

# EP2120 Internetworking

## IK2218 Protocols and Principles of the Internet

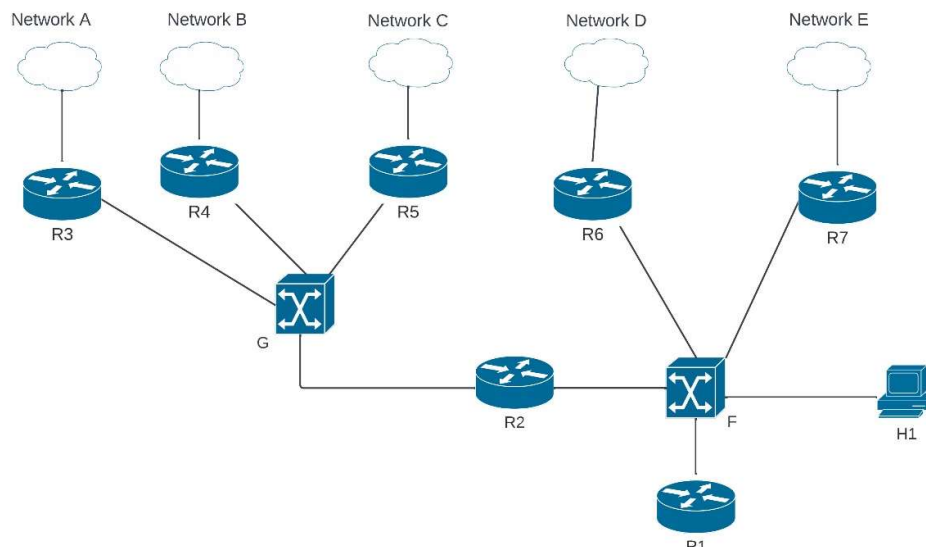
### Homework Assignment 1

(Solutions due 19:00, Mon., 11 Sept. 2023)  
(Review due 19:00, Wed., 13 Sept. 2023)

#### 1. IPv4 Addressing (30/100)

- What is the best fit netmask (i.e., resulting in as few host addresses as possible) for a network with 62 hosts in it? (5p)
- What is the maximum number of hosts you can have in a /24 network? (5p)
- Split up the network 172.20.16.0/24 into five networks, three /26 networks and two /27 networks. Provide the resulting subnets in binary and in dotted decimal notation including the prefix length. (5p)
- What is the directed broadcast address of the network 37.156.192.0/20? (5p)
- Assume that the address of a host in a network is 172.20.17.193 and the directed broadcast address of the network is 172.20.17.255. What is the network address of the largest and smallest subnet that the device may belong to? Provide the results in dotted decimal notation including the prefix length. (5p)
- Use the services of IANA and a regional registry to figure out to whom the IP address block 37.156.192.0/24 belongs. Provide the name of the organization and the AS number. (5p)

#### 2. Address allocation (30/100)



Consider the network above, a routed network in an organization's enterprise network. The organization built a core network (network F) connected to a central router (R1), which provides access to the rest of the Internet. Router (R2) connects network F to the switched Ethernet network G. The access routers

(R3 to R7) are connected to a set of local offices (networks A to E). The host H1, connected to network F, performs various traffic monitoring tasks. All networks use Ethernet on the link layer.

The organization wants to make an *address allocation* by assigning an address block to networks A to G in the following way:

- i. Network A requires 500 hosts, networks B and C require 200 hosts each, and networks D and E require 100 hosts each. The lowest address should be assigned to network A.
- ii. There are no unnumbered point-to-point links: all Ethernet networks are IP subnets and all nodes (routers and hosts) have an IP address on all their network interfaces. All nodes need to be reachable from any other host.
- iii. The address allocation should be such that the subnets can be *aggregated*.
- iv. Each subnet should not be larger than necessary in order to accommodate all nodes (host or router interfaces) in the subnet.

a) Assume that the allocated address block is 152.68.208.0/22. Is it possible to have an address allocation that satisfies the above requirements? Justify your answer. (4p)

b) Now, assume that the enterprise allocated prefix 152.68.208.0/21 for its internal addresses. Make an address allocation as described in (i-iv). Based on your address allocation, provide the network addresses of networks A to G, and the required entries of the forwarding table of router R1. Choose appropriate IP addresses for the router interfaces that appear as next hop in the forwarding table. Give a sketch of your reasoning to support your solution. (26p)

### 3. IPv4 forwarding (20/100)

A router has the forwarding table shown below. Determine the next-hop address and the outgoing interface for the packets arriving to the router with destination addresses as given in points (a)-(e).

Destination	Next hop	Flags	Interface
80.5.0.0/16	-	U	m2
129.40.160.0/20	-	U	m1
201.50.1.0/25	-	U	m0
91.0.0.96/27	80.5.0.100	UG	m2
147.17.0.0/16	201.50.1.44	UG	m0
129.40.128.0/17	201.50.1.2	UG	m0
0.0.0.0/0	80.5.0.1	UG	m2

a) 201.50.1.63 (4p)

b) 91.0.0.140 (4p)

c) 129.40.255.48 (4p)

d) 201.40.195.2 (4p)

e) 147.17.224.224 (4p)

#### 4. IPv4 and IPv6 datagram formats (20/100)

- a. What is the purpose of TTL in the IPv4 header and in the IPv6 header? Please explain what could happen if the TTL field did not exist. (5p)
- b. How is error checking done in IPv4? What is the purpose? (5p)
- c. In the IPv4 header, the 'Flags' field consists of 3 bits, of which the 'DF' (Don't Fragment) and 'MF' (More Fragments) flags are used. Explain a scenario where these flags would be relevant, how they are set, and the implications for packet fragmentation and reassembly. (5p)
- d. What is Explicit Congestion Notification (ECN)? How is it used? (5p)