

The Subnet Mask



- A host can send traffic directly to another host on the same subnet via switches
- For a host to send traffic to another host in a different subnet, it must be forwarded by a router
- The host therefore needs to understand if the destination is on the same or a different subnet in order to know how to send it
- The subnet mask is used for this
- The subnet mask is also 32 bits long, and can be written in dotted decimal or slash notation

Network and Host Portion



- A host's IP address is divided into a network portion and a host portion
- The subnet mask defines where the boundary is
- The easiest way to explain this is through example...
- Let's say the host's IP address is 192.168.10.15 and its subnet mask is 255.255.255.0
- We write the IP address out in binary notation, and then the subnet mask underneath

Subnet 'Masking'



● 192.168.10.15 / 255.255.255.0

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1							
1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	1	1							
128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1							
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0

- The IP address is compared ('masked') with the subnet mask
- A '1' in the subnet mask indicates that bit in the IP address is part of the network address
- A '0' indicates the bit is part of the host address

Local Subnet or Routed Traffic



● 192.168.10.15 / 255.255.255.0

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	1	1
128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	

- For a destination address to be in the same subnet, the network portion has to be **exactly** 192.168.10.
- Otherwise it's in a different subnet and traffic must be sent via a router

Valid Subnet Masks



● 192.168.10.15 / 255.255.255.0

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	
1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	

- The subnet mask always begins with contiguous '1's
- For example, 11111111.11110000.00000000.00000000 is a legal subnet mask
- 11101101.11110000.11100000.00001111 is not

The Host Portion

● 192.168.10.15 / 255.255.255.0

128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1							
1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	1	1						
128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1							
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0

- The host portion of the address is available to be allocated to the different hosts on the subnet (eg PCs, Servers, Printers, Router Interfaces and Switch Management Addresses)
- With two exceptions (coming up after the next slide)...

Host Addresses



- The host portion of the address specifies the individual host and must be unique on that subnet
- Hosts do not have to be numbered sequentially
- If the network portion of the address is 10.10.10, you can have a host with IP address 10.10.10.10 and another host with 10.10.10.20
- You can't have two different hosts both with IP address 10.10.10.10. That would be a duplicate IP address. Whenever another host sent traffic to 10.10.10.10, the network wouldn't know which one to send it to.
- We could have host 10.10.10.10 on one subnet and host 10.10.20.10 on another subnet

The Network Address (Network ID)



● 192.168.10.15 / 255.255.255.0



128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	
128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	

- All 0's in the host portion designates the network address and is not allowed to be allocated to a host
- In our example the network address is 192.168.10.0

1	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
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