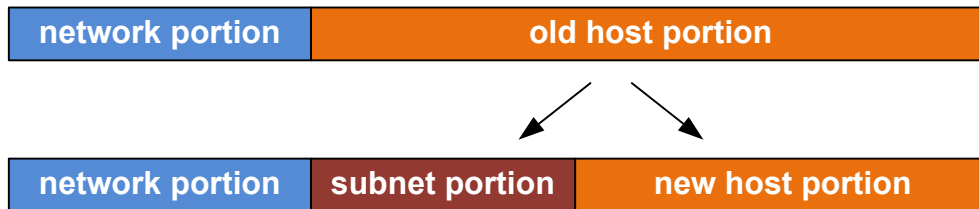
### 12.1 Revision

In chapter 5 we have seen that:

- An IPv4 address is a 32 bit number.
- An IP address is split into a network portion and a host portion.
- The subnet mask indicates the length of the network portion.
  
- All hosts in a network have the same network portion.
- The network address is the lowest possible IP address in a network, thus all host bits are set low (=0).
- The broadcast address is the highest possible IP address in a network, thus all host bits are set high (=1).
- number of possible IP addresses in a network =  $2^{\text{number of bits in host portion}}$
- number of possible hosts in a network =  $2^{\text{number of bits in host portion}-2}$

## 12.2 Subnetting

Under subnetting we understand the splitting of one big bigger network into several smaller networks. Therefore we need to borrow some bits of the host portion in order to number the different subnets.



number of possible subnets = $2^{\text{number of bits in subnet portion}}$
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number of possible IP addresses = $2^{\text{number of bits in host portion}}$
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There is roughly two types of subnetting situations:

1. A certain number of hosts have to be foreseen per subnet.

Determine the number of bits needed in order to number at least the requested hosts. Don't forget the network address and the broadcast address.

This number is the length of the new host portion. The remaining bits of the old host portion can be used to number the different subnets.

2. A certain number of subnets have to be foreseen.

Determine the number of bits needed in order to number at least the requested subnets.

This number is the length of the subnet portion. The remaining bits are forming the new host portion.

The subnet mask of the subnets includes all bits of the network portion plus the bits of the host portion.

### Example:

The network 10.1.0.0/16 should be split into subnets containing maximum 128 host.

source: <http://www.hs-weingarten.de/~perk/rnet/uebungen/Subnetting/subnetting.pdf>

### **Exercise 1:**

You want to subdivide the network 200.150.50.0/24 in a school in that way that every classroom has its own subnet.

- a) How many IP addresses are needed in every subnet if you want to install in every classroom 30 student PC's, 1 teacher PC and a network printer?
- b) How many subnets can be formed?
- c) Indicated in form of a table all network addresses, subnet masks and broadcast IP addresses of the chosen subnets.
- d) What kind of problem will occur when you want to connect the subnets to the internet?

### **Exercise 2:**

The network 141.69.203.0/24 should be split upon 3 computer labs such that every lab has its own network. The subnets should have the same size. The default gateway uses the lowest possible host address.

- a) Indicate the subnet mask of the subnets.
- b) Indicate the maximal number of host that can be connected to one subnet.
- c) Indicated in form of a table all network addresses, broadcast IP address and gateway IP addresses of the chosen subnets.
- d) What's the inconvenience about splitting the network into equal sized subnets.

source: <http://dt.wara.de/itKlassen/e1it3/aufgabenFuer2013-04-30/subnettingAufgaben.pdf>

### **Exercise 3:**

Your provider has assigned all IP addresses of the network 134.12.3.64/26 to you.

- a) Calculate the number of IP addresses the provider has assigned to you.
- b) The assigned address range should now be split into 4 subnets with 4, 7, 12 and 23 Hosts. Determine a useful subnetting and complete the below table.

	<b>network address</b>	<b>subnet mask</b>	<b>broadcast address</b>	<b>number of IP addresses</b>
subnet 1				
subnet 2				
subnet 3				
subnet 4				

## **12.3 Supernetting**

Under supernetting we understand increasing the size of a network. As a consequence the network portion will get smaller and the network address will change.

Of course supernetting requires that we are allowed to use the IP addresses we are extending the network to.

### **Exercise 4:**

The Integrated Services Router of your start-up company is using the network 192.168.255.0/24. Your enterprise is so successful that the number of hosts in your network is slowly heading towards 254 hosts. Obviously, you need to increase the size of your network. As you have installed quite a lot of hosts with static IP addresses you don't want to switch to a completely different private IP address range as 10.0.0.0/8 or 172.16.0.0/16. Your new network should allow connecting up to 1000 hosts and should include the old network for the above-mentioned reason.

- a) Suggest a solution that will occupy a strict minimum of IP addresses.
- b) Suggest a least effort solution.