Redes de Comunicação 2021/2022

TP02
IP routing and addressing
IP subnetting

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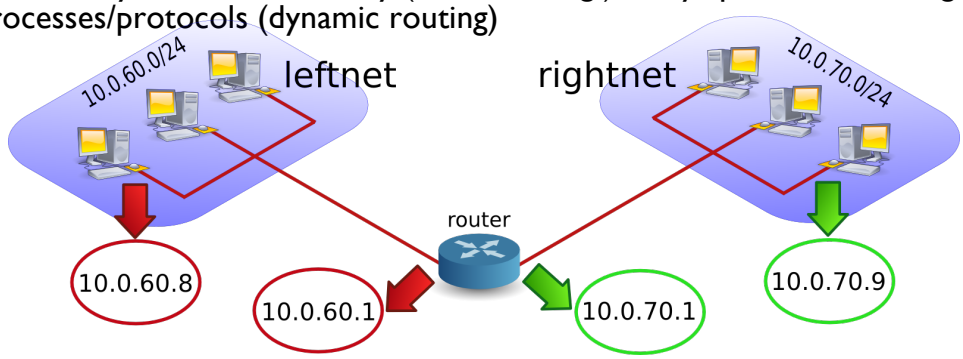
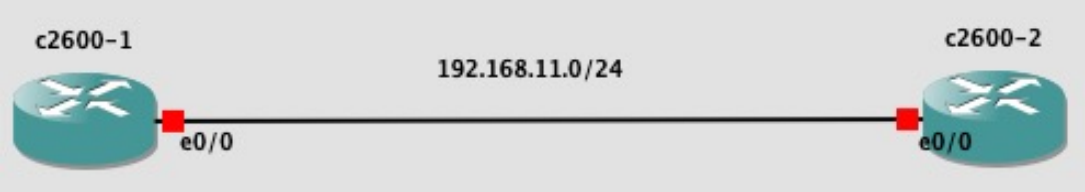
Internet (IP) routing

- A router is responsible for the forwarding of IP packets across different (physical) networks
- A router (and also a host) uses a routing table to select the next destination (hop) for an IP packet
- The information in the routing table is referred to as routes
- Routes may be added manually (static routing) or by specializes routing processes/protocols (dynamic routing)



Network scenarios: challenges



1. Configure the interface *e0/0* in router c2600-1, using an IP address from the network 192.168.11.0/24
2. Confirm that you able to reach ("ping") router c2600-2 from router c2600-1
3. Configure the interface *e0/0* in router c2600-2, using an IP address from the same network

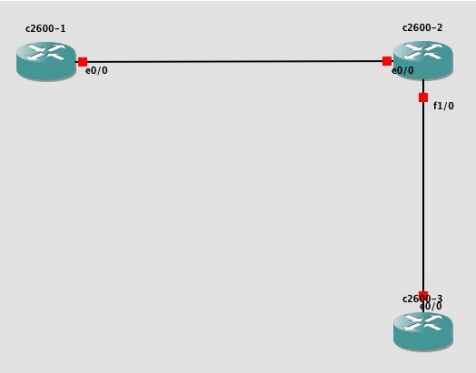
IP subnetting

- Further subdivision (subnetting) of the addressing space is possible
- As different physical networks need to use different IP address networks this is a very common operation

Subnet Mask	CIDR	Subnet Mask	CIDR
255.128.0.0	/9	255.255.240.0	/20
255.192.0.0	/10	255.255.248.0	/21
255.224.0.0	/11	255.255.252.0	/22
255.240.0.0	/12	255.255.254.0	/23
255.248.0.0	/13	255.255.255.0	/24
255.252.0.0	/14	255.255.255.128	/25
255.254.0.0	/15	255.255.255.192	/26
255.255.0.0	/16	255.255.255.224	/27
255.255.128.0	/17	255.255.255.240	/28
255.255.192.0	/18	255.255.255.248	/29
255.255.224.0	/19	255.255.255.252	/30

IP subnetting (example 1)

- Consider that you need to use the network 192.168.11.0/24 in this scenario
- As router c2600-2 interconnects two different (physical) networks, we need two different IP sub-networks (non-overlapping address ranges)
- Simpler approach to create two subnet: use two /25 networks!



IP subnetting (example 1)

/24 supports 256 addresses (254 addresses for hosts)
/25 supports 128 addresses (126 addresses for hosts)

/25 = 11111111 11111111 11111111 10000000

We can now use the new bit in the netmask to create two subnetworks of the original network

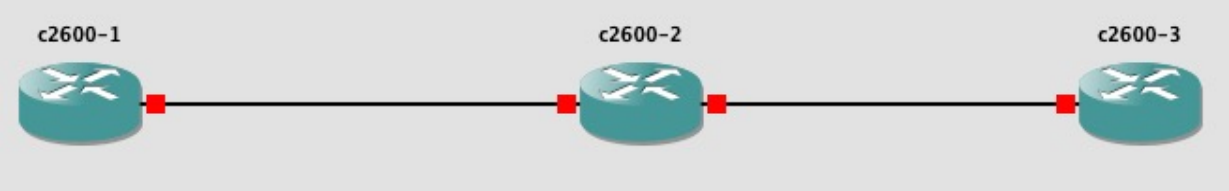
If the bit is "0":

Network: 192.168.11.0/25
Netmask: 255.255.255.128
Network address: 192.168.11.0
Broadcast address: 192.168.11.127
IP address range: 192.168.11.1 to 126

If the bit is "1".

Network: 192.168.11.128/25
Netmask: 255.255.255.128
Network address: 192.168.11.128
Broadcast address: 192.168.11.255
IP address range: 192.168.11.129 to 254

IP subnetting (example 2)



Consider that you need to use the network 192.168.192.0/18 in this scenario:

Subnet this network, in order to obtain two subnets for the network scenario above

IP subnetting (example 2)

/19 = 11111111 11111111 11100000 00000000

We use the new bit in the netmask to create two subnetworks

If the bit is "0":

Network: 192.168.192.0
(3rd decimal number of network address is 192 = 11000000)

Netmask: 255.255.224.0 (or /19)

Network address: 192.168.192.0 (first address of range)

Broadcast address: 192.168.223.255
(3rd decimal number of address is 223 = 11011111)

IP address range: 192.168.192.1 to 192.168.223.254

If the bit is "1":

Network: 192.168.224.0
(3rd decimal number of network address is 224 = 11100000

Netmask: 255.255.224.0 (or /19)

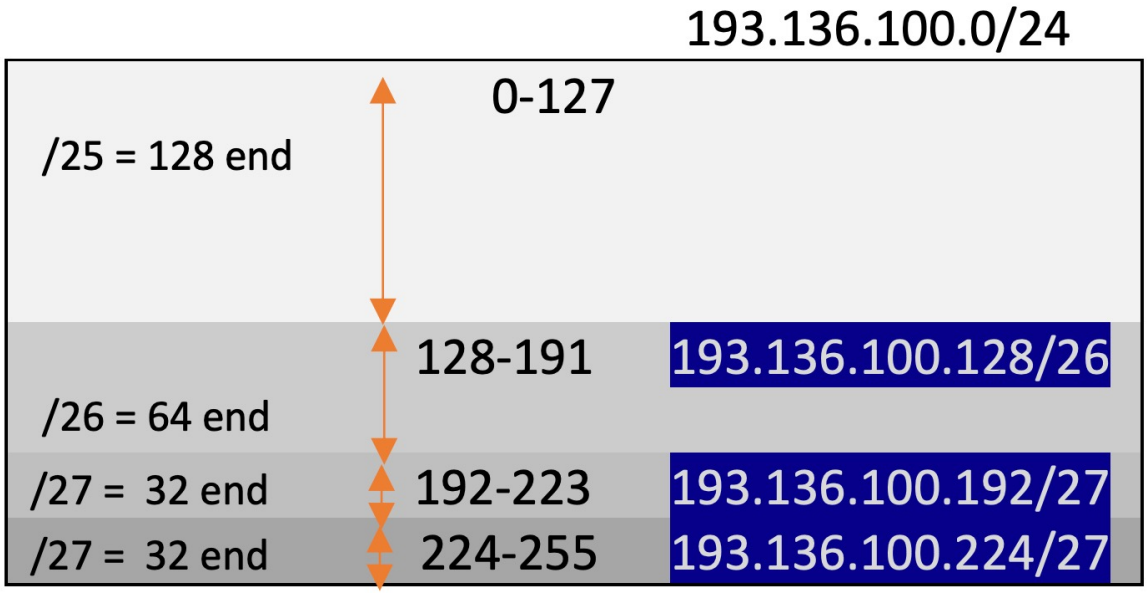
Network address: 192.168.224.0 (first address of range)

Broadcast address: 192.168.255.255
(3rd decimal number of address is 255 = 11111111)

IP address range: 192.168.224.1 to 192.168.255.254

IP subnetting (example 3)

Using the network 193.136.100.128/25 create 3 subnets:



IP subnetting (example 3)

Using the network 193.136.100.128/25 create 3 subnets:

Network 1: 193.136.100.128/26
Netmask: 255.255.255.192 (or /26)
IP address range: 193.136.100.129 to 193.136.100.190
Broadcast address: 193.136.100.191

Network 2: 193.136.100.192/27
Netmask: 255.255.255.224 (or /27)
IP address range: 193.136.100.193 to 193.136.100.222
Broadcast address: 193.136.100.223

Network 3: 193.136.100.1224/27
Netmask: 255.255.255.224 (or /27)
IP address range: 193.136.100.225 to 193.136.100.254
Broadcast address: 193.136.100.255

TP02: Summary

What we have covered here?

- Static versus dynamic routing
- Using GNS3 to configure (simple) network scenarios
- IP address subnetting