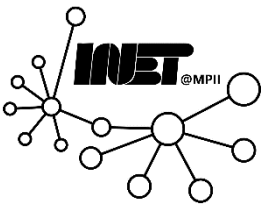
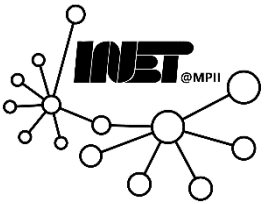
Homework 6

IP Addressing



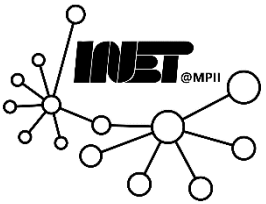
Get the Slides here

tinyurl.com/4shcamdd



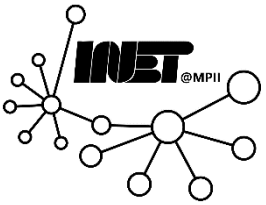
Homework Overview

- Learn about IP addressing
- Learn about how network address translation works
- Forwarding table



Question 1

Figure shows two sites, “Some Provider” and “Family home network”, connected via the public Internet. The topology comprises four routers, R1, R2, R3 and R4, two switches S1 and S2, and several hosts, e.g., “Lisa’s PC” or “Web Server”. Each of the hosts has only one networking interface. The router interfaces are labeled eth_i and switch ports are labeled $port_i$. Communication between routers R2 and R3 within the public Internet is not relevant for this exercise.



Question 1

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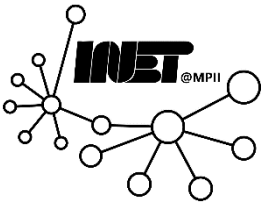
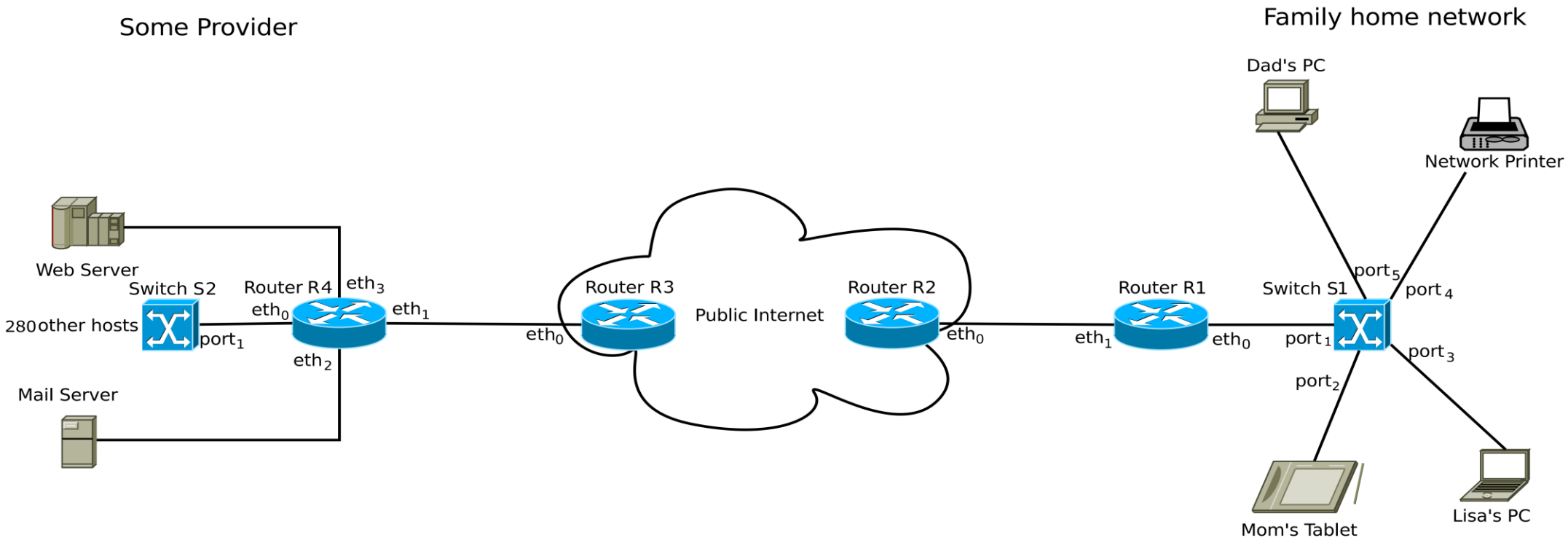
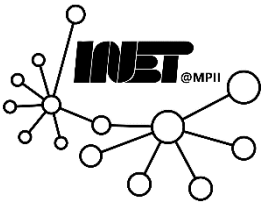


Question 1


Some Provider
Family home network
Web Server
Switch S2
Router R4
eth3
eth0
eth1
280 other hosts
port1
eth2
Mail Server
Router R3
Public Internet
Router R2
eth0
eth0
Router R1
eth1
eth0
Switch S1
port5
port4
port1
port3
port2
Dad's PC
Network Printer
Mom's Tablet
Lisa's PC

Question 1 (a)

Identify sub-networks in the topology by providing a list of the subnet's routers, their boundary interfaces and all devices that belong to the respective subnet. Assign IDs to the subnets like "SN XX". The public internet itself should be ignored, the router's interfaces are omitted on purpose there. Assume that the switches are Layer-2, so they do not speak IP and they do not have IP addresses. Consider that the number of hosts connected to the switch S2 may increase by 508.



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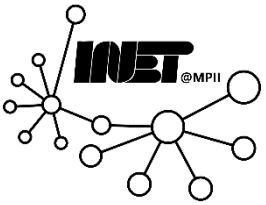
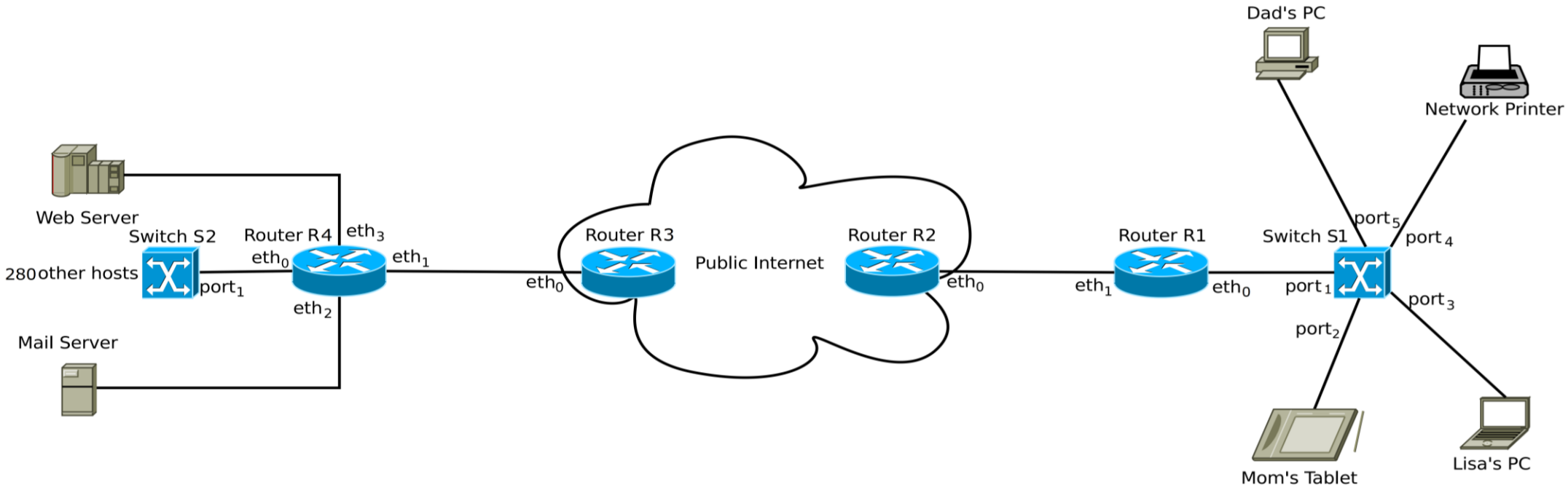
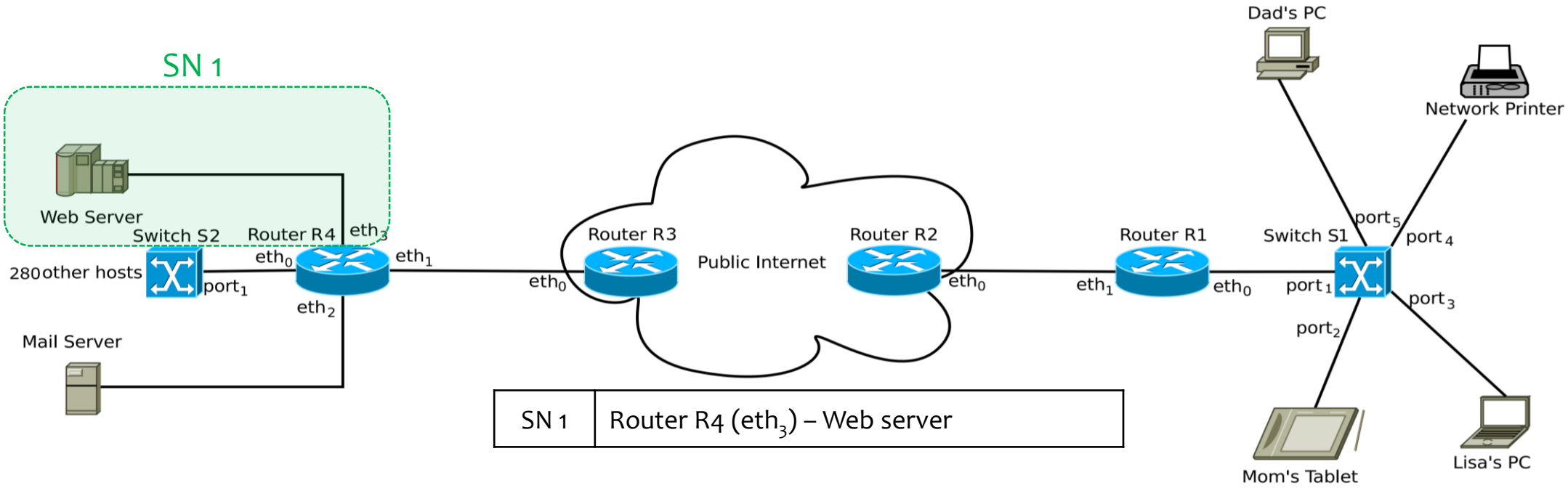


Question 1 (a)

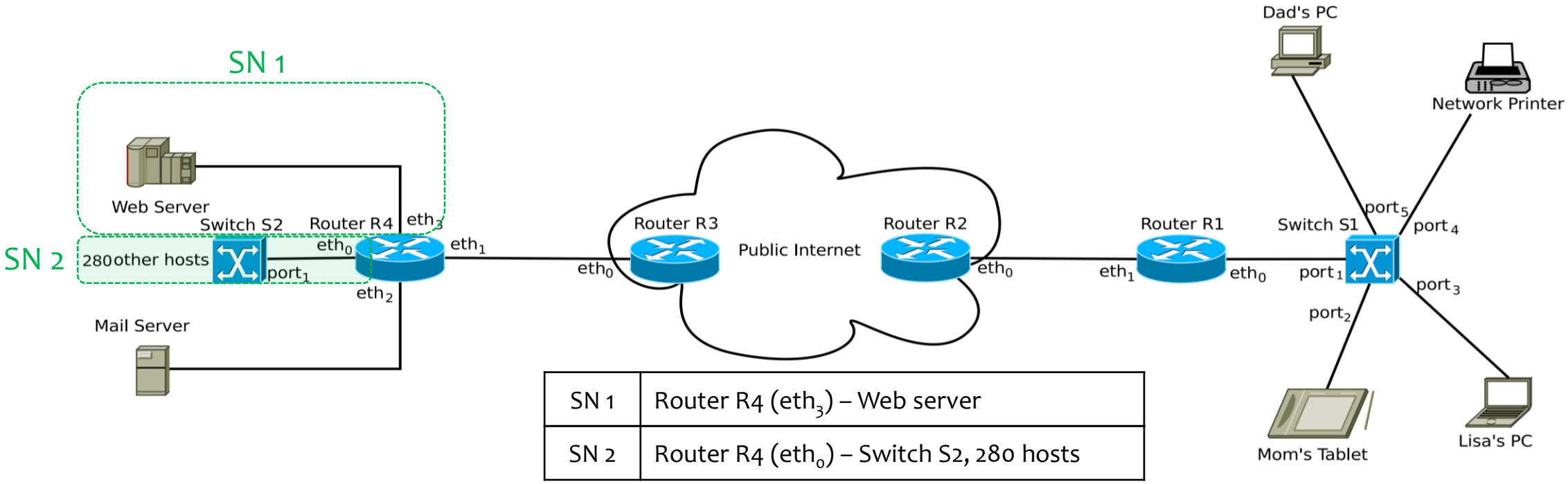

Dad's PC
Network Printer
Web Server
Switch S2
Router R4
eth3
eth0
eth1
Router R3
Router R2
Router R1
Switch S1
port5
port4
280 other hosts
port1
eth2
Public Internet
eth0
eth0
eth1
eth0
port1
port3
port2
Mail Server
Mom's Tablet
Lisa's PC

Question 1 (a)



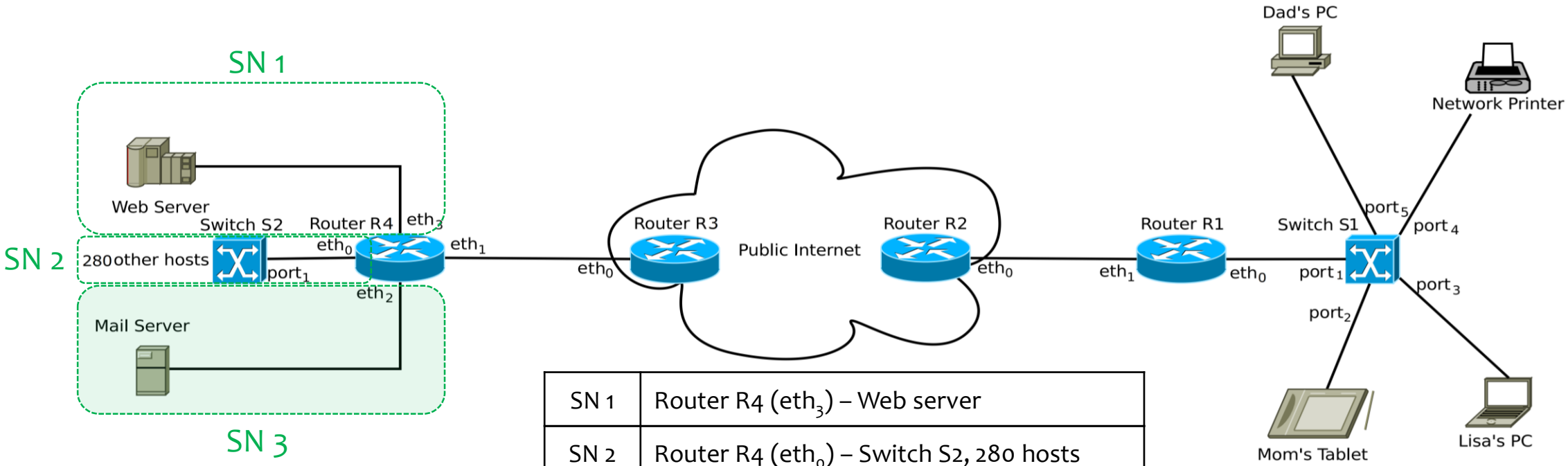
SN 1	Router R4 (eth_3) – Web server

Question 1 (a)



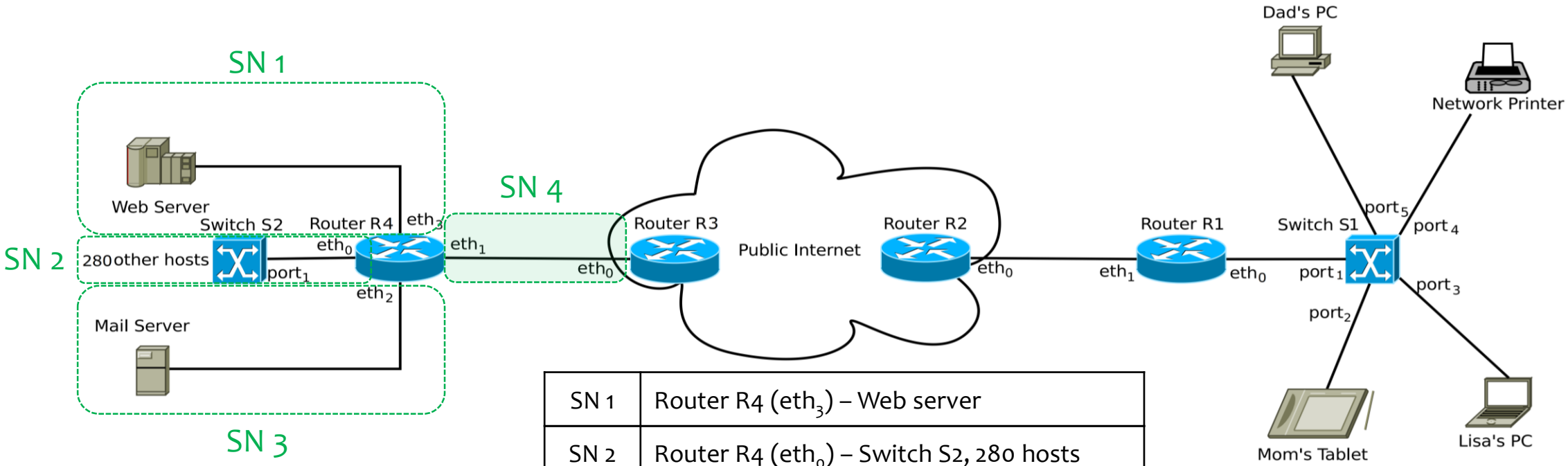
SN 1	Router R4 (eth_3) – Web server
SN 2	Router R4 (eth_0) – Switch S2, 280 hosts

Question 1 (a)



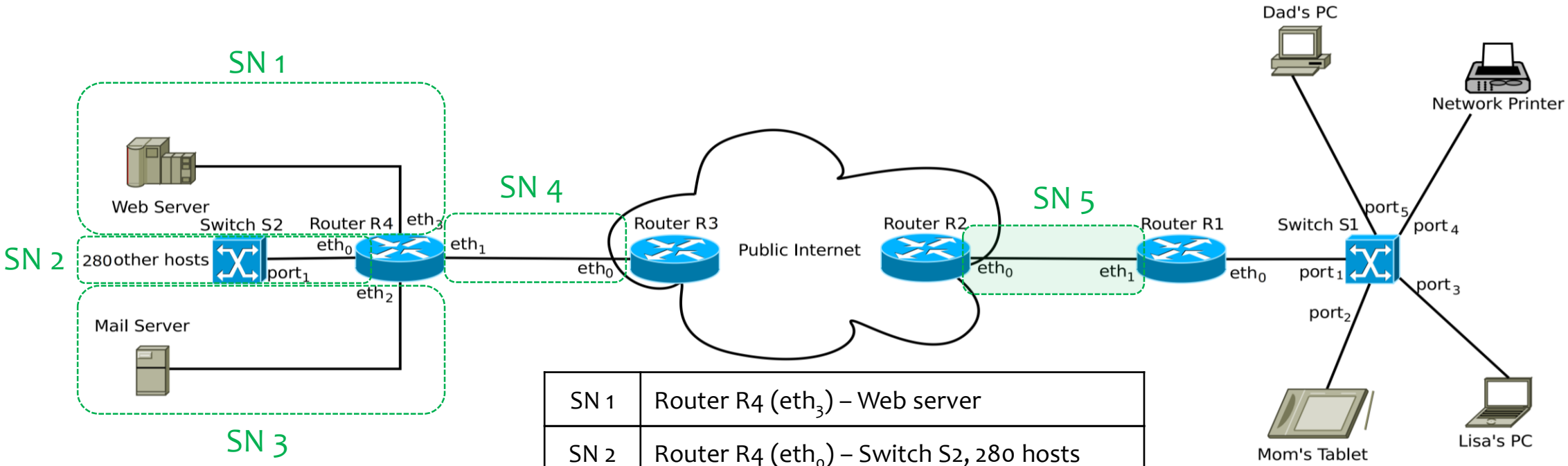
SN 1	Router R4 (eth_3) – Web server
SN 2	Router R4 (eth_0) – Switch S2, 280 hosts
SN 3	Router R4 (eth_2) – Mail server

Question 1 (a)



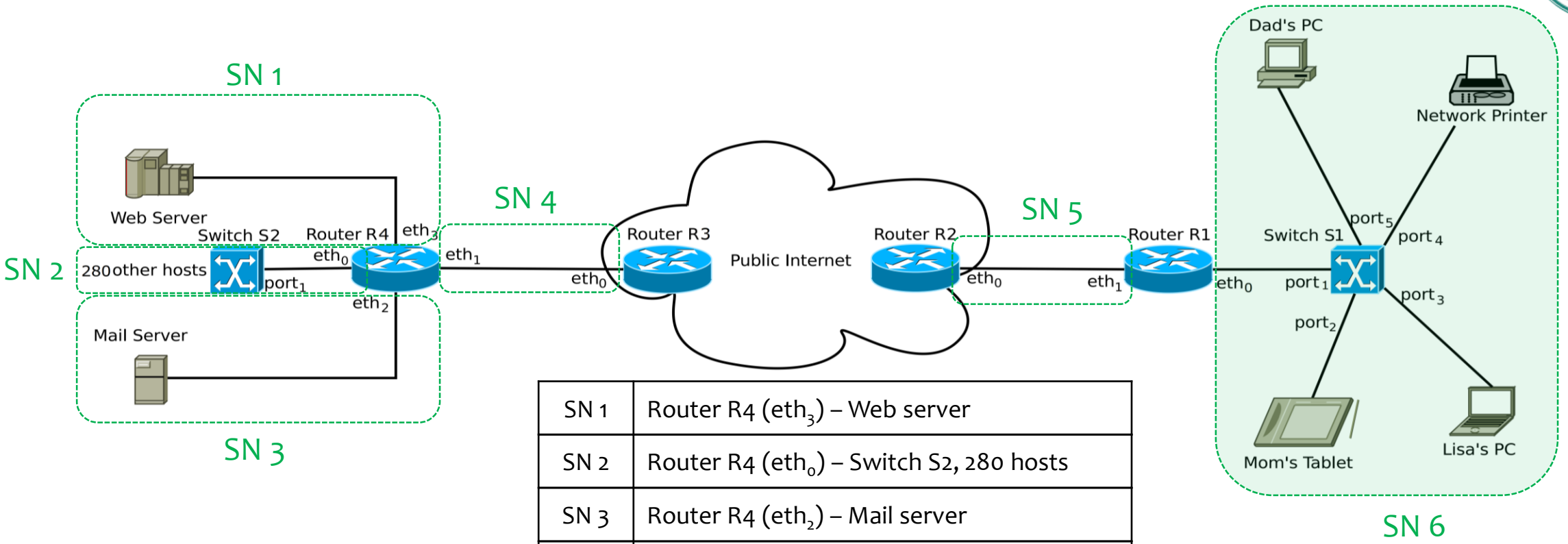
SN 1	Router R4 (eth_3) – Web server
SN 2	Router R4 (eth_0) – Switch S2, 280 hosts
SN 3	Router R4 (eth_2) – Mail server
SN 4	Router R4 (eth_1) – Router R3 (eth_0)

Question 1 (a)



SN 1	Router R4 (eth_3) – Web server
SN 2	Router R4 (eth_0) – Switch S2, 280 hosts
SN 3	Router R4 (eth_2) – Mail server
SN 4	Router R4 (eth_1) – Router R3 (eth_0)
SN 5	Router R2 (eth_0) – Router R1 (eth_1)

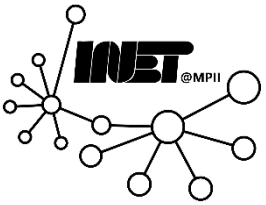
Question 1 (a)



SN 1	Router R4 (eth_3) – Web server
SN 2	Router R4 (eth_0) – Switch S2, 280 hosts
SN 3	Router R4 (eth_2) – Mail server
SN 4	Router R4 (eth_1) – Router R3 (eth_0)
SN 5	Router R2 (eth_0) – Router R1 (eth_1)
SN 6	Router R1 (eth_0) – Switch S1, Dad's PC, Mom's tablet, Lisa's PC, Network Printer

Question 1 (b)

Within each subnet, how many interfaces are there? How many IP addresses are needed for each subnet?



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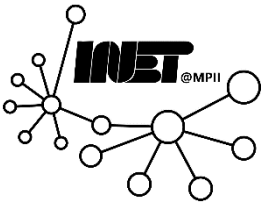
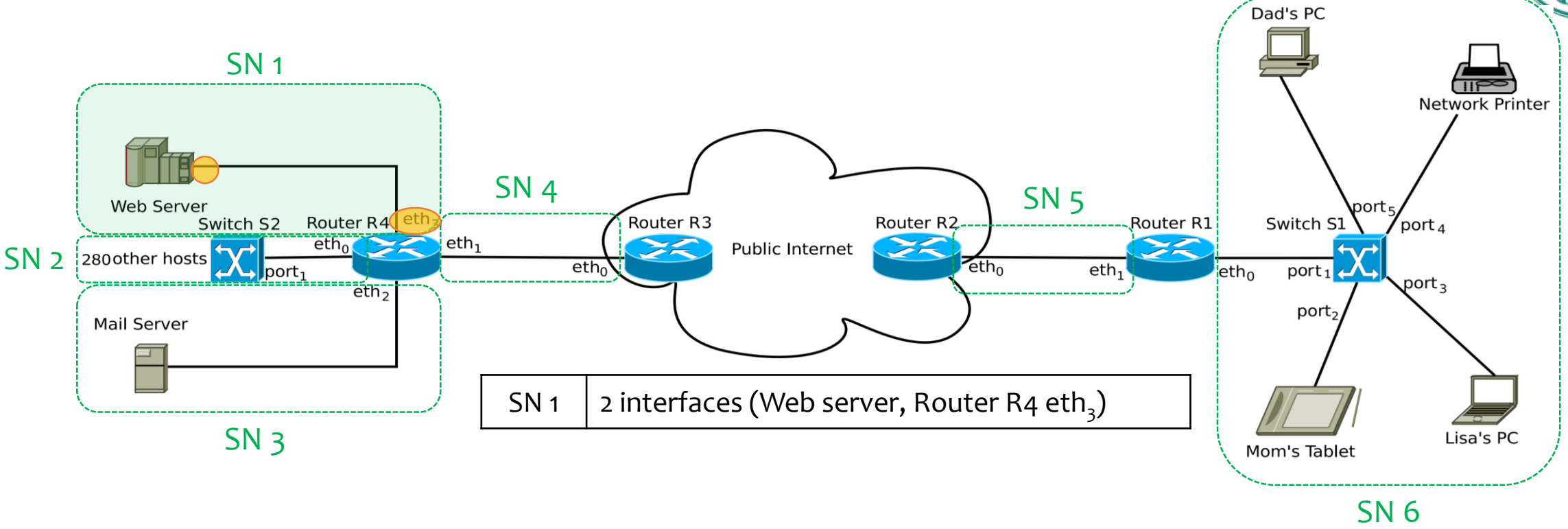
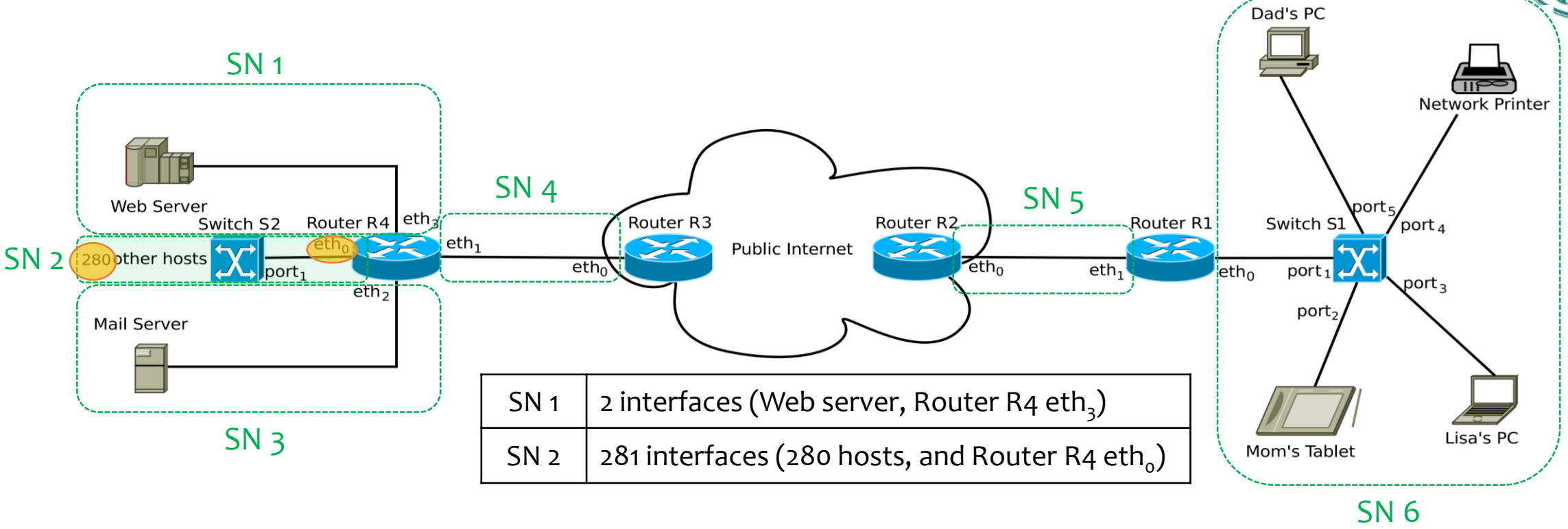


Question 1 (b)



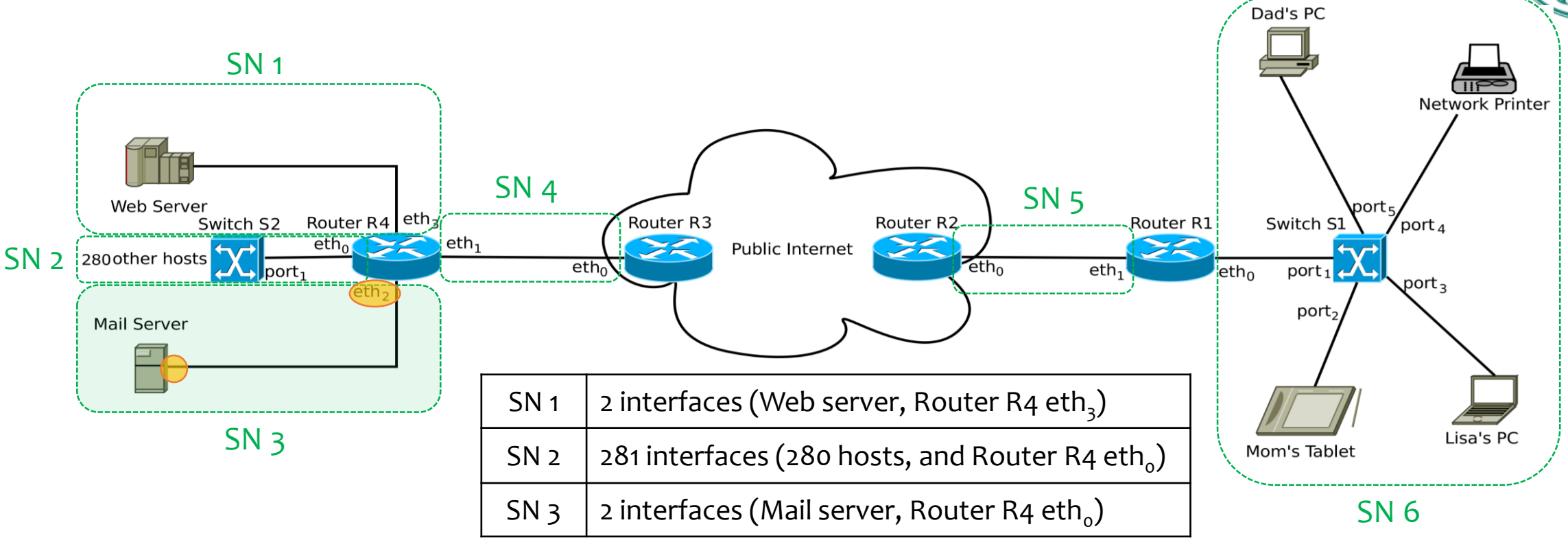
SN 1	2 interfaces (Web server, Router R4 eth_3)

Question 1 (b)



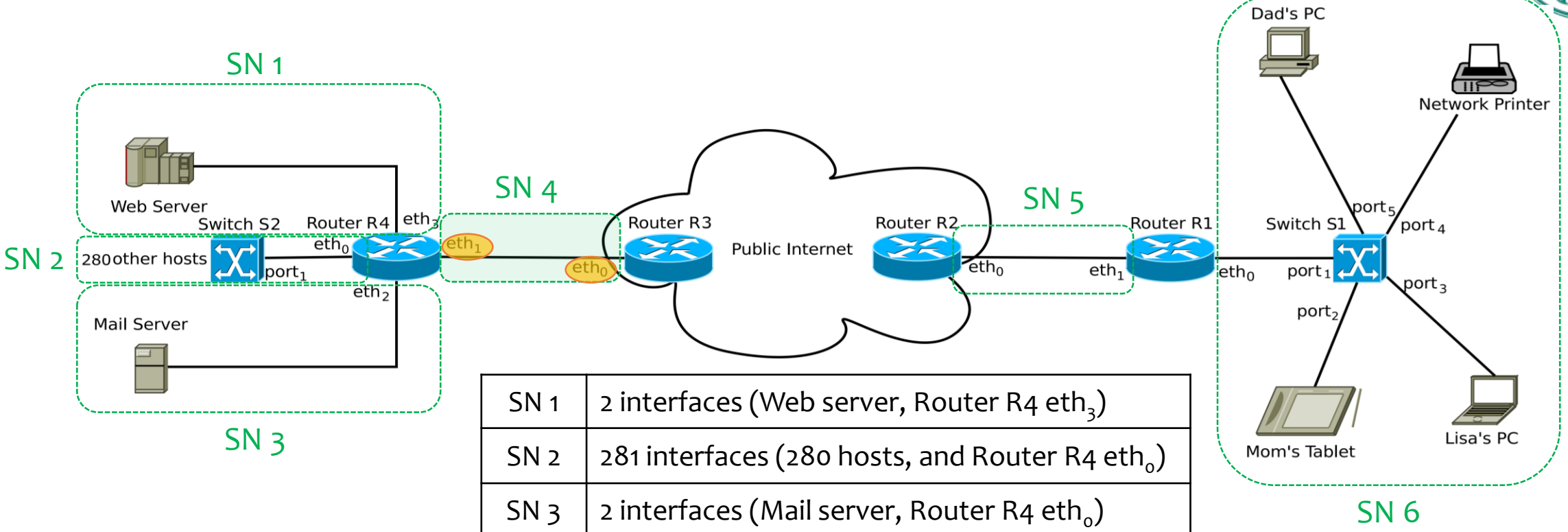
SN 1	2 interfaces (Web server, Router R4 eth_3)
SN 2	281 interfaces (280 hosts, and Router R4 eth_0)

Question 1 (b)



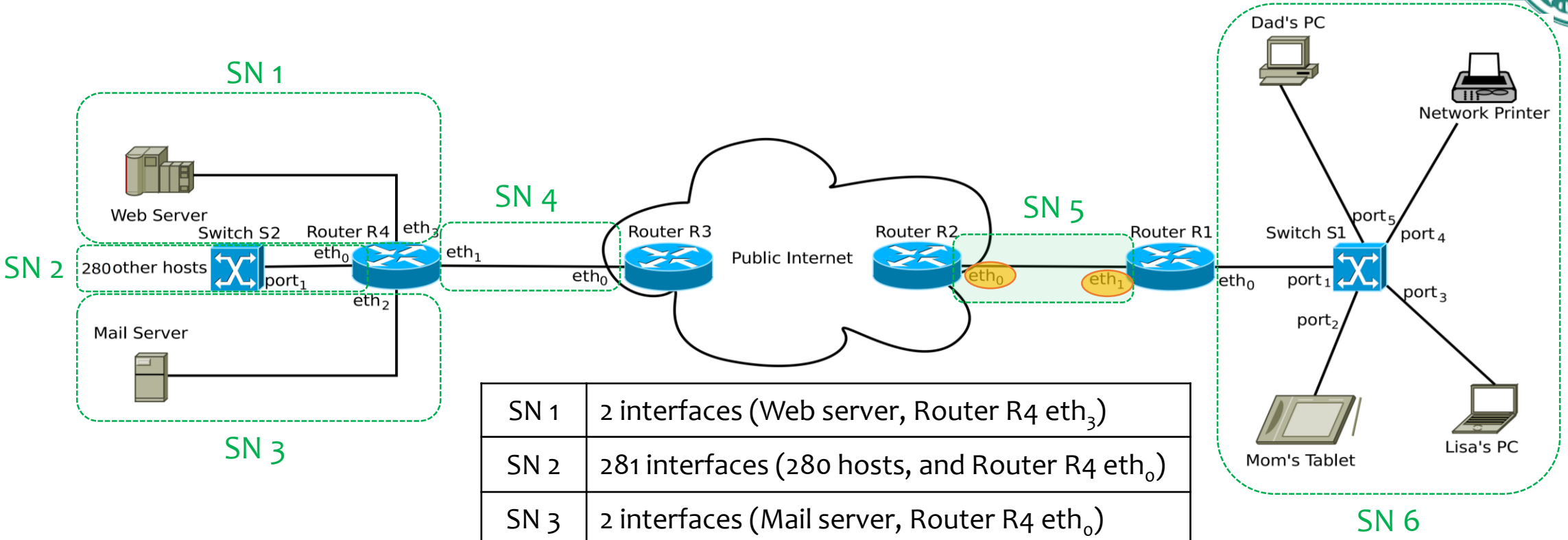
SN 1	2 interfaces (Web server, Router R4 eth_3)
SN 2	281 interfaces (280 hosts, and Router R4 eth_0)
SN 3	2 interfaces (Mail server, Router R4 eth_0)

Question 1 (b)



SN 1	2 interfaces (Web server, Router R4 eth_3)
SN 2	281 interfaces (280 hosts, and Router R4 eth_0)
SN 3	2 interfaces (Mail server, Router R4 eth_0)
SN 4	2 interfaces (R4 eth_4, R3 eth_0)

Question 1 (b)



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SN 5	2 interfaces (R2 eth_0, R1 eth_1)

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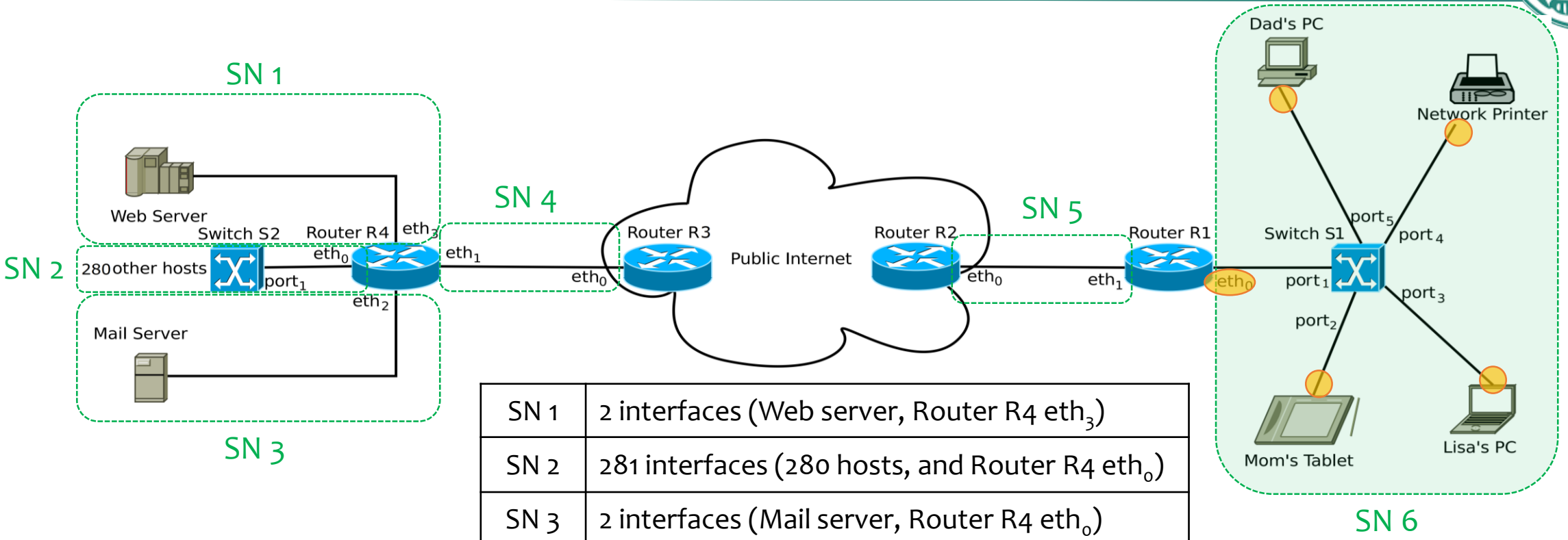

SN 1	2 interfaces (Web server, Router R4 eth_3)
SN 2	281 interfaces (280 hosts, and Router R4 eth_0)
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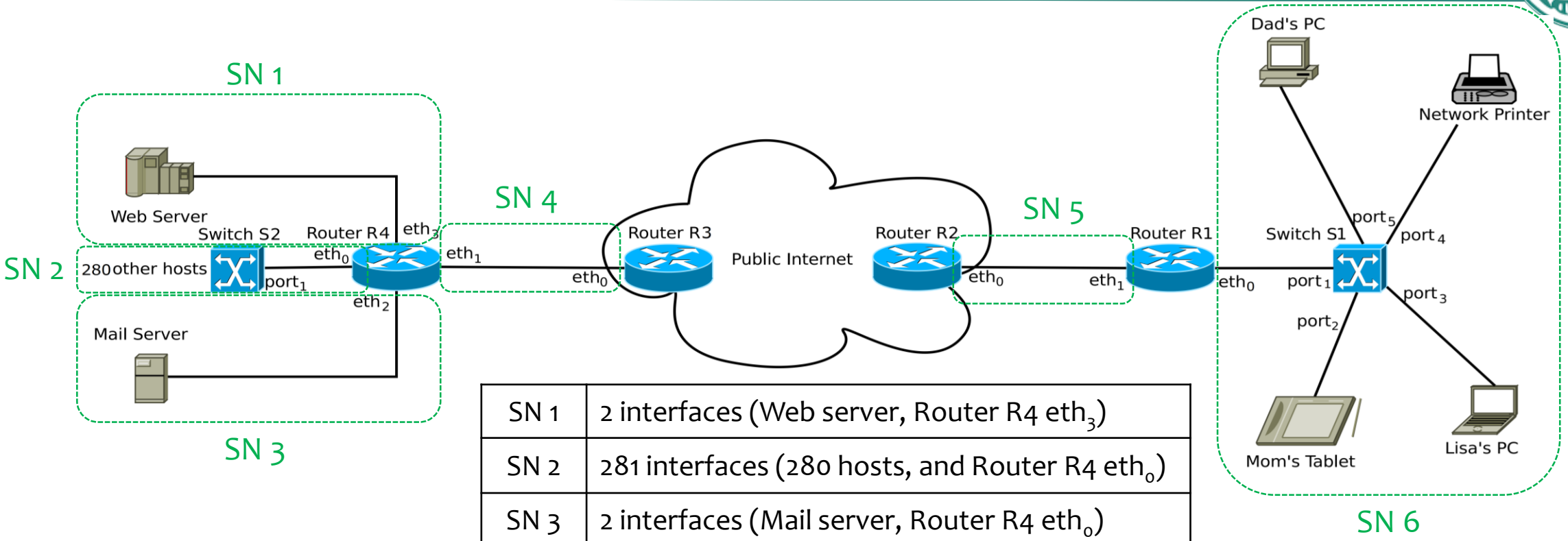
SN 5	2 interfaces (R2 eth_0, R1 eth_1)
SN 6	5 interfaces (Router R1 eth_0, Dad's PC, Mom's Tablet, Lisa's PC, Network Printer)

Question 1 (b)



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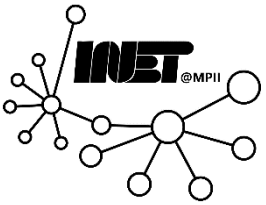
Within each subnet, how many interfaces are there? How many IP addresses are needed for each subnet?

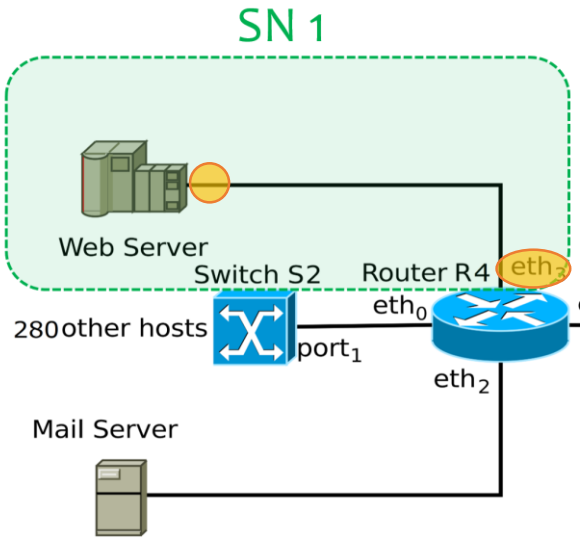
- Consider that the number of hosts connected to the switch S2 may increase by 508.



Question 1 (b)

No. Interfaces + network IP address + broadcast IP address

No. IP Addresses for SN 1: 2 + 1 + 1 = 4 IP addresses



Question 1 (b)

No. Interfaces + network IP address + broadcast IP address

No. IP Addresses for SN 1: 2 + 1 + 1 = 4 IP addresses

SN 1	2 interfaces (Web server, Router R4 eth_3)	4 IP addresses

Question 1 (b)

No. Interfaces + network IP address + broadcast IP address

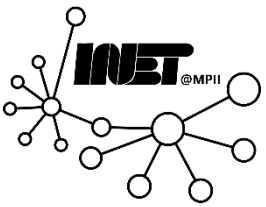
No. IP Addresses for SN 2: (788+1) + 1 + 1 =791 IP addresses

SN 1	2 interfaces (Web server, Router R4 eth_3)	4 IP addresses
SN 2	281 interfaces (potential 508 hosts, and Router R4 eth_0)	791 IP addresses

Question 1 (b)

No. Interfaces + network IP address + broadcast IP address

SN 1	2 interfaces (Web server, Router R4 eth_3)	4 IP addresses
SN 2	281 interfaces (potential 508 hosts, and Router R4 eth_0)	791 IP addresses
SN 3	2 interfaces (Mail server, Router R4 eth_0)	4 IP addresses



Question 1 (b)

No. Interfaces + network IP address + broadcast IP address

SN 1	2 interfaces (Web server, Router R4 eth_3)	4 IP addresses
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SN 4	2 interfaces (R4 eth_4, R3 eth_0)	4 IP addresses

Question 1 (b)

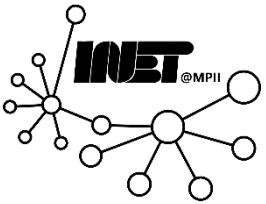
No. Interfaces + network IP address + broadcast IP address

SN 1	2 interfaces (Web server, Router R4 eth_3)	4 IP addresses
SN 2	281 interfaces (potential 508 hosts, and Router R4 eth_0)	791 IP addresses
SN 3	2 interfaces (Mail server, Router R4 eth_0)	4 IP addresses
SN 4	2 interfaces (R4 eth_4, R3 eth_0)	4 IP addresses
SN 5	2 interfaces (R2 eth_0, R1 eth_1)	4 IP addresses

Question 1 (b)

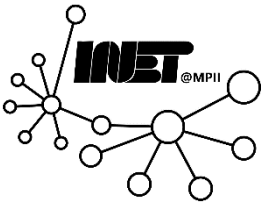
No. Interfaces + network IP address + broadcast IP address

SN 1	2 interfaces (Web server, Router R4 eth_3)	4 IP addresses
SN 2	281 interfaces (potential 508 hosts, and Router R4 eth_0)	791 IP addresses
SN 3	2 interfaces (Mail server, Router R4 eth_0)	4 IP addresses
SN 4	2 interfaces (R4 eth_4, R3 eth_0)	4 IP addresses
SN 5	2 interfaces (R2 eth_0, R1 eth_1)	4 IP addresses
SN 6	5 interfaces (Router R1 eth_0, Dad's PC, Mom's Tablet, Lisa's PC, Network Printer)	7 IP addresses



Question 1 (c)

Based on your answer to the previous question, what are the smallest possible IPv4 address spaces for each subnet? Provide your answer in prefix notation and explain how you mathematically get these numbers.



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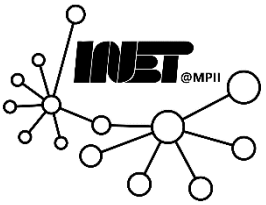


Question 1 (c)

- No. required addresses: n
- No. bits to cover required addresses: $\lceil \log_2 n \rceil$
- IPv4 Subnet size: $32 - \lceil \log_2 n \rceil$
- SN 1: $32 - \lceil \log_2 4 \rceil = 30$ -> prefix notation: /30

SN 1	2 interfaces (Web server, Router R4 eth_3)	4 IP addresses	/30

Question 1 (c)

- No. required addresses: n
- No. bits to cover required addresses: $\lceil \log_2 n \rceil$
- IPv4 Subnet size: $32 - \lceil \log_2 n \rceil$
- SN 2: $32 - \lceil \log_2 791 \rceil = 22$ -> prefix notation: /22

SN 1	2 interfaces (Web server, Router R4 eth_3)	4 IP addresses	/30
SN 2	281 interfaces (potential 508 hosts, and Router R4 eth_0)	791 IP addresses	/22

Question 1 (c)

- No. required addresses: n
- No. bits to cover required addresses: $\lceil \log_2 n \rceil$
- IPv4 Subnet size: $32 - \lceil \log_2 n \rceil$
- SN3

SN 1	2 interfaces (Web server, Router R4 eth_3)	4 IP addresses	/30
SN 2	281 interfaces (potential 508 hosts, and Router R4 eth_0)	791 IP addresses	/22
SN 3	2 interfaces (Mail server, Router R4 eth_0)	4 IP addresses	/30

Question 1 (c)

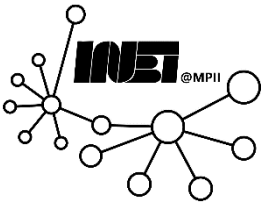
- No. required addresses: n
- No. bits to cover required addresses: $\lceil \log_2 n \rceil$
- IPv4 Subnet size: $32 - \lceil \log_2 n \rceil$
- SN 4

SN 1	2 interfaces (Web server, Router R4 eth_3)	4 IP addresses	/30
SN 2	281 interfaces (potential 508 hosts, and Router R4 eth_0)	791 IP addresses	/22
SN 3	2 interfaces (Mail server, Router R4 eth_0)	4 IP addresses	/30
SN 4	2 interfaces (R4 eth_4, R3 eth_0)	4 IP addresses	/30

Question 1 (c)

- No. required addresses: n
- No. bits to cover required addresses: $\lceil \log_2 n \rceil$
- IPv4 Subnet size: $32 - \lceil \log_2 n \rceil$
- SN 5

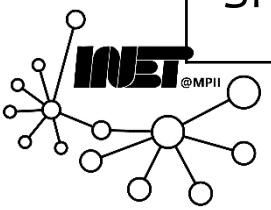
SN 1	2 interfaces (Web server, Router R4 eth_3)	4 IP addresses	/30
SN 2	281 interfaces (potential 508 hosts, and Router R4 eth_0)	791 IP addresses	/22
SN 3	2 interfaces (Mail server, Router R4 eth_0)	4 IP addresses	/30
SN 4	2 interfaces (R4 eth_4, R3 eth_0)	4 IP addresses	/30
SN 5	2 interfaces (R2 eth_0, R1 eth_1)	4 IP addresses	/30



Question 1 (c)

- No. required addresses: n
- No. bits to cover required addresses: $\lceil \log_2 n \rceil$
- IPv4 Subnet size: $32 - \lceil \log_2 n \rceil$
- SN 6: $32 - \lceil \log_2 7 \rceil = 29$ -> prefix notation: /29

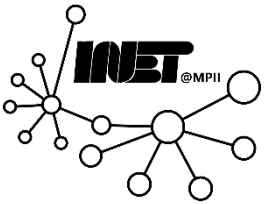
SN 1	2 interfaces (Web server, Router R4 eth_3)	4 IP addresses	/30
SN 2	281 interfaces (potential 508 hosts, and Router R4 eth_0)	791 IP addresses	/22
SN 3	2 interfaces (Mail server, Router R4 eth_0)	4 IP addresses	/30
SN 4	2 interfaces (R4 eth_4, R3 eth_0)	4 IP addresses	/30
SN 5	2 interfaces (R2 eth_0, R1 eth_1)	4 IP addresses	/30
SN 6	5 interfaces (Router R1 eth_0, Dad's PC, Mom's Tablet, Lisa's PC, Network Printer)	7 IP addresses	/29



Question 1 (d)

Assign IPv4 address space to all the subnets. Your IPv4 space allocation should be as dense as possible. Start assigning IPv4 space from 31.0.0.0 onward. Provide, for every allocated IPv4 address space, its prefix, network address, usable IPv4 address range and broadcast address, like shown in Table

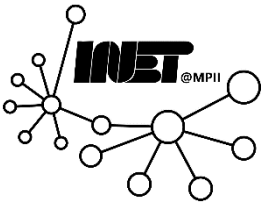
Subnet ID	IPv4 Prefix	Network Address	Usable IPv4 Range	Broadcast Address
SN 01	31.0.0.0/XX	31.0.0.0	31.0.0.1 - 31.XX.XX.XX	31.XX.XX.XX



Question 1 (d)

Assign IPv4 address space to all the subnets. Your IPv4 space allocation should be as dense as possible. Start assigning IPv4 space from 31.0.0.0 onward. Provide, for every allocated IPv4 address space, its prefix, network address, usable IPv4 address range and broadcast address, like shown in Table

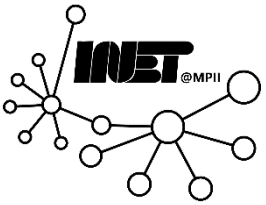
Subnet ID	IPv4 Prefix	Network Address	Usable IPv4 Range	Broadcast Address
SN 01	31.0.0.0/XX	31.0.0.0	31.0.0.1 - 31.XX.XX.XX	31.XX.XX.XX



Question 1 (d)

IPv4 space 31.0.0.0

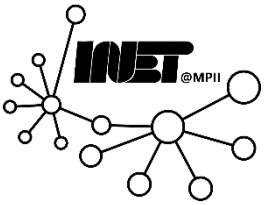
Subnet ID	IPv4 Prefix	Network Address	Usable IPv4 Range	Broadcast Address
SN 2	31.0.0.0/22	31.0.0.0	31.0.0.1 - 31.0.3.254	31.0.3.255



Question 1 (d)

IPv4 space 31.0.0.0

Subnet ID	IPv4 Prefix	Network Address	Usable IPv4 Range	Broadcast Address
SN 2	31.0.0.0/22	31.0.0.0	31.0.0.1 - 31.0.3.254	31.0.3.255
SN 6	31.0.4.0/29	31.0.4.0	31.0.4.1 - 31.0.4.6	31.0.4.7



Question 1 (d)

IPv4 space 31.0.0.0

Subnet ID	IPv4 Prefix	Network Address	Usable IPv4 Range	Broadcast Address
SN 2	31.0.0.0/22	31.0.0.0	31.0.0.1 - 31.0.3.254	31.0.3.255
SN 6	31.0.4.0/29	31.0.4.0	31.0.4.1 - 31.0.4.6	31.0.4.7
SN 1	31.0.4.8/30	31.0.4.8	31.0.4.9 - 31.0.4.10	31.0.4.11

Question 1 (d)

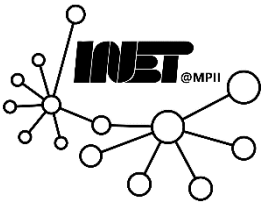
IPv4 space 31.0.0.0

Subnet ID	IPv4 Prefix	Network Address	Usable IPv4 Range	Broadcast Address
SN 2	31.0.0.0/22	31.0.0.0	31.0.0.1 - 31.0.3.254	31.0.3.255
SN 6	31.0.4.0/29	31.0.4.0	31.0.4.1 - 31.0.4.6	31.0.4.7
SN 1	31.0.4.8/30	31.0.4.8	31.0.4.9 - 31.0.4.10	31.0.4.11
SN 3	31.0.4.12/30	31.0.4.12	31.0.4.13 - 31.0.4.14	31.0.4.15

Question 1 (d)

IPv4 space 31.0.0.0

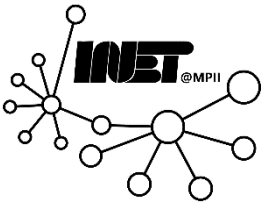
Subnet ID	IPv4 Prefix	Network Address	Usable IPv4 Range	Broadcast Address
SN 2	31.0.0.0/22	31.0.0.0	31.0.0.1 - 31.0.3.254	31.0.3.255
SN 6	31.0.4.0/29	31.0.4.0	31.0.4.1 - 31.0.4.6	31.0.4.7
SN 1	31.0.4.8/30	31.0.4.8	31.0.4.9 - 31.0.4.10	31.0.4.11
SN 3	31.0.4.12/30	31.0.4.12	31.0.4.13 - 31.0.4.14	31.0.4.15
SN 4	31.0.4.16/30	31.0.4.16	31.0.4.17 - 31.0.4.18	31.0.4.19



Question 1 (d)

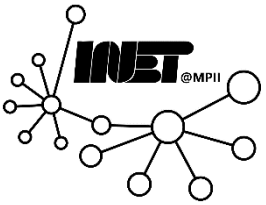
IPv4 space 31.0.0.0

Subnet ID	IPv4 Prefix	Network Address	Usable IPv4 Range	Broadcast Address
SN 2	31.0.0.0/22	31.0.0.0	31.0.0.1 - 31.0.3.254	31.0.3.255
SN 6	31.0.4.0/29	31.0.4.0	31.0.4.1 - 31.0.4.6	31.0.4.7
SN 1	31.0.4.8/30	31.0.4.8	31.0.4.9 - 31.0.4.10	31.0.4.11
SN 3	31.0.4.12/30	31.0.4.12	31.0.4.13 - 31.0.4.14	31.0.4.15
SN 4	31.0.4.16/30	31.0.4.16	31.0.4.17 - 31.0.4.18	31.0.4.19
SN 5	31.0.4.20/30	31.0.4.20	31.0.4.21 - 31.0.4.22	31.0.4.23



Question 1 (e)

Assign IPv4 addresses to the devices. Your mapping must be consistent with the IPv4 address space assigned in the preceding task. Note: For the hosts connected to Switch S2, you should provide the assigned IPv4 address range. Do not list all hosts separately!



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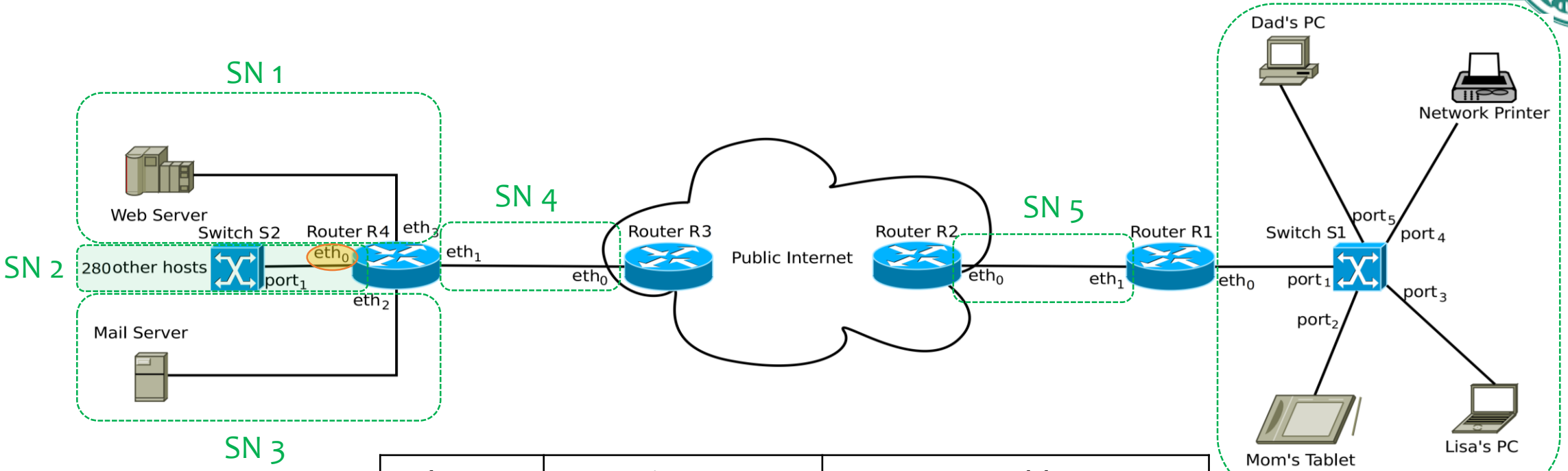
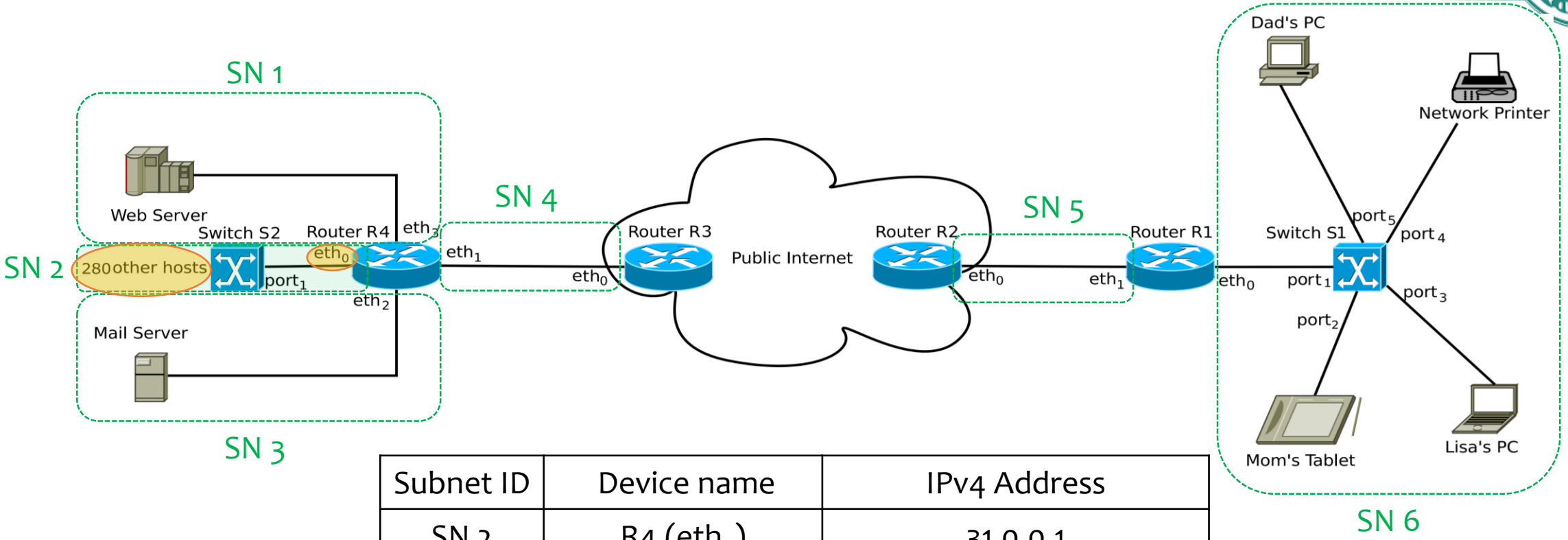
Question 1 (e)



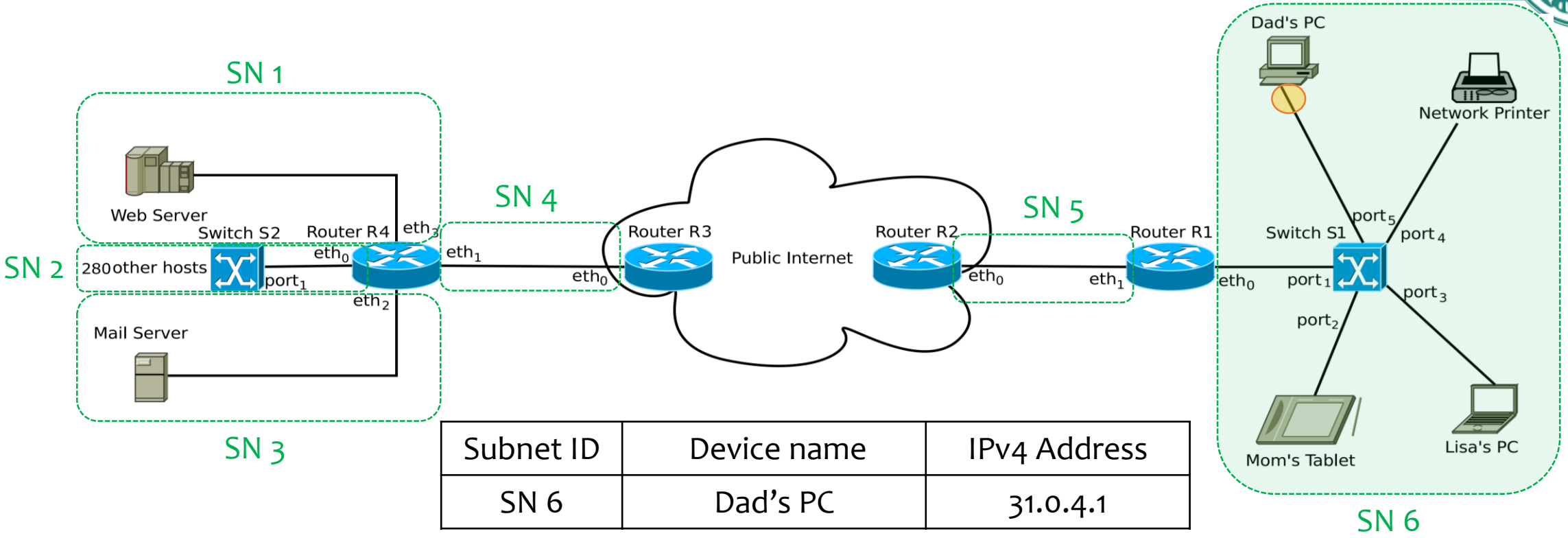
Subnet ID	Device name	IPv4 Address
SN 2	R4 (eth_0)	31.0.0.1

Question 1 (e)



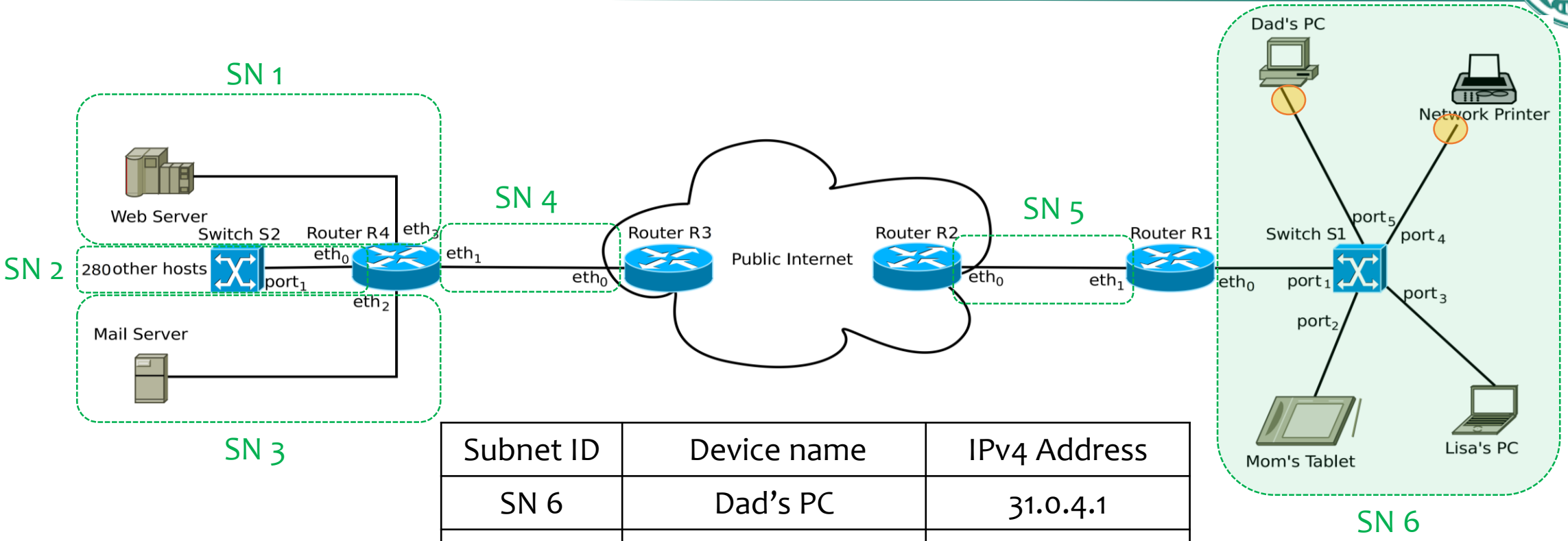
Subnet ID	Device name	IPv4 Address
SN 2	R4 (eth_0)	31.0.0.1
SN 2	280 hosts	31.0.0.2 - 31.0.1.25 (from 31.0.1.26 to 31.0.3.254 is reserved for the future)

Question 1 (e)



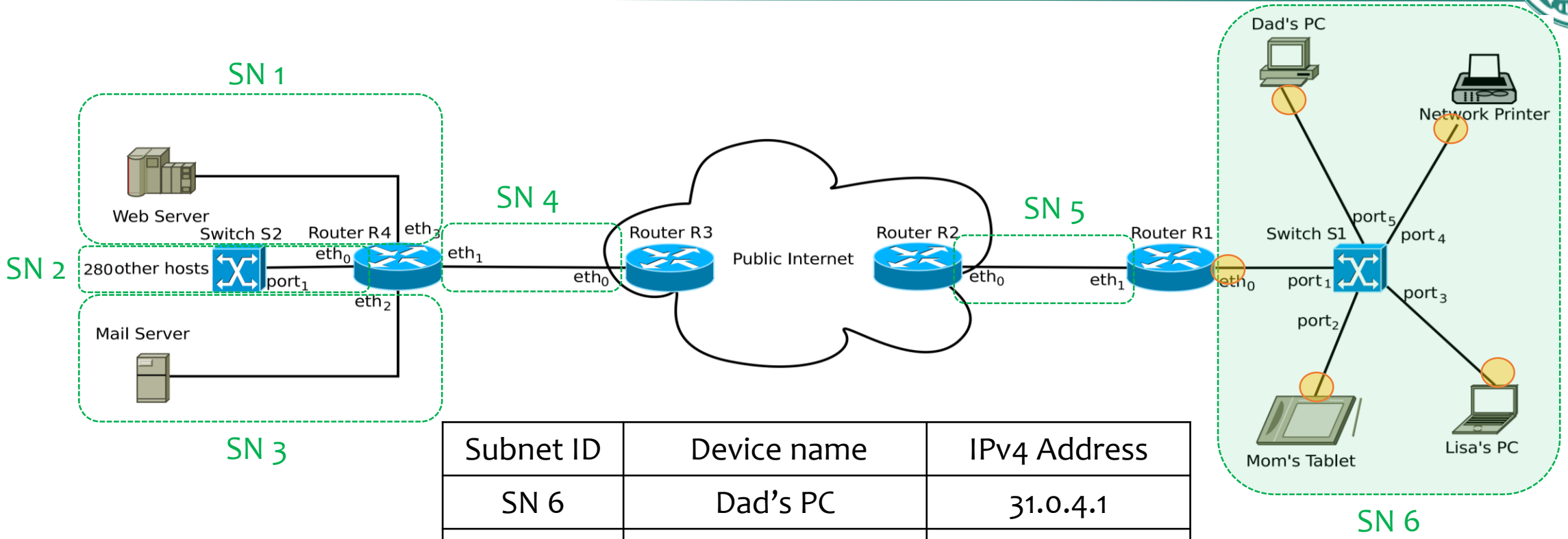
Subnet ID	Device name	IPv4 Address
SN 6	Dad's PC	31.0.4.1

Question 1 (e)



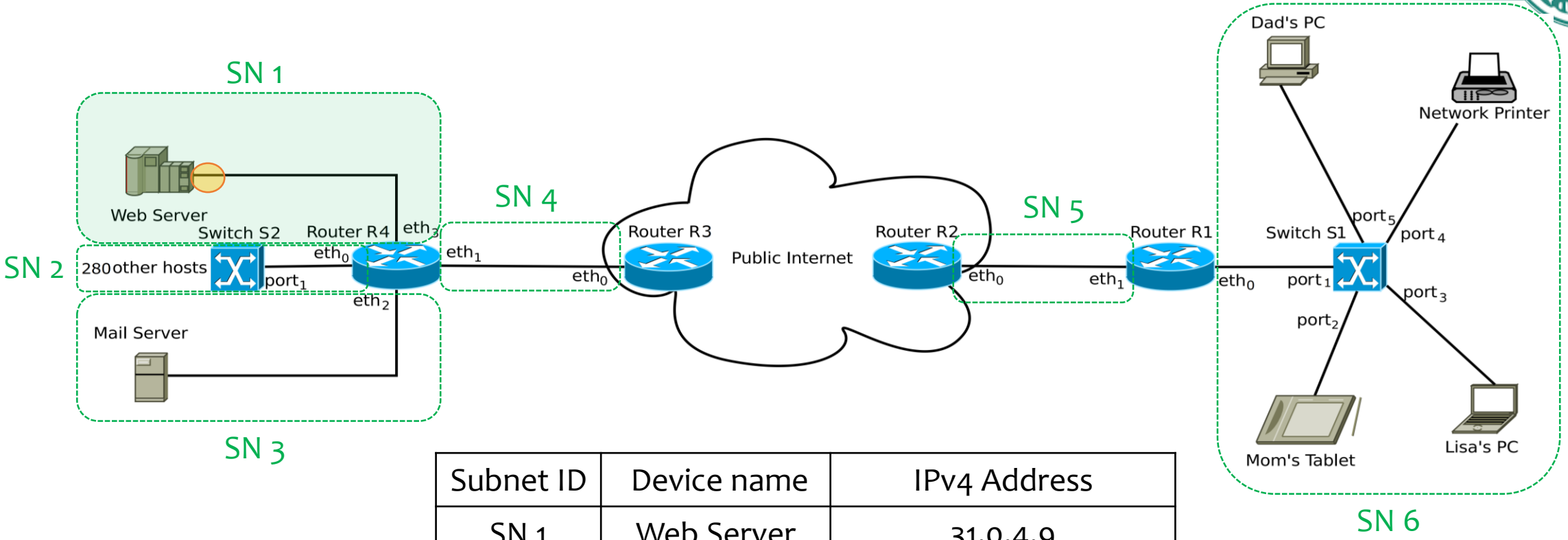
Subnet ID	Device name	IPv4 Address
SN 6	Dad's PC	31.0.4.1
SN 6	Network Printer	31.0.4.2

Question 1 (e)



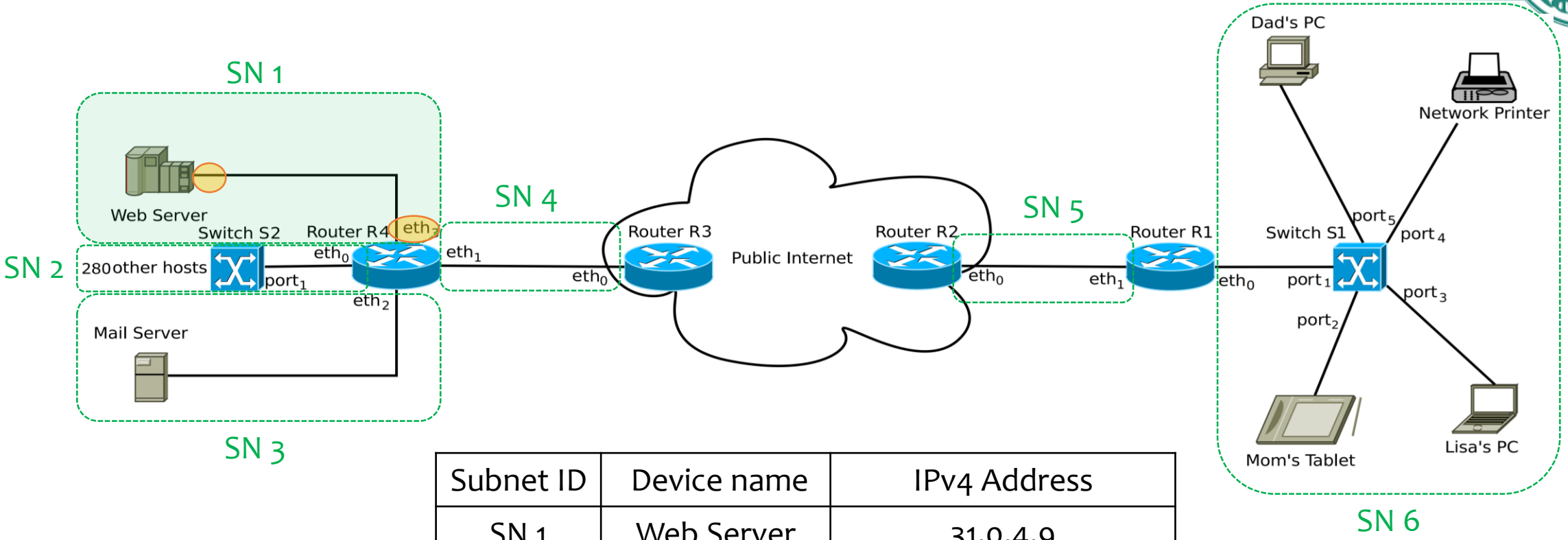
Subnet ID	Device name	IPv4 Address
SN 6	Dad's PC	31.0.4.1
SN 6	Network Printer	31.0.4.2
SN 6	Lisa's PC	31.0.4.3
SN 6	Mom's Tablet	31.0.4.4
SN 6	R1 (eth_0)	31.0.4.5

Question 1 (e)



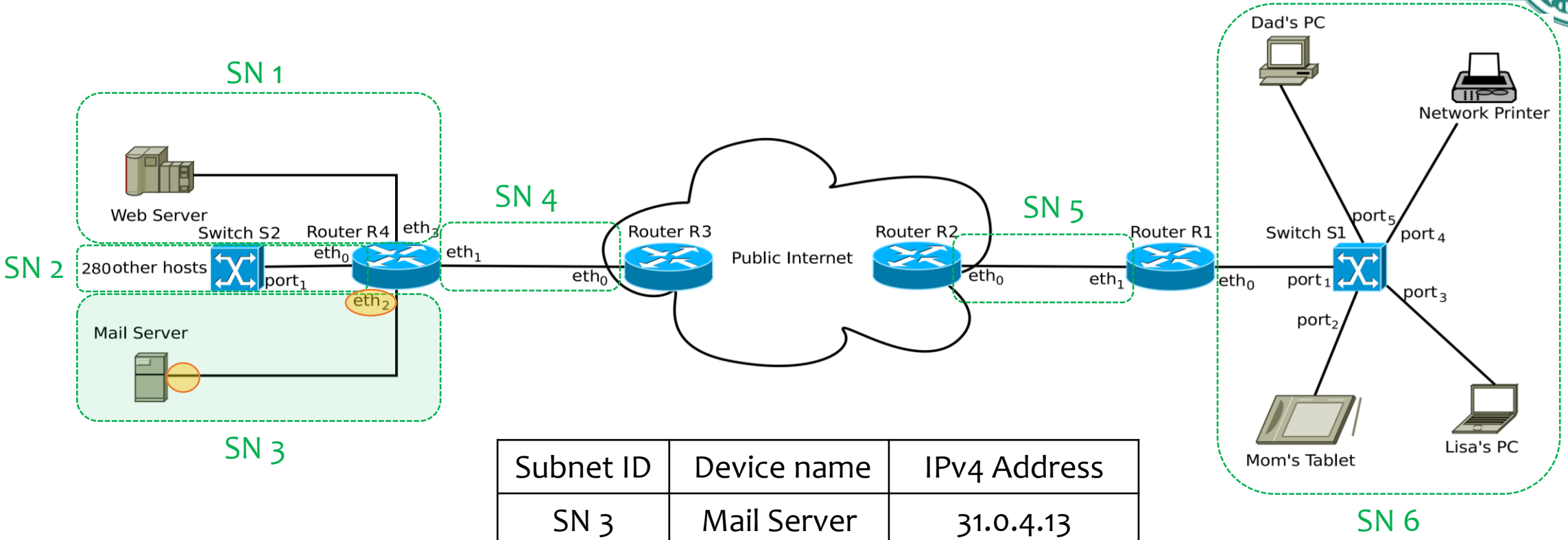
Subnet ID	Device name	IPv4 Address
SN 1	Web Server	31.0.4.9

Question 1 (e)



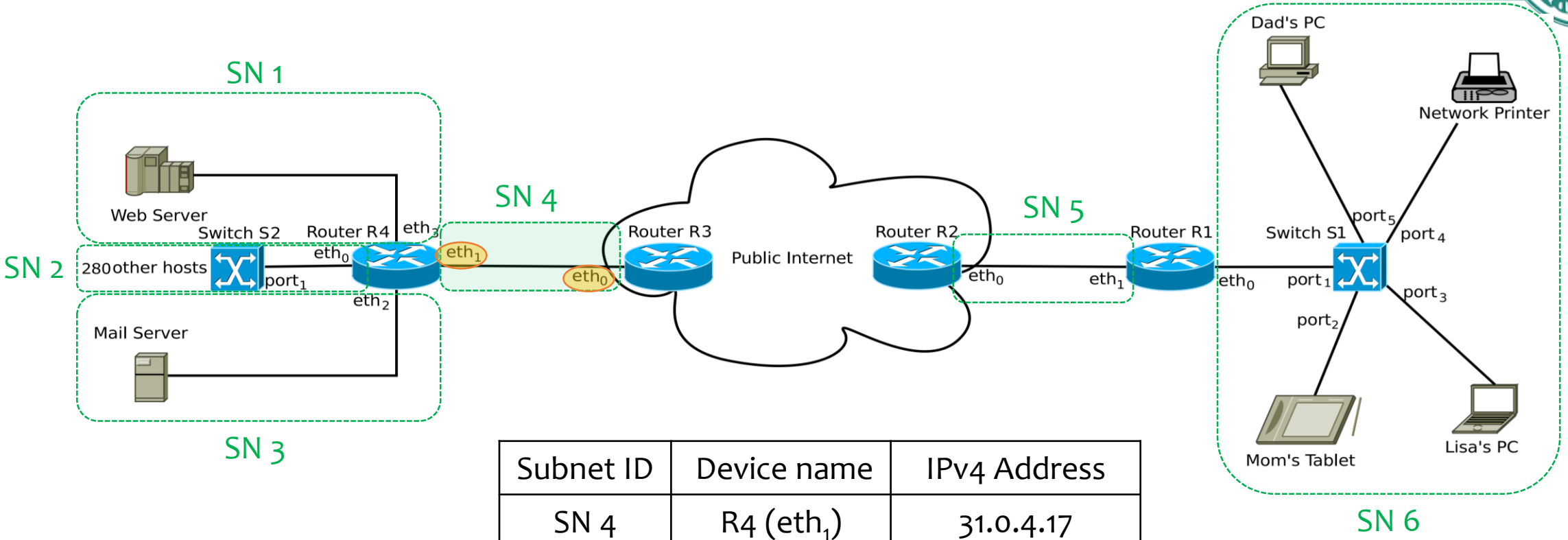
Subnet ID	Device name	IPv4 Address
SN 1	Web Server	31.0.4.9
SN 1	R4 (eth_3)	31.0.4.10

Question 1 (e)



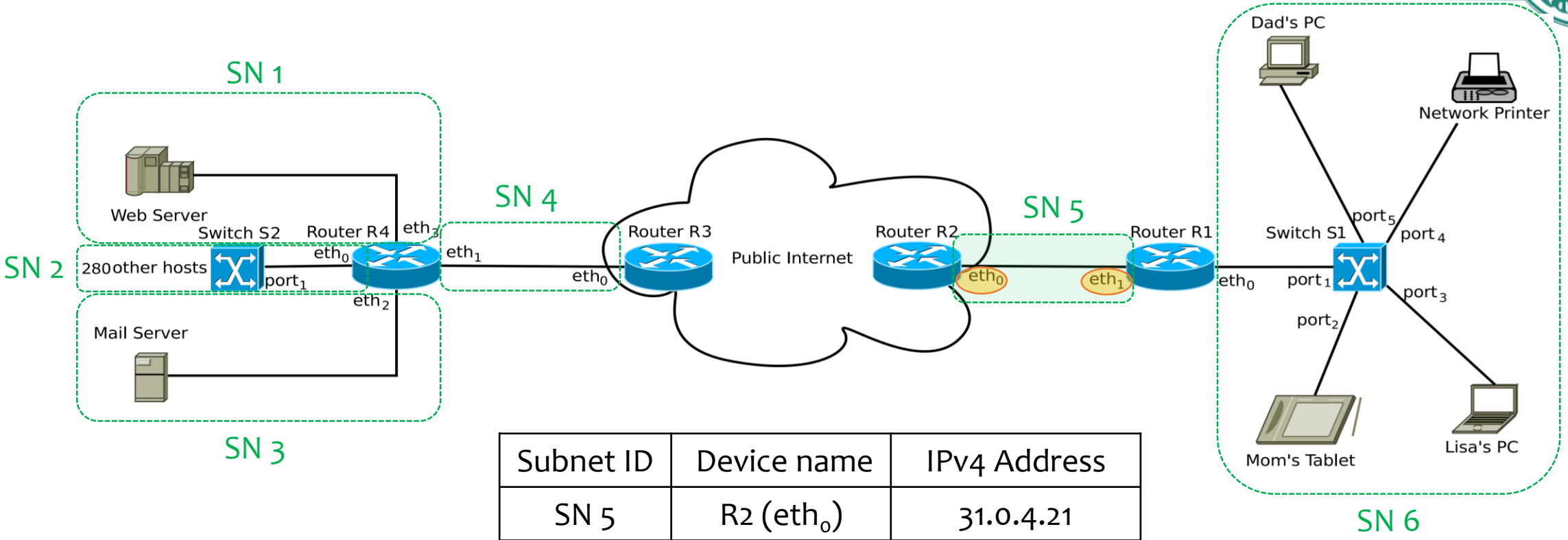
Subnet ID	Device name	IPv4 Address
SN 3	Mail Server	31.0.4.13
SN 3	R4 (eth_2)	31.0.4.14

Question 1 (e)



Subnet ID	Device name	IPv4 Address
SN 4	R4 (eth_1)	31.0.4.17
SN 4	R3 (eth_0)	31.0.4.18

Question 1 (e)



Subnet ID	Device name	IPv4 Address
SN 5	R2 (eth_0)	31.0.4.21
SN 5	R1 (eth_1)	31.0.4.22

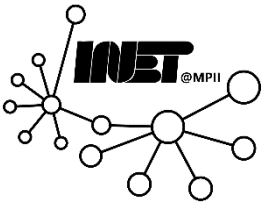
Question 1 (e)

Subnet ID	Device name	IPv4 Address
SN 2	R4 (eth_0)	31.0.0.1
SN 2	280 hosts	31.0.0.2 - 31.0.1.25 (from 31.0.1.26 to 31.0.3.254 is reserved for the future)
SN 6	Dad's PC	31.0.4.1
SN 6	Network Printer	31.0.4.2
SN 6	Lisa's PC	31.0.4.3
SN 6	Mom's Tablet	31.0.4.4
SN 6	R1 (eth_0)	31.0.4.5
SN 1	Web Server	31.0.4.9
SN 1	R4 (eth_3)	31.0.4.10

Subnet ID	Device name	IPv4 Address
SN 3	Mail Server	31.0.4.13
SN 3	R4 (eth_2)	31.0.4.14
SN 4	R4 (eth_1)	31.0.4.17
SN 4	R3 (eth_0)	31.0.4.18
SN 5	R2 (eth_0)	31.0.4.21
SN 5	R1 (eth_1)	31.0.4.22

Question 1 (f)

If we were traveling back to the past, where only classful addressing was available: What type of class-networks would your subnets be? How many unused IP addresses would there be in each subnet? Why is classful addressing (nearly, hopefully) not used anymore?



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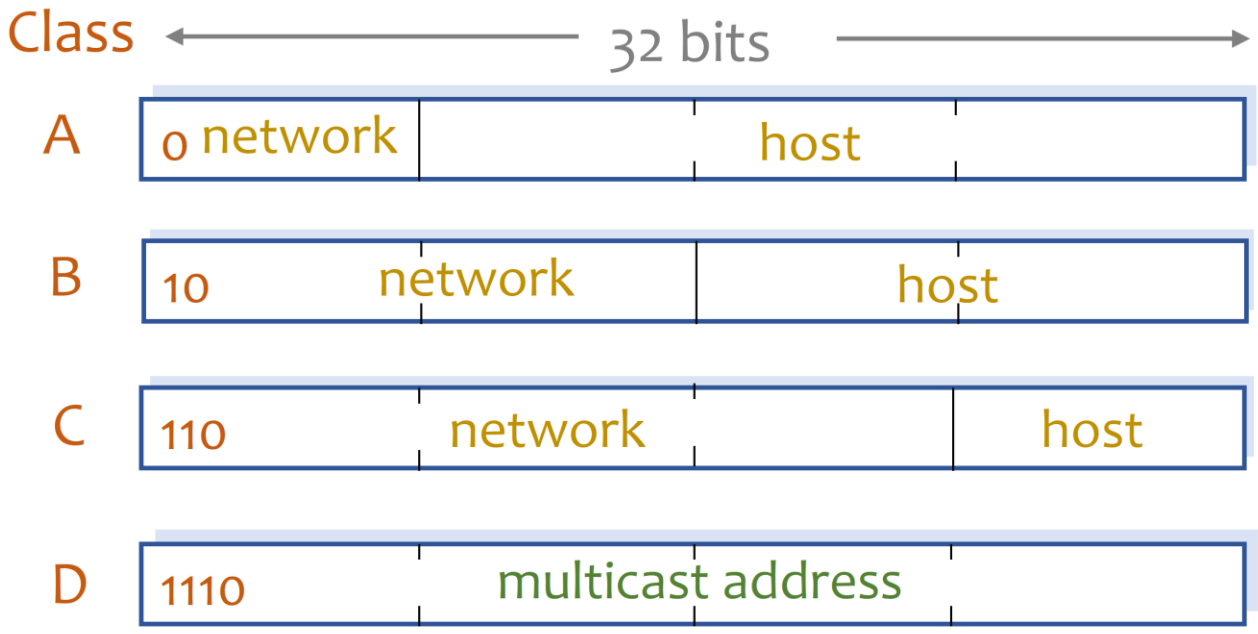
Question 1 (f)

IPv4 Classful addressing



0.0.0.0 to
127.255.255.255

128.0.0.0 to
191.255.255.255

192.0.0.0 to
223.255.255.255

224.0.0.0 to
239.255.255.255

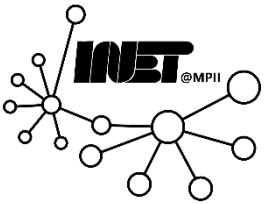
Question 1 (f)

Answer:

- Every subnet (with less than 254 required IP addresses) would become a Class C network.
- Except subnet 2 (with 789 IP addresses) which would become Class B.

Question 1 (f)

How many unused IP addresses would there be in each subnet? Why is classful addressing (nearly, hopefully) not used anymore?



Question 1 (f)

Answer:

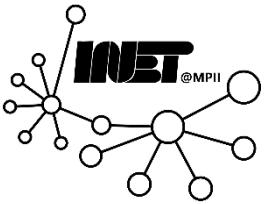
The first and last IP addresses in classful network addressing are reserved for network and broadcast addresses, respectively.

Example:

Class C: 256 – 1 – 1 (Network and Broadcast address) = 254 addresses for host

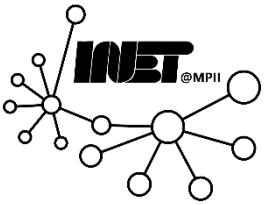
Question 1 (f)

- SN 1: Class C network, 254 – 2 = 252 unused IP addresses
- SN 2: Class B network, 65534 – 789 = 64745 unused IP addresses
- SN 3: Class C network, 254 – 2 = 252 unused IP addresses
- SN 4: Class C network, 254 – 2 = 252 unused IP addresses
- SN 5: Class C network, 254 – 2 = 252 unused IP addresses
- SN 6: Class C network, 254 – 5 = 249 unused IP addresses



Question 1 (g)

Now assign IPv6 address space to all subnets, just like you previously did for IPv4 address space. Find out about and adhere to the recommended IPv6 prefix size, instead of squeezing the IP space as much as possible. Start with IPv6 address space allocation with IPv6 address 2001:db8:: and onward.



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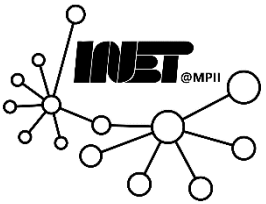
Question 1 (g)

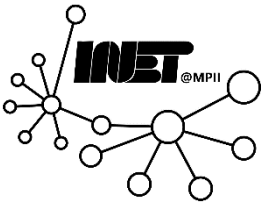
This is a sample allocation

IPv6 address: 2001:db8::

Subnet ID	IPv6 Prefix
SN 1	2001:db8:0:0::/64
SN 2	2001:db8:0:1::/64
SN 3	2001:db8:0:2::/64
SN 4	2001:db8:0:3::/64
SN 5	2001:db8:0:4::/64
SN 6	2001:db8:0:5::/64



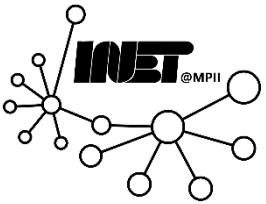
Questions?



Question 2

Given that there are not enough global IPv4 addresses, the Internet Service Provider of the "Family home network" does not provide global IPv4 addresses for this network, but uses Network Address Translation (NAT). For this question, assume that the NAT gateway is running on router R1.

The "Family home network" is now called a Local Area Network (LAN), and the rest of the topology is a Wide Area Network (WAN).



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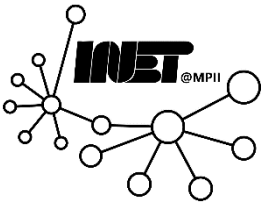
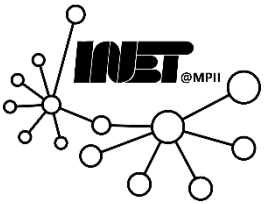


Question 2 (a)

Change the IPv4 address assignment of the interfaces within the “Family home network” by using private addresses. Choose an appropriate private IPv4 address space, name it in correct prefix notation and populate Table



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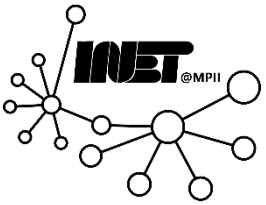
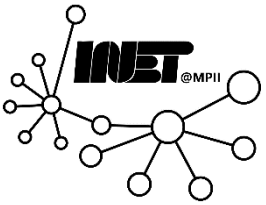


Question 2 (a)

Private IPv4 address:

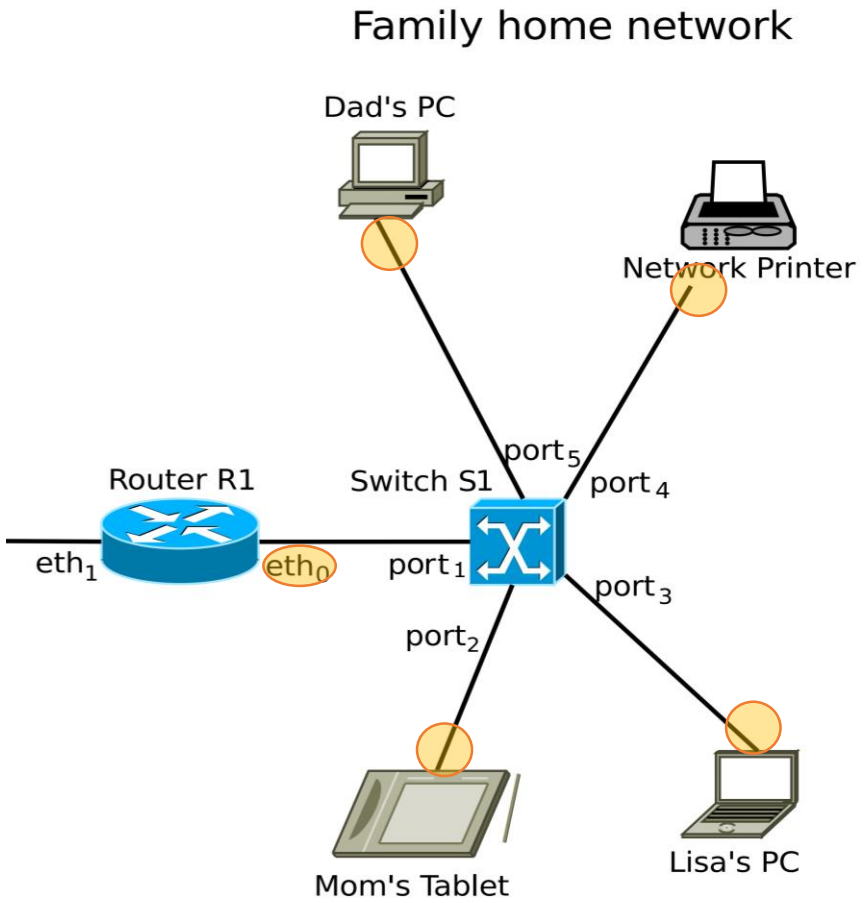
- 10.0.0.0/8 -> 10.0.0.0 to 10.255.255.255
- 172.16.0.0/12 -> 172.16.0.0 to 172.31.255.255
- 192.168.0.0/16 -> 192.168.0.0 to 192.168.255.255



Question 2 (a)

- 192.168.178.0/29

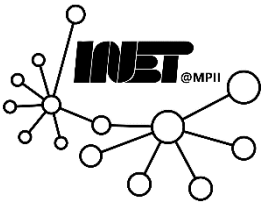
Device Name	Private IPv4 Address
Router R1 (eth_0)	192.168.178.1
Dad's PC	192.168.178.2
Network Printer	192.168.178.3
Lisa's PC	192.168.178.4
Mom's Tablet	192.168.178.5



Question 2 (b)

Lisa uses her computer to load a web page from the web server, for which it has to establish a TCP connection. It uses 51450 as its source port and 443 as destination port.

Show the NAT table of Router R1 after forwarding the TCP SYN packet of that connection using Table. The IP addresses of the devices should be consistent with your results from the preceding questions.



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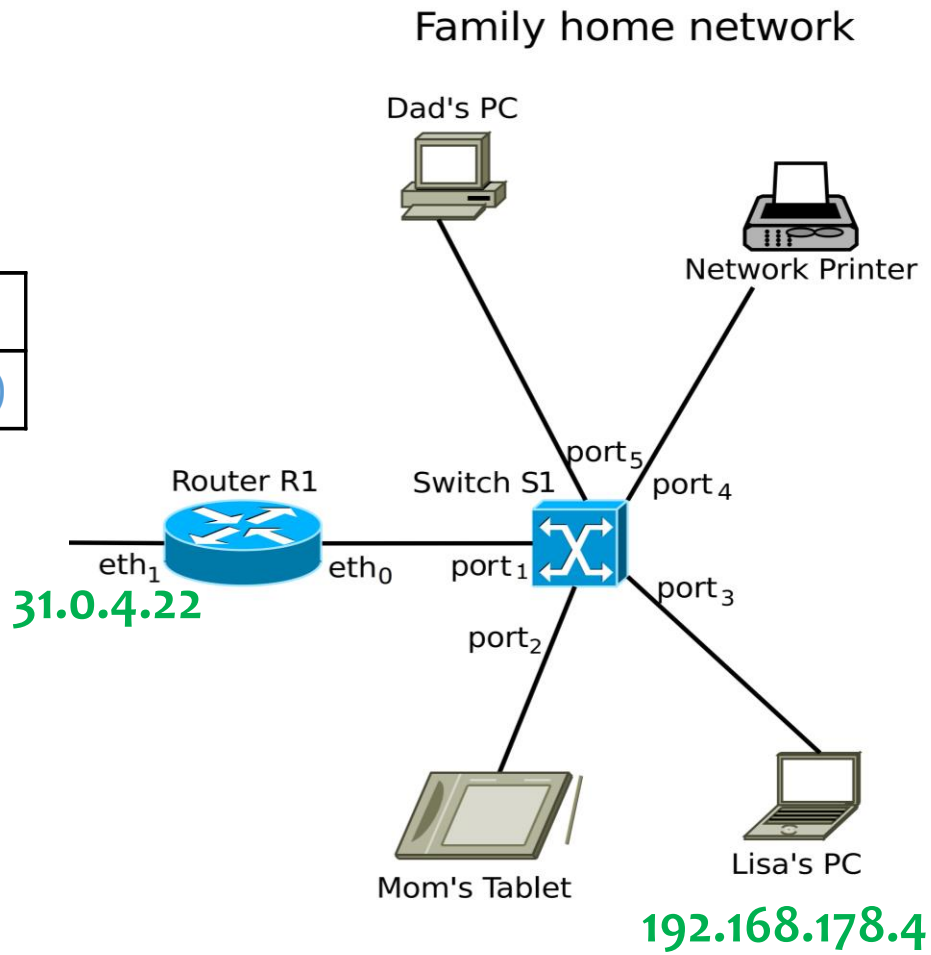
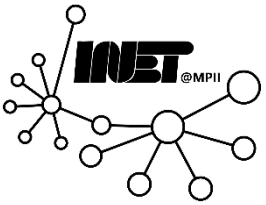
Question 2 (b)

LAN IP	LAN port	WAN IP	WAN port
192.168.178.4	51450	31.0.4.22	24823 (arbitrary port)



Question 2 (c)

Now Dad wants to load the same page from the web server using his PC. It establishes a TCP connection to the web server in parallel. Similar to Lisa's PC, it uses 51450 as source port and 443 as destination port at the same time. Show the NAT table of Router R1 after forwarding the TCP SYN packets of that connection from both computers.



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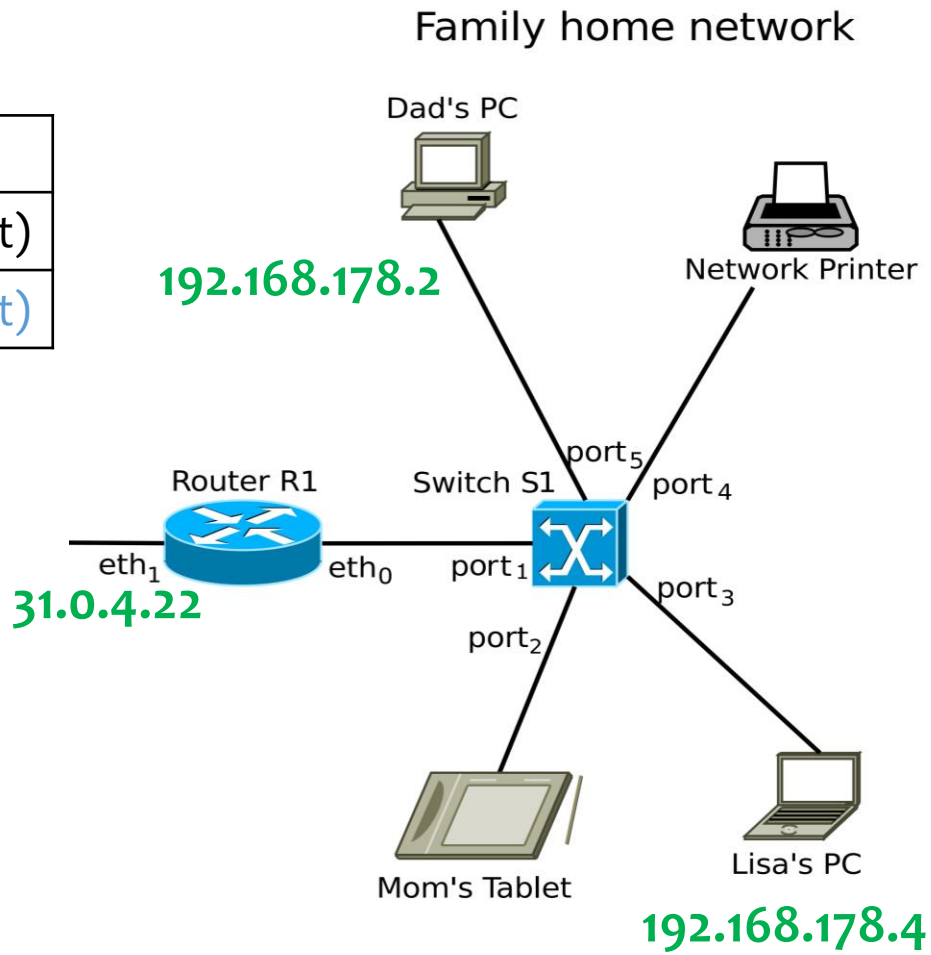
Question 2 (c)

LAN IP	LAN port	WAN IP	WAN port
192.168.178.4	51450	31.0.4.22	24823 (arbitrary port)
192.168.178.2	51450	31.0.4.22	24824 (arbitrary port)



Question 3

Provide the IPv4 forwarding table of router R4 according to the previously assigned IPv4 addresses, using table

prefix/mask	next hop IP address	interface

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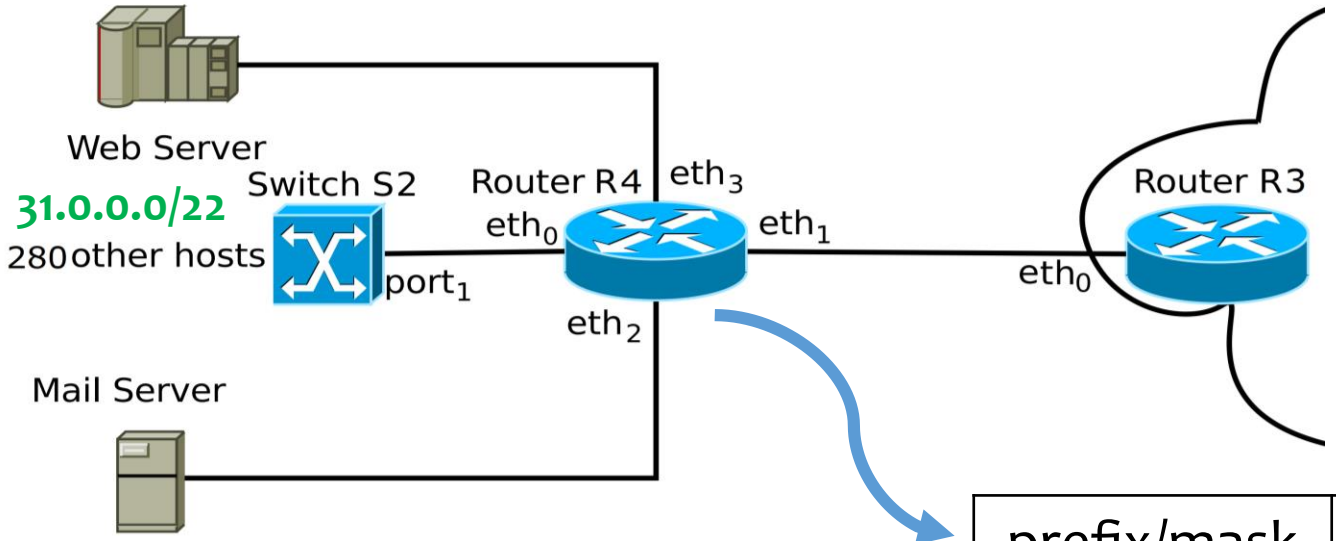
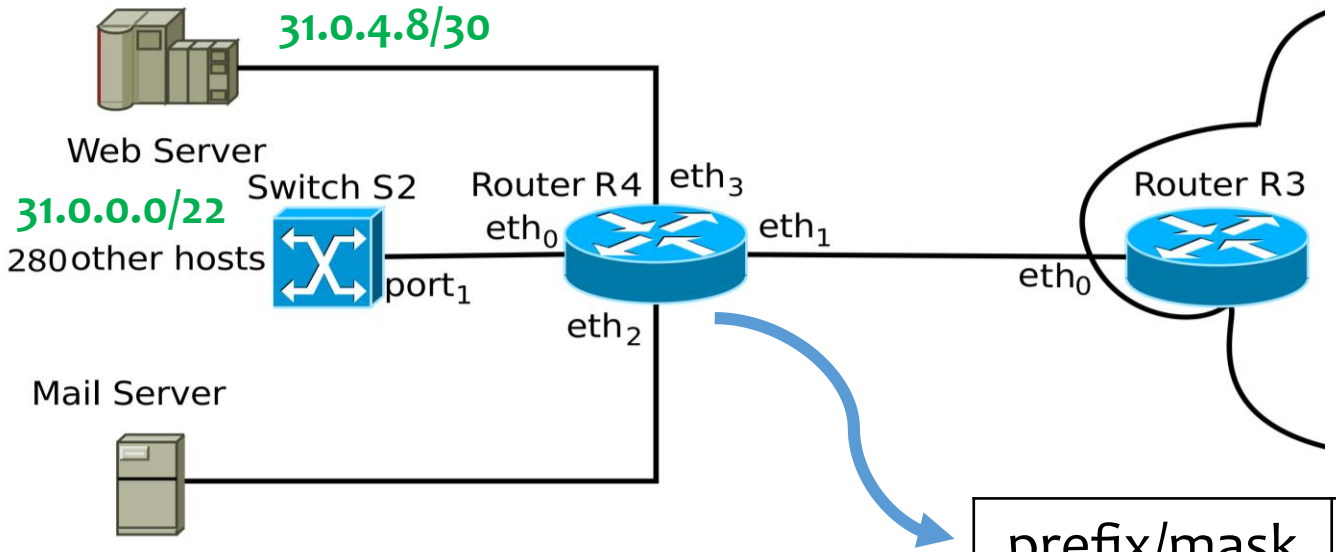
Question 3



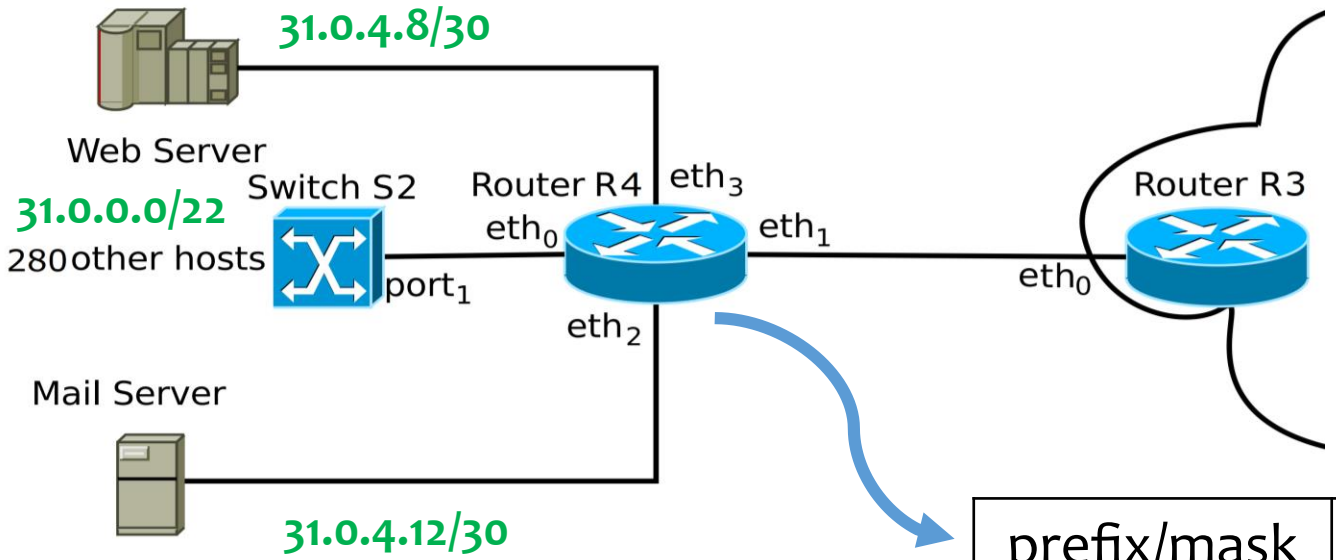
prefix/mask	next hop IP address	interface
31.0.0.0/22	-	eth_0

Question 3



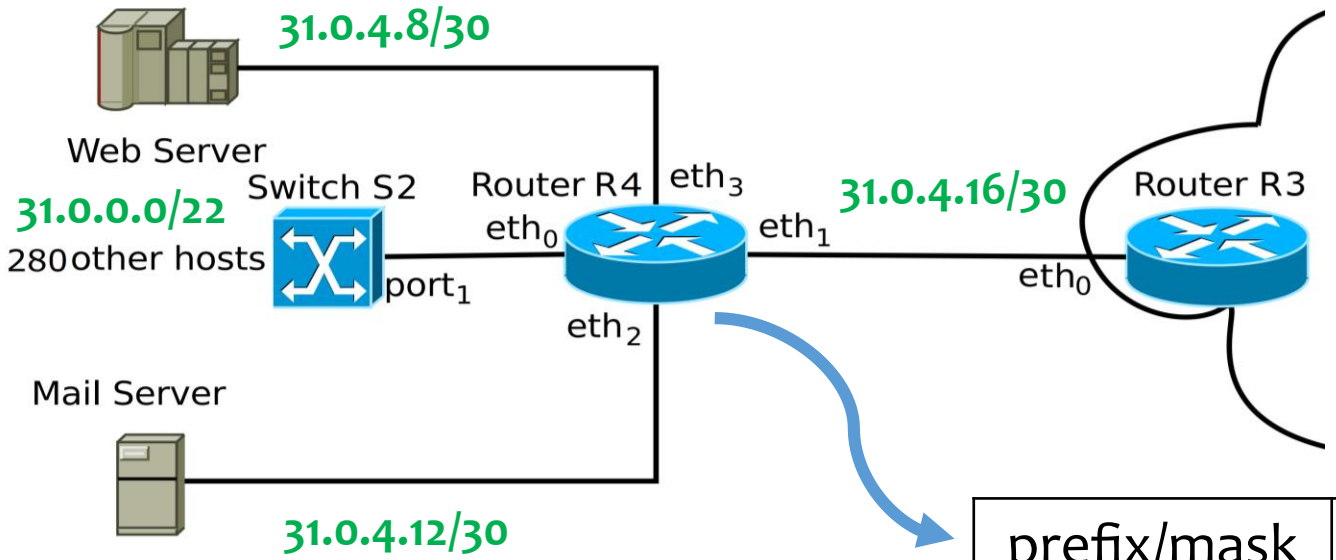
prefix/mask	next hop IP address	interface
31.0.0.0/22	-	eth_0
31.0.4.8/30	-	eth_3

Question 3



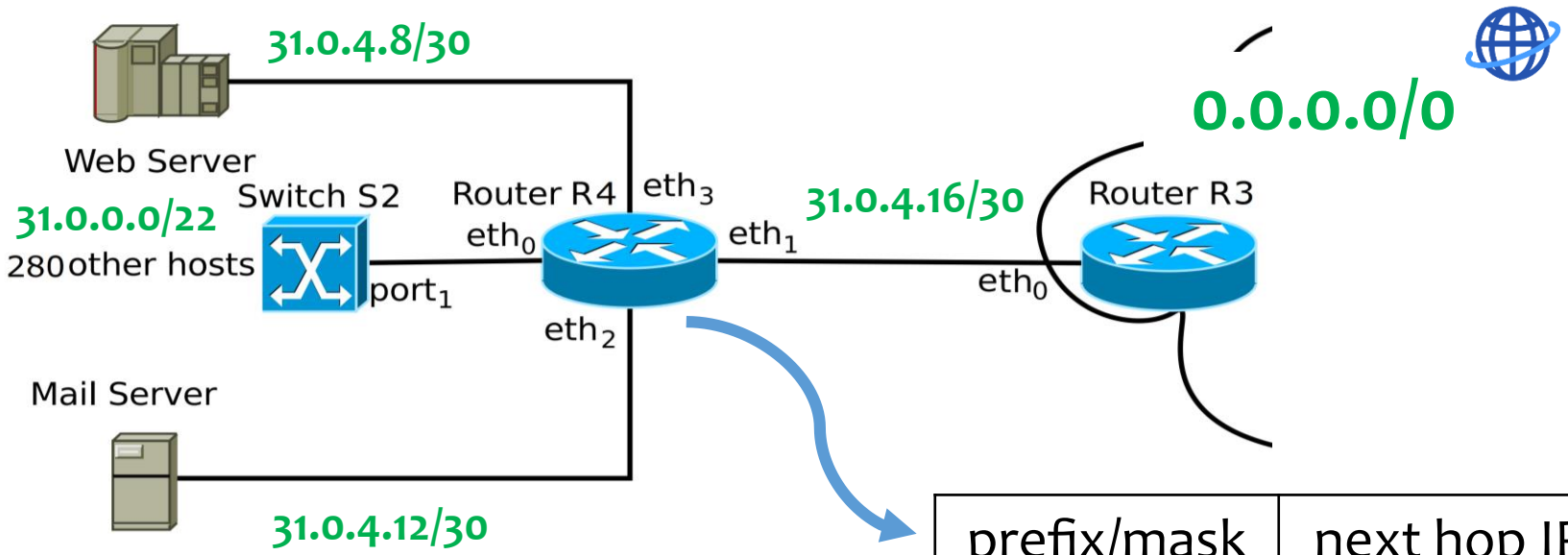
prefix/mask	next hop IP address	interface
31.0.0.0/22	-	eth_0
31.0.4.8/30	-	eth_3
31.0.4.12/30	-	eth_2

Question 3



prefix/mask	next hop IP address	interface
31.0.0.0/22	-	eth_0
31.0.4.8/30	-	eth_3
31.0.4.12/30	-	eth_2
31.0.4.16/30	-	eth_1

Question 3



prefix/mask	next hop IP address	interface
31.0.0.0/22	-	eth_0
31.0.4.8/30	-	eth_3
31.0.4.12/30	-	eth_2
31.0.4.16/30	-	eth_1
0.0.0.0/0	31.0.4.[17,18] (R3)	eth_1

Questions?