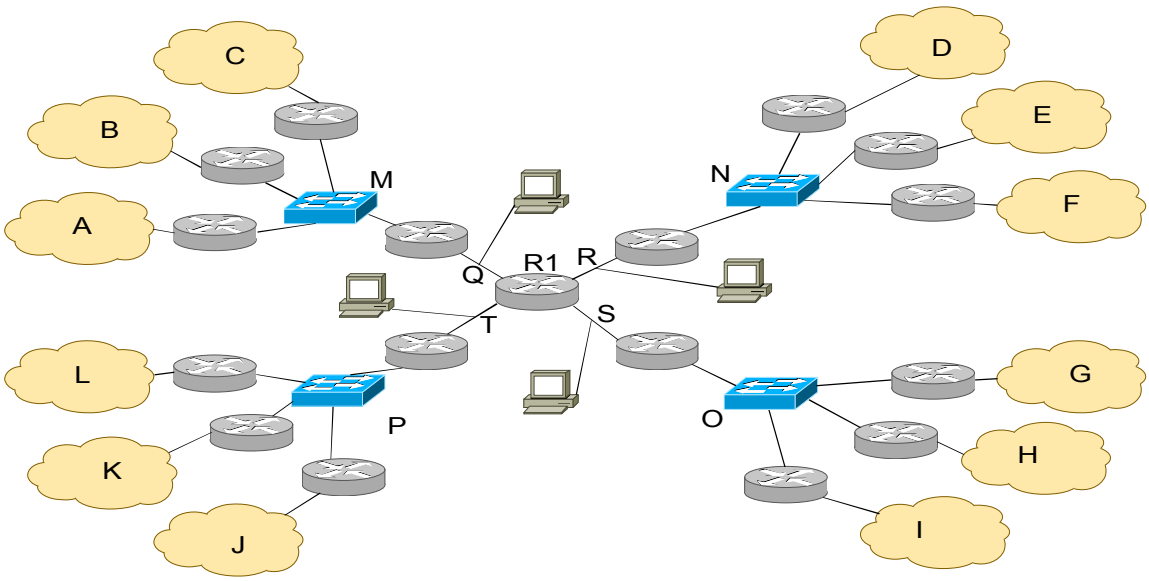
# EP2120 Internetworking/Internetteknik
# DD2393 Internets Protokoll och Principer

## Homework Assignment 1
### (Solutions due 17:00, Wednesday, 2011.Sept.07)
### (Review due 17:00, Friday, 2011.Sept.09)

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

a) Propose the best fit netmask (i.e., resulting in as few host addresses as possible) for a network with 15 hosts in it! (5p)
b) How many hosts can you have in a /26 network? (5p)
c) Split up the network 192.168.48.0/23 into four equally sized /25 networks! (5p)
d) What is the directed broadcast address of the network 121.2.20.0/22? (5p)
e) What is the limited broadcast address of the network 121.2.20.0/22? (5p)
f) Use the services of IANA and a regional registry to figure out to whom the network 130.237.0.0/16 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 around a central router R1 (networks Q, R, S, T), and connected their edge/access routers with (long-haul) switched Ethernet (networks M, N, O, P). The access routers in turn are connected to a set of local offices (Networks A to L). Individual hosts are connected to networks Q, R, S and T to monitor network traffic. All networks use Ethernet on the link layer.

The enterprise allocated prefix 12.128.0.0/17 for its internal addresses.

Make an *address allocation* using 12.128.0.0/17 in the network by assigning a sub-block to each network A-T in the following way:

1) The local offices require 900 addresses each. Create a minimal block for each local office A to L. Start with the lowest address for network A.
2) There are no unnumbered point-to-point links: all Ethernet networks have IP sub-networks and all nodes (routers and hosts) have an IP address on all their network interfaces.
3) The address allocation should be such that the sub-networks can be *aggregated*. The central router R1 should have *at most eight entries* in its forwarding table (plus possibly a default route).

Which are the eight entries in router R1? Give a sketch of your reasoning to support your solution. (30p)
Hint: Four of these entries should encompass all local offices.

## 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 |
|---|---|---|---|
| 93.171.0.0/16 | - | U | m0 |
| 62.88.93.32/28 | - | U | m1 |
| 111.92.64.0/18 | - | U | m2 |
| 133.10.165.0/24 | 62.88.93.33 | UG | m1 |
| 112.147.12.0/24 | 111.92.113.25 | UG | m2 |
| 173.78.34.128/25 | 62.88.93.34 | UG | m1 |
| 7.152.35.0/24 | 93.171.172.13 | G | m0 |
| 192.121.17.13/32 | 111.92.92.127 | UGH | m2 |
| 0.0.0.0/0 | 93.171.89.1 | UG | m0 |

a) 167.14.81.9 (4p)
b) 192.121.17.13 (4p)
c) 7.152.35.14 (4p)
d) 111.92.66.178 (4p)
e) 133.10.165.254 (4p)

## 4. IPv4 options and IPv6 extension headers (20/100)

Consider two hosts, A and B, connected by two networks. Network 1 uses IPv4 and Network 2 uses IPv6. The path MTU on both networks is 100000 bytes. You would like to send a datagram of 120000 bytes.
(Hint: Check rfc2460 and rfc2675 to see how fragmentation and jumbo payloads can/can not coexist in IPv6.)

a) Assume you choose the IPv4 network. Do the IP datagrams need to carry IPv4 options? If yes, how many? (7p)
b) Assume you choose the IPv6 network. Do the datagrams need to carry IPv6 extension headers? If yes, how many? How many options would they carry? (7p)
c) Which network should you choose to minimize the total number of bytes sent in datagram headers? (6p)