Our entire address space is 202.144.139.0/24 Host part XXXXXXX Total number of IPs = 2^8 = 256 (00000000 to 111111111) Lowest IP: Highest IP: 11001010 10010000 10001011 **11111111** = 202.144.139.255 For this exercise, we will divide this up as follows: +----+ |.0/29 |.8/29 |.16/29 |.24/29 |.32/29 | 0-7 | 8-15 | 16-23 | 24-31 | 32-39 | +----+ separate subnet for each group +-----1.192/26 - 255 192 +----+ backbone TABLE ONE 202.144.139.192/26 Classroom backbone _____ Group one (PC1-3) border router 202.144.139.193 202.144.139.194 Group two (PC4-6) border router 202.144.139.195 Group three (PC7-9) border router Group four (PC10-12) border router 202.144.139.196 202.144.139.197 Group five (PC13-15) border router

Q. What is the netmask for a /26 network? _

There are separate /29 networks for the *private* networks between machines on each desktop

TABLE TWO

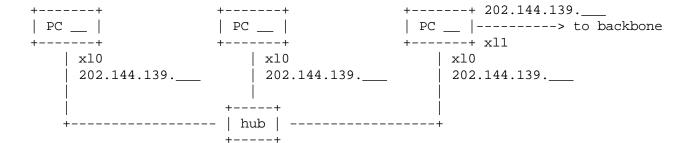
202.144.139.0/29	Group	one
202.144.139.8/29	Group	two
202.144.139.16/29	Group	three
202.144.139.24/29	Group	four
202.144.139.32/29	Group	five

Q. What is the netmask for a /29 network? _

INSTRUCTIONS

- We will rebuild the classroom as a routed network
- The objective is that every machine in the class will be able to ping every other machine.
- YOU ARE NOT PERMITTED TO USE DEFAULT ROUTE

Each group has one machine which will be the ROUTER, two machines which are CLIENTS, and a private ethernet network (hub) between them.



1. Remove your existing defaultroute:

route delete default

- 2. Find your group's local network allocation from TABLE TWO. Allocate one IP address to the router and one each to the clients (remember you cannot use the network address or broadcast address). Write them in the diagram above.
- 3. On both ROUTER and CLIENTS, remove your existing xl0 connection. Connect them to your group's hub instead. Configure your xl0 with your new IP address and netmask (see commands below). Make sure the three machines can ping each other. If they cannot, then debug the problem before continuing.
- 4. On the ROUTER, configure xl1 with your new backbone address and netmask from TABLE ONE, and plug it into the backbone switch. Make sure you can ping all the other group's routers (202.144.139.193 to .197 inclusive). If you cannot, check that the other group's router is configured properly, and try "arp -d x.x.x.x" where x.x.x.x is the other router's IP address before pinging them again.
- 5. On the ROUTER only, issue the command to enable IP forwarding:
 - # sysctl net.inet.ip.forwarding=1
- 6. On both the CLIENTS and the ROUTER, add routes to be able to reach the rest of the classroom. Eventually you should be able to ping all addresses.

Don't change /etc/rc.conf, because we don't want these changes to be permanent. The commands you will need are:

```
ifconfig
                                                    # show interfaces
ifconfig xl0 x.x.x.x/p
                                                    # configure interface
ifconfig xl0 x.x.x.x netmask y.y.y.y
                                                    # (alternative form)
netstat -nr
                                                    # show routes (ignore ipv6)
route add x.x.x.x/p z.z.z.z
                                                    # add a route to network x.x.x.x/p
                                                                  via next-hop z.z.z.z
                                                    #
route add -net x.x.x.x -netmask y.y.y.y z.z.z.z
                                                    # (alternative form)
route delete x.x.x.x/p
                                                    # delete a route
route delete default
                                                    # delete defaultroute
                                       # send test packets (Ctrl-C to stop)
ping x.x.x.x
traceroute -n x.x.x.x
                                       # show route to destination
```

Remember that the next hop gateway (z.z.z.z) must be an address on one of the networks which you are DIRECTLY connected to.

Can you ping other routers on the backbone? Can you ping other clients in other groups? Debug the problems.