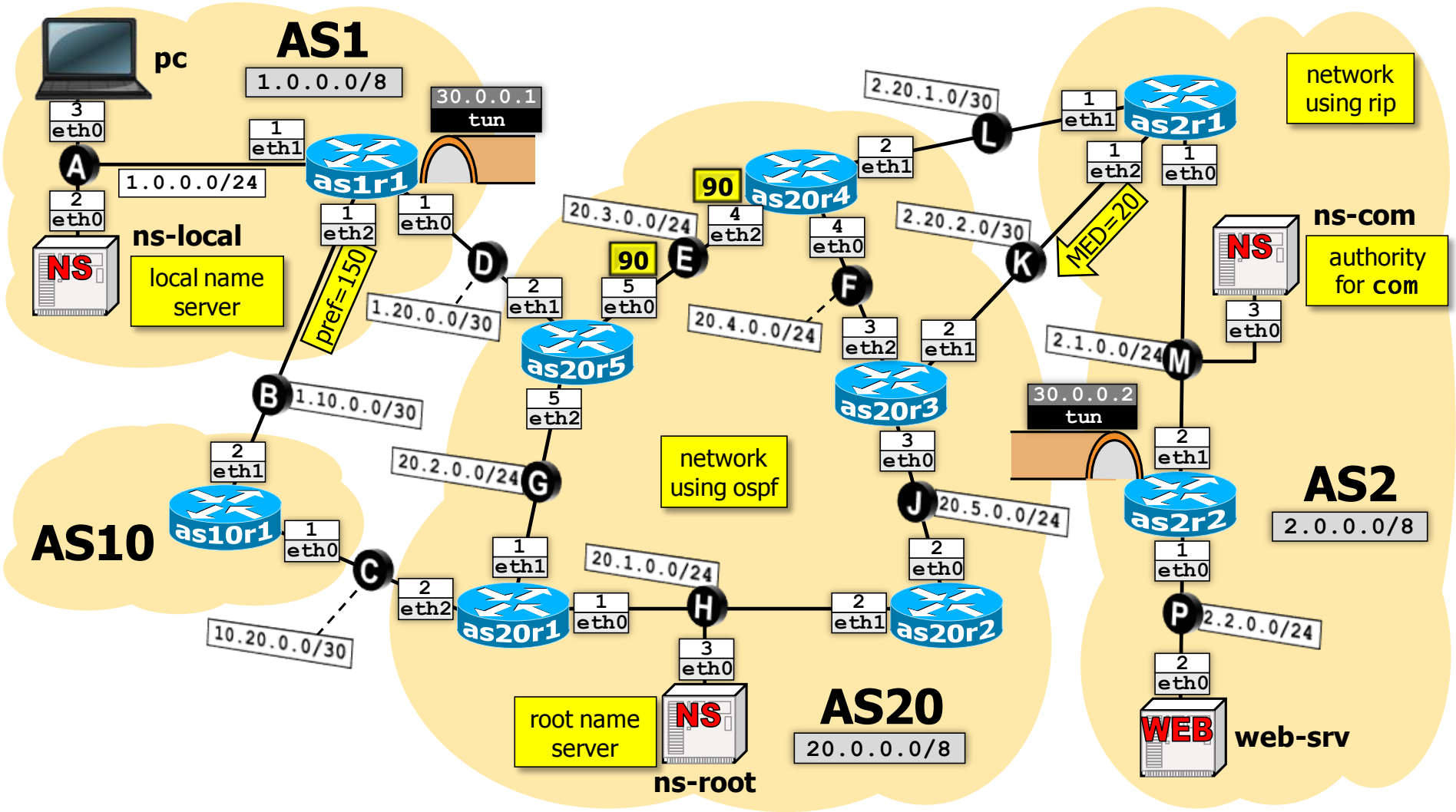
ICN – Examination date: 02 Feb 2016 – "Cliff"

Available time: 120 minutes.



Using Netkit, implement the network depicted in the figure and described below.

- ☐ Remember to set up a default route on all the end systems.
- ☐ Routing within AS2 is implemented by using RIP.
  - as2r1 injects in RIP all the routes learned via BGP.
- ☐ Routing within AS20 is implemented by using OSPF.
  - All the interfaces belong to area 0.0.0.0.
  - Border routers inject BGP-learned routes into OSPF (do not worry about redistributing eBGP only: OSPF will automatically take care of this).
  - Some interfaces are assigned the OSPF costs specified in the picture. All the other interfaces have the default cost.
- ☐ Inter-domain routing is implemented by using BGP, which is set up as follows:
  - AS1, AS2, and AS20 also announce their own internal subnets, in gray.
  - All peering LANs are announced in BGP. No routers announce the default route 0.0.0.0/0.
  - Border routers in AS20 establish iBGP peerings with each other. Pick the IP addresses of network interfaces consistently with OSPF routing in order to establish such peerings.
  - as1r1 prefers announcements received from AS10, applying to them a local-preference value of 150.
  - as1r1 applies a community 1:1 to announcements sent to AS10.
  - as2r1 sets a metric equal to 20 on announcements sent to as20r3.
  - as20r1 prefers received announcements that carry a community value 1:1.

SETTING AND VERIFYING THE PRESENCE OF A BGP COMMUNITY

In a `route-map`: `set community` *communityValue*
On a router that receives updates with communities: `show ip bgp` *prefix*

MATCHING A BGP COMMUNITY

`ip community-list standard` *CLname* `permit` *communityValue*
Then, in a `route-map`: `match community` *CLname*

- ☐ An IP-in-IP tunnel is set up between as1r1's interface eth0 and as2r2's interface eth1.
  - Routing towards the tunnel is set up by using static routes.
  - The tunnel is only used by traffic sent from AS1 towards 2.2.0.0/24.

SETUP OF AN IP-IN-IP TUNNEL (to be accomplished at both endpoints)

```
ip tunnel add tunnelInterface mode ipip remote remoteIP local localIP ttl 255
ip link set tunnelInterface up
ip address add IPaddress peer remoteTunnelIPaddress dev tunnelInterface
ip route add subnet/netmask [via nextHop] dev tunnelInterface
```

- ☐ A DNS is available on the network, set up as follows:
  - ns-local is the local name server for pc.
  - ns-root is the root name server.
  - ns-com is the authority for zone com.
  - The only relevant DNS name is web.com, which is associated with IP address 2.2.0.2.
- ☐ web-srv is a Web server running apache, which serves a private web page for the "guest" user, accessible by using the URL http://web.com/~guest/.

Goals: IP routing must comply with the above requirements. In particular:
- packets from AS1 to 2.2.0.0/24 must be sent through the tunnel and traverse links B, C, H, J, F, L, M;
- packets from AS20 to AS1 must traverse link C.

It must be possible to access the Web page http://web.com/~guest/ from pc.