POLYTECH®
PARIS-SUD

IP Addressing

Activity 1

- An organization is assigned the following network address
  - address: 208.57.0.0 *1101000.00111001.00000000.00000000*
  - netmask: 255.255.0.0 *1111111.11111111.00000000.00000000*
- We want to partition the address space to serve a LAN with 4000 host
  1) What netmask do we need for such network that contains 4000 host?
  2) What NetID should be assigned to such subnetwork?
  3) How many further equivalent subnets can be served?
  4) How many subnets with 60 hosts can be further defined (besides the one with 4000 hosts)?

Activity 1 - Solution

- 4000 host can be addressed with 12 bits (2^{12}-2=4094). Consequently:
  - Netmask with 20 consecutive 1s: 255.255.240.0
  - All feasible addresses for the subnet are obtained arbitrarily combining the first four bits in the third byte

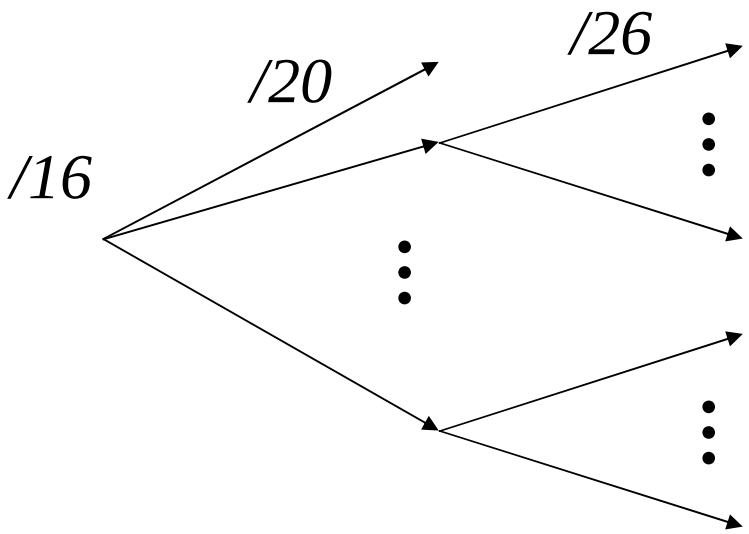
    11010000.00111001.xxxx0000.00000000

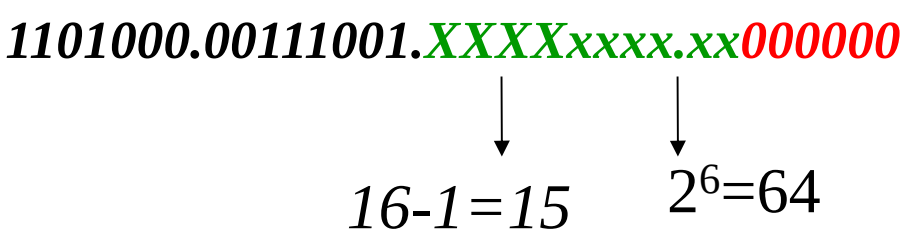
  - For example: ***11010000.00111001.00000000.00000000***
  - Using Decimal notation: *208.57.0.0/20*

- The 4 bits in the SubnetID can be used to define 15 further subnets with 4094 hosts each.

Activity 1 - Solution

- To give an address to 60 hosts, 6 bits are needed (2^6=64). Hence, each of the 15 remaining subnets can be further divided into 64 subnets (/26), each one serving 62 hosts.





Activity 2

- A University is assigned a class B address 129.174.0.0. The network administrator needs to define one IP subnet for each of the 15 university departments.
  1) Describe how the subnets can be defined
  2) Write the IP addresses of the subnets
  3) How many host can be contained in each subnet?
  4) Which subnets do the following addresses belong to?
     a) 129.174.28.66
     b) 129.174.99.122
     c) 129.174.130.255
     d) 129.174.191.255

  For each address, specify if such address is a host address or a *special* one

Activity 2 - Solution

- 129.174.0.0: 16 bits for NetID and other 16 bits for HostID
- A netmask 4 bit longer is enough to define 15 subnets
- The netmask will have 20 1s
- Decimal notation:
  - 255.255.240.0

1	0	0	0	0	0	0	0	128
1	1	0	0	0	0	0	0	192
1	1	1	0	0	0	0	0	224
1	1	1	1	0	0	0	0	240
1	1	1	1	1	0	0	0	248
1	1	1	1	1	1	0	0	252
1	1	1	1	1	1	1	0	254
1	1	1	1	1	1	1	1	255

Activity 2 - Solution

- **The IP addresses of all the 16 subnets are:**

129.174. .0/20

0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	16
0	0	1	0	0	0	0	0	32
0	0	1	1	0	0	0	0	48
0	1	0	0	0	0	0	0	64
0	1	0	1	0	0	0	0	80
0	1	1	0	0	0	0	0	96
0	1	1	1	0	0	0	0	112
1	0	0	0	0	0	0	0	128
1	0	0	1	0	0	0	0	144
1	0	1	0	0	0	0	0	160
1	0	1	1	0	0	0	0	176
1	1	0	0	0	0	0	0	192
1	1	0	1	0	0	0	0	208
1	1	1	0	0	0	0	0	224
1	1	1	1	0	0	0	0	240
0	0	0	0	0	0	0	0	0

  - The maximum number of hosts per each subnet is: $2^{12}-2=4096-2$

Activity 2 - Solution

129.174.

0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	16
0	0	1	0	0	0	0	0	32
0	0	1	1	0	0	0	0	48
0	1	0	0	0	0	0	0	64
0	1	0	1	0	0	0	0	80
0	1	1	0	0	0	0	0	96
0	1	1	1	0	0	0	0	112
1	0	0	0	0	0	0	0	128
1	0	0	1	0	0	0	0	144
1	0	1	0	0	0	0	0	160
1	0	1	1	0	0	0	0	176
1	1	0	0	0	0	0	0	192
1	1	0	1	0	0	0	0	208
1	1	1	0	0	0	0	0	224
1	1	1	1	0	0	0	0	240
0	0	0	0	0	0	0	0	0

.0/20

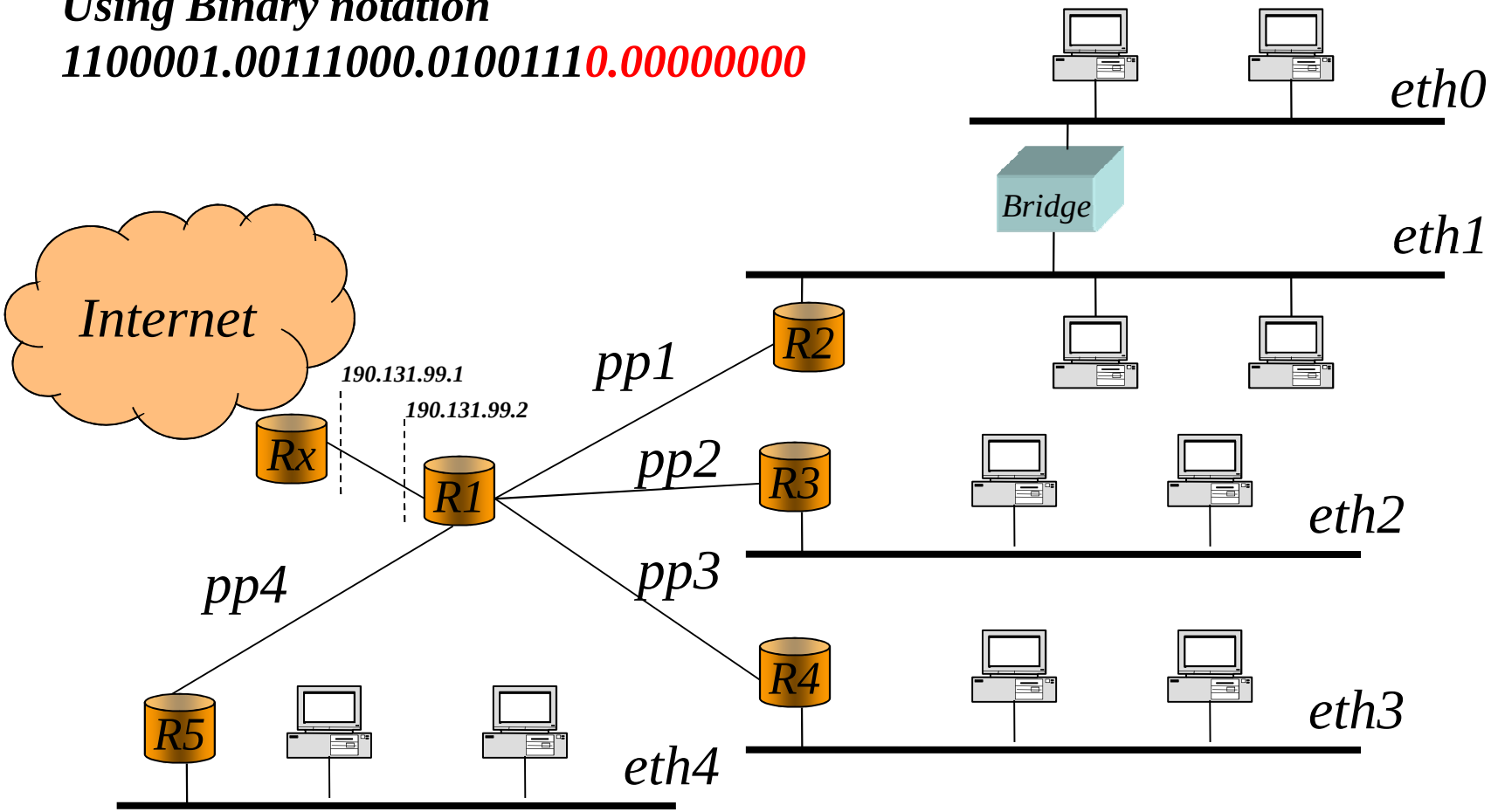
- 129.174.28.66 129.174.16.0/20 (host)
- 129.174.99.122 129.175.96.0/20 (host)
- 129.174.130.255 129.174.128.0/20 (host)
- 129.174.191.255 129.174.176.0/20 (broadcast)

Activity 3

- An Organization wants to set up the network topology in the figure and is assigned the net address 195.56.78.0/23

Using Binary notation

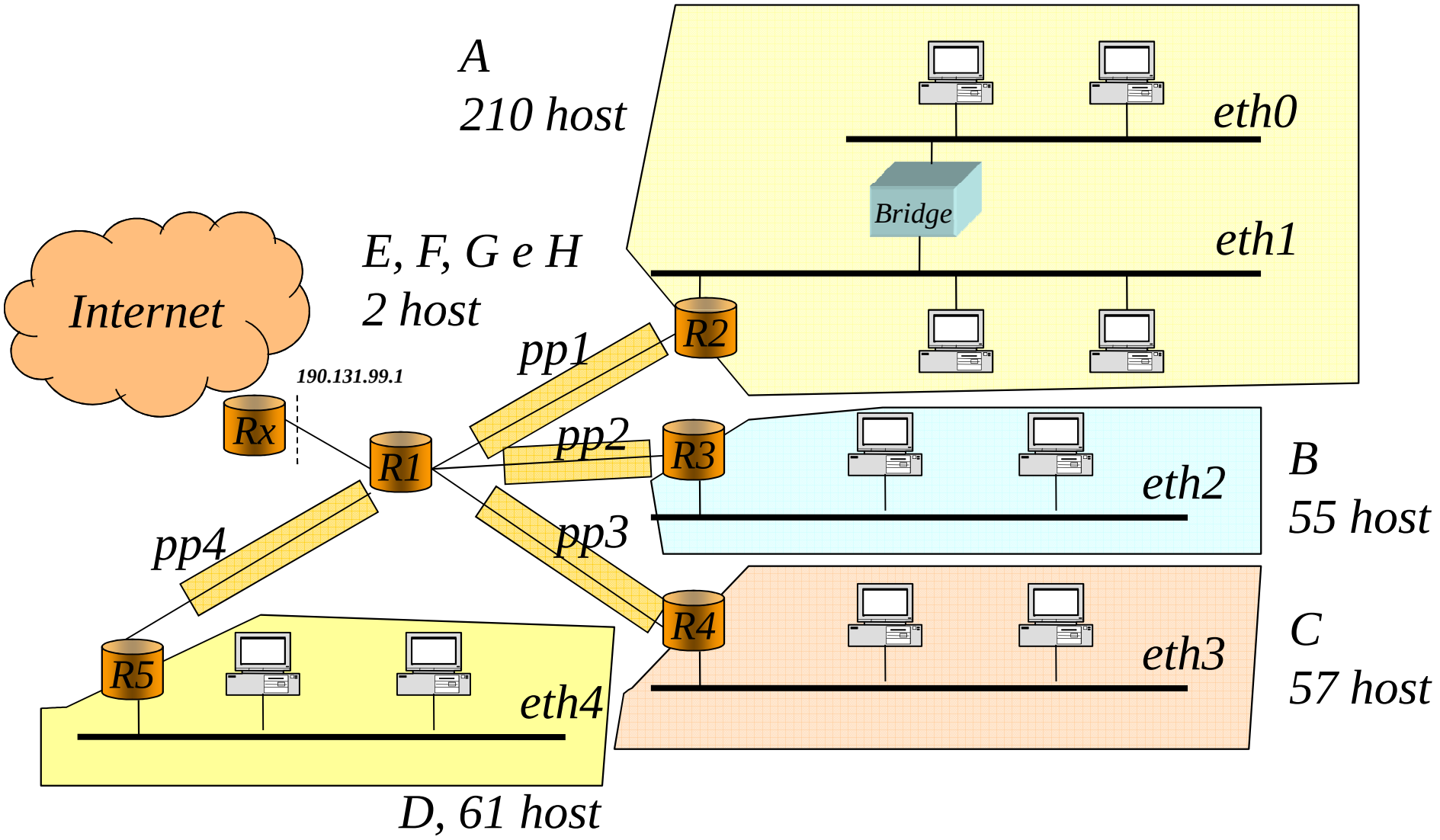
***1100001.00111000.0100111*0.00000000**



Activity 3

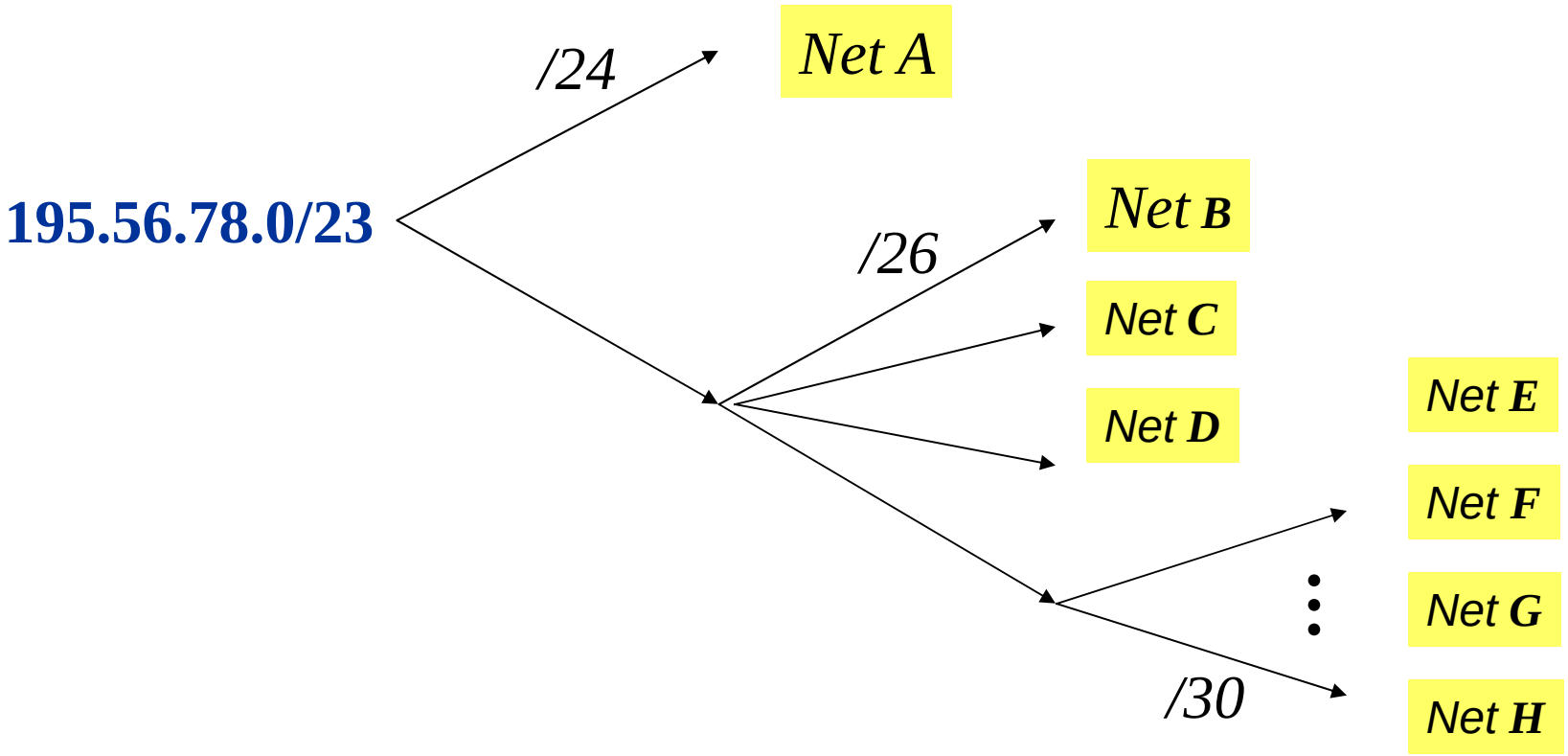
- The nets in the figure must contain at least:
  - eth0: 150 hosts (eth=ethernet)
  - eth1: 60 hosts
  - eth2: 55 hosts
  - eth3: 57 hosts
  - eth4: 61 hosts
- "pp" (pp1-pp4) are *point to point* connections
  a) Split the network into the given sub-networks (see the following slide) reporting the NetID and the netmask for each of them (both for ethernet LAN and for the pp connections)
  b) Assign to the routers' interfaces consistent IP addresses
  c) Write down feasible routing tables for all the routers

Activity 3 - Solution



Activity 3 - Solution

- Subnet A needs a 8 bit hostID (2^8-2=254)
- Subnets B, C and D need a 6 bit hostID (2^6-2=62)
- Subnets E, F, G and H need a 2 bit hostID (2^2-2=2)



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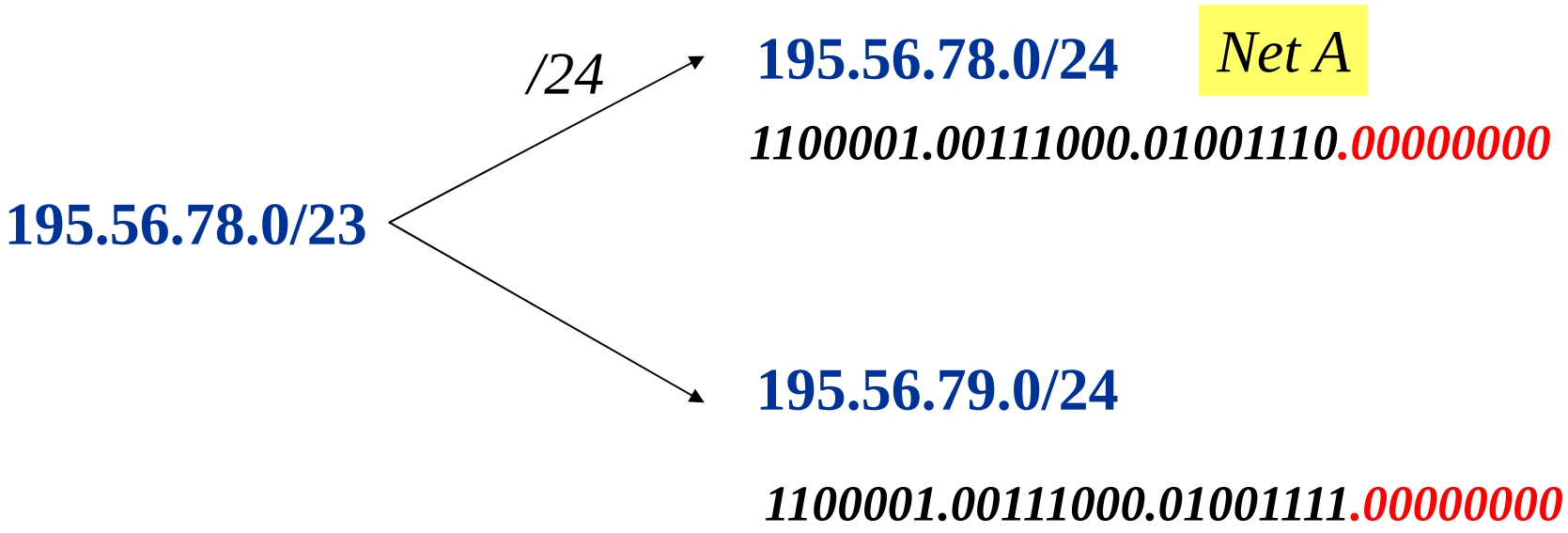

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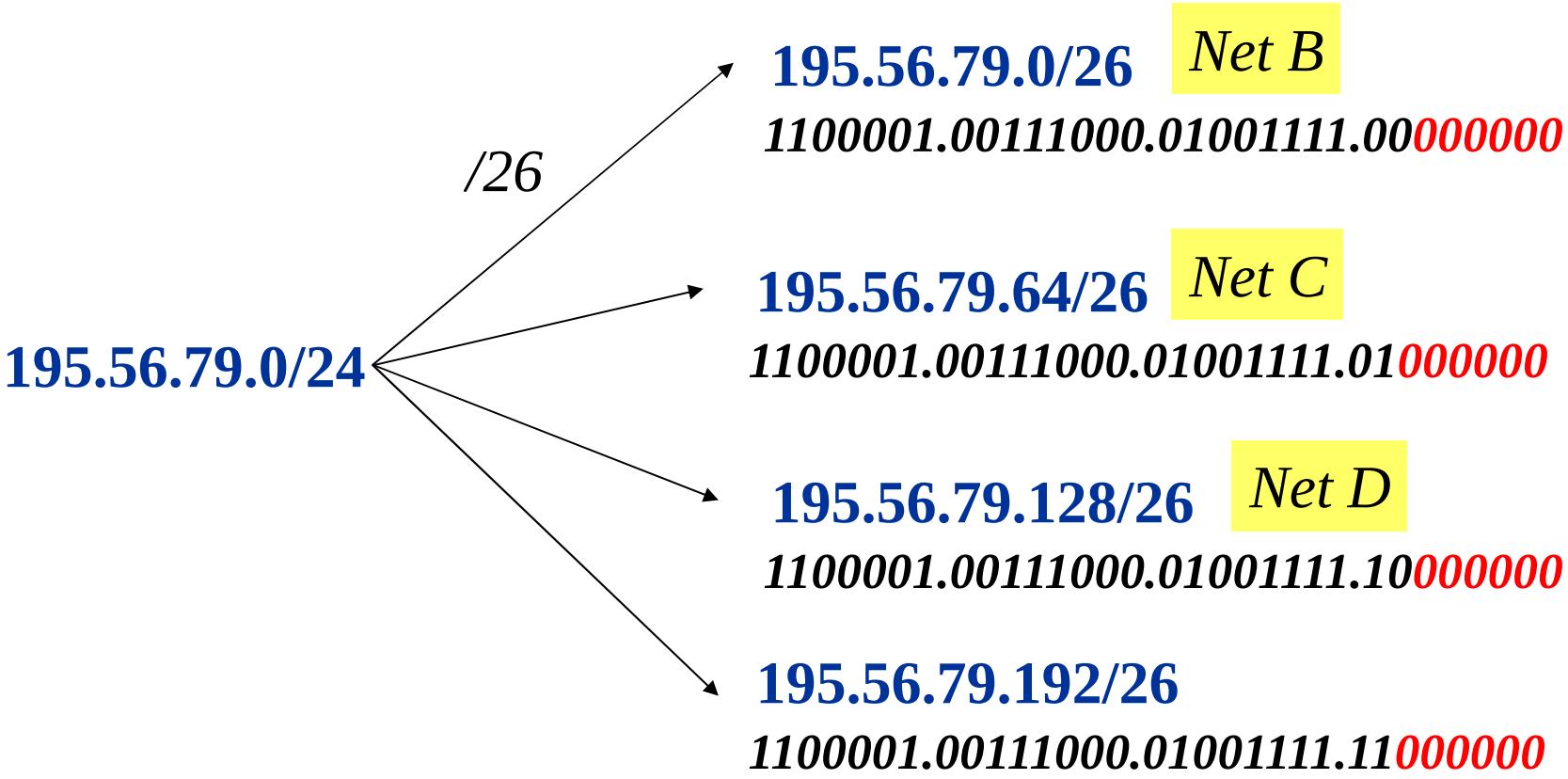

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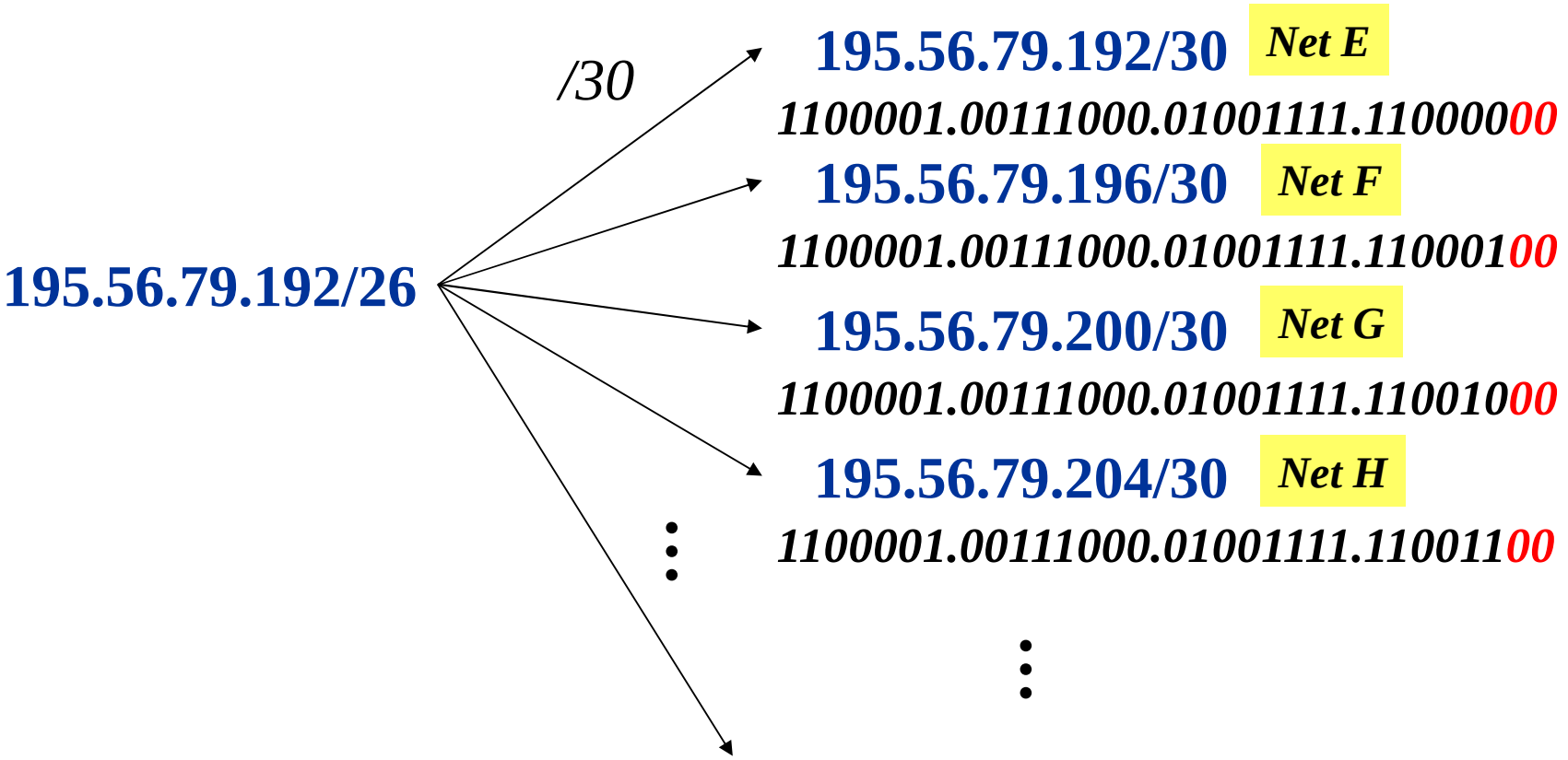
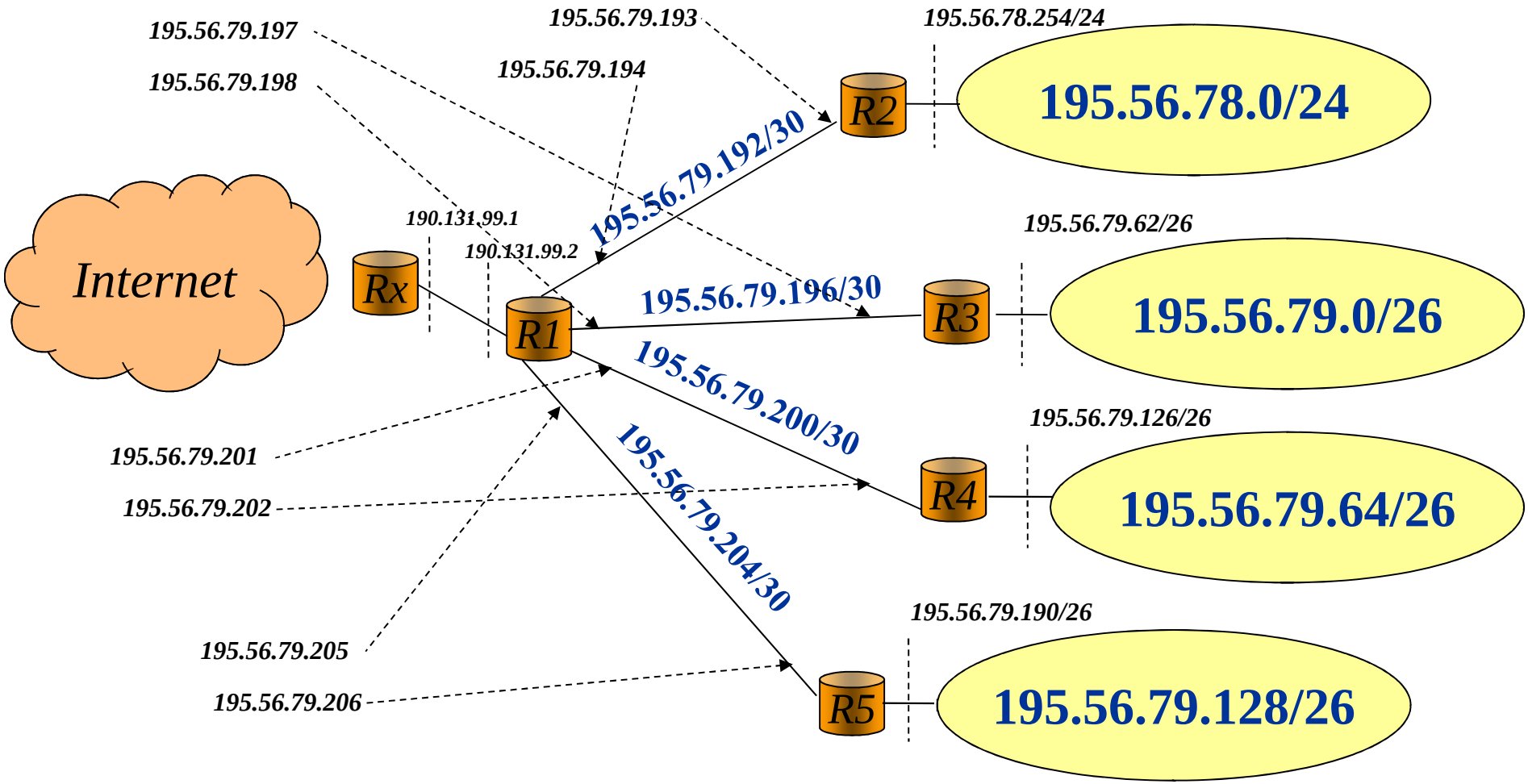


Activity 3 - Solution

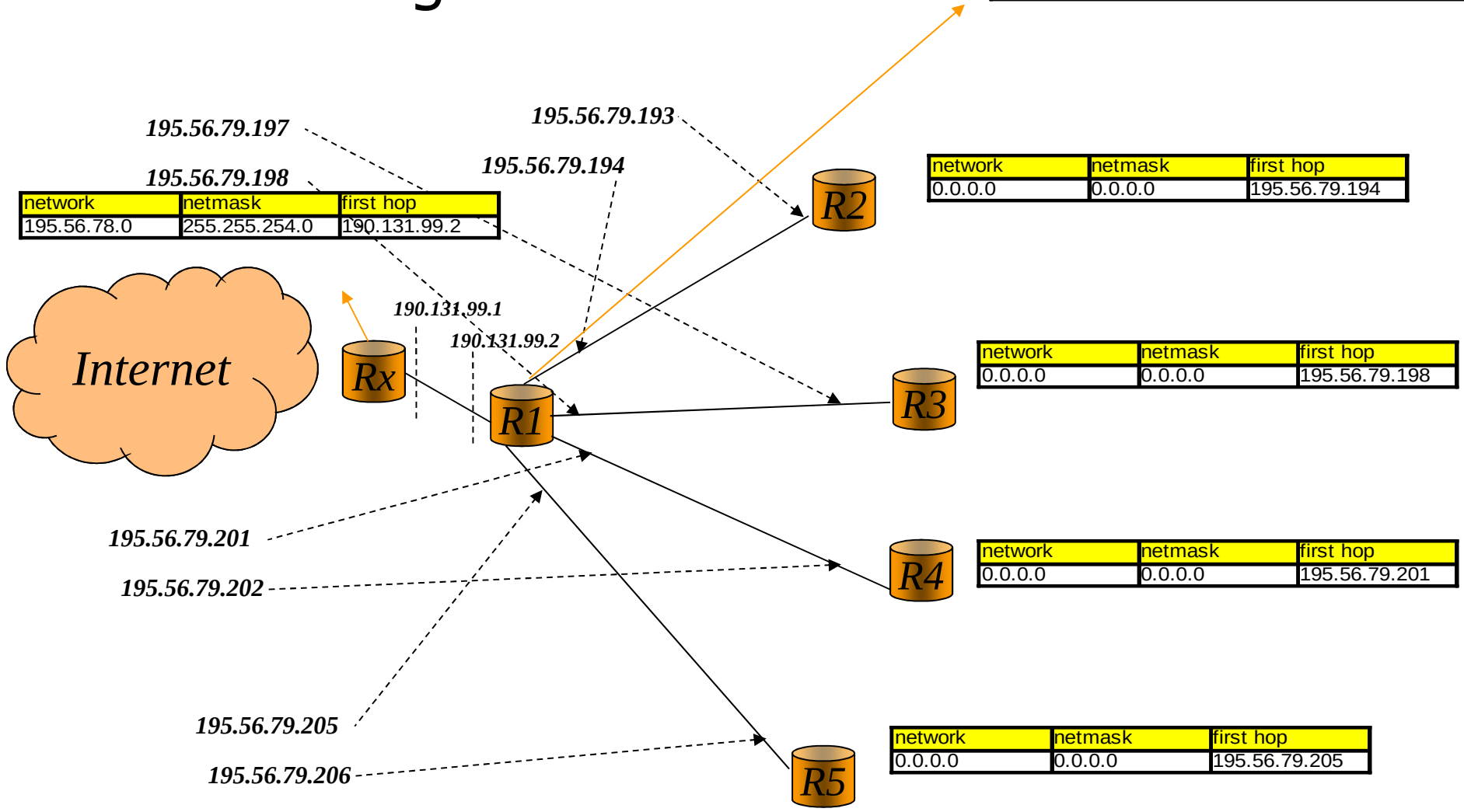
- Feasible interface addresses:



Activity 3 - Solution

- Routing Tables:

network	netmask	first hop
195.56.78.0	255.255.255.0	195.56.79.193
195.56.79.0	255.255.255.192	195.56.79.197
195.56.79.64	255.255.255.192	195.56.79.202
195.56.79.128	255.255.255.192	195.56.79.206
0.0.0.0	0.0.0.0	190.131.99.1



network	netmask	first hop
195.56.78.0	255.255.254.0	190.131.99.2

network	netmask	first hop
0.0.0.0	0.0.0.0	195.56.79.194

network	netmask	first hop
0.0.0.0	0.0.0.0	195.56.79.198

network	netmask	first hop
0.0.0.0	0.0.0.0	195.56.79.201

network	netmask	first hop
0.0.0.0	0.0.0.0	195.56.79.205