

# X36PKO

## Úvod

### Protokolová rodina TCP/IP



# Kontakty

- Jan Kubr
  - [kubr@fel.cvut.cz](mailto:kubr@fel.cvut.cz), místnost E-435, (22435) 7628,
- konzultace
  - Po – 15:30,
  - po předchozí domluvě,
- <https://dsn.felk.cvut.cz/wiki/vyuka/cviceni/x36pko/start>

# Osnova proseminářů

1. Úvod, komunikace v síti TCP/IP. Adresace, překlad adres, konfigurace
2. Komunikace v síti TCP/IP. Programové rozhraní BSD Socketů
3. Test1
4. Protokoly - teoretické modely, komunikující automaty, Petriho síť
5. Efektivita linkových protokolů
6. Test2
7. Rezerva

# Hodnocení

- Cvičení – 40%
  - dvě programovací úlohy – 13%
  - praktická úloha – 7%
  - testy – 20%
- Zkouška – 60%
  - písemná s možností diskuse



# Protokolová rodina TCP/IP v 4

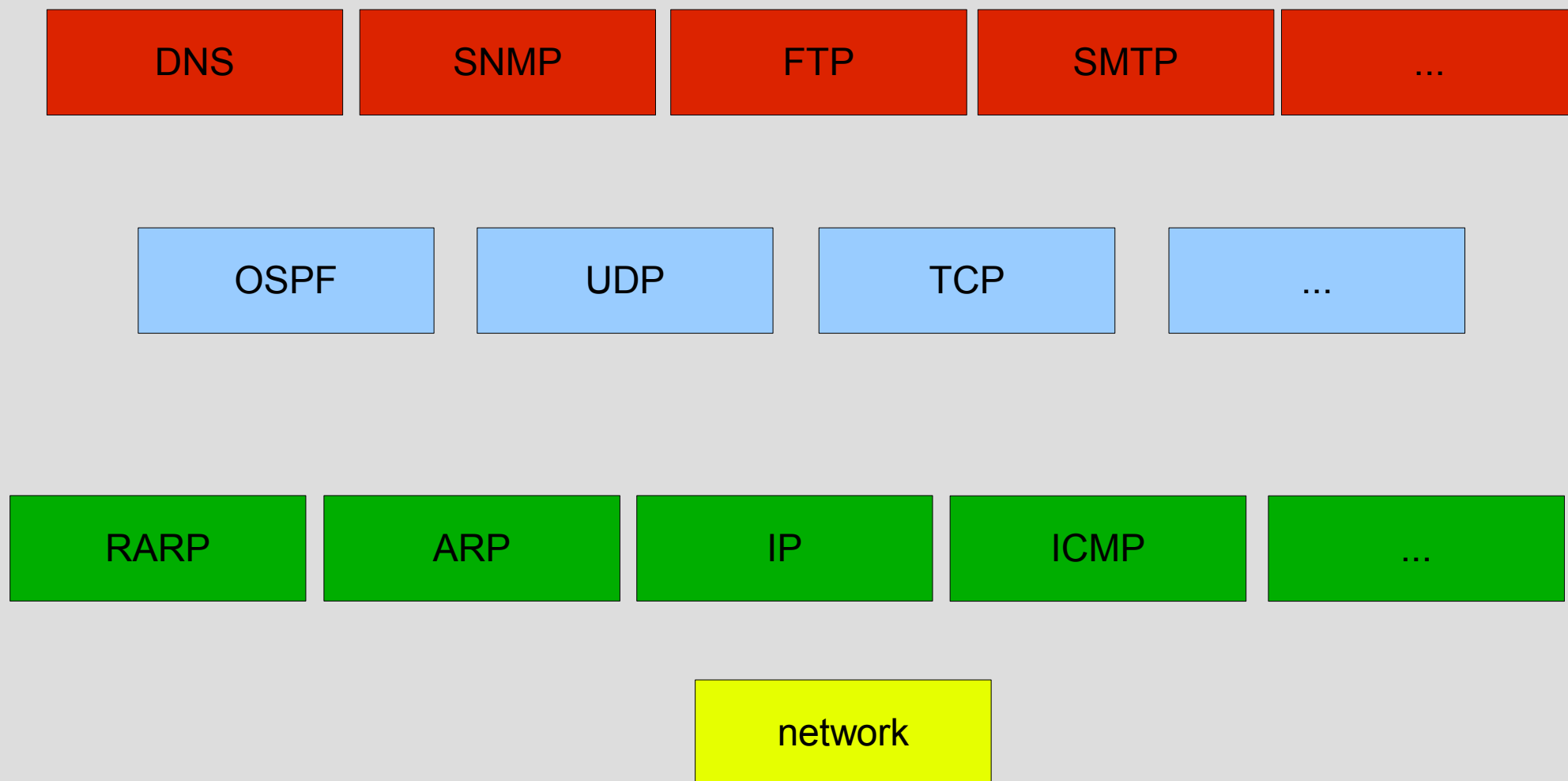
# Historie

- 1974 – první zmínka o TCP
- 1978 – oficiální uvedení TCP/IP
- 1983 – ARPANET adoptuje TCP/IP
- 1991 – začátek prací na TCP/IP v 6
- 1995 – první RFC dokumenty k v 6

# Request for Comments

- 1969 – Jon Postel, Internet Society
- množina technických a organizačních dokumentů
- Internet Engineering Task Force (IETF),  
Internet Engineering Steering Group (IESG )

# TCP/IP protokoly





# Adresace

- hierarchická adresa
- třídy adres, beztrždní adresy
- subnet, supernet
- převody mezi IP a linkovými adresami
- speciální adresy
- privátní sítě
- nečíslované sítě

# Adresace

třída A	0..1-127			
třída B	10..128-191			
třída C	110..192-223			
třída D	1110..224-239			
třída E	>239			



# Sít', uzel, maska

192.168.45.55	11000000 10101000 00101101 00110111
255.255.255.0 (24)	11111111 11111111 11111111 00000000
192.168.45.0	11000000 10101000 00101101 00000000
55	00110111

# Subnet

192.168.45.55                    11000000 10101000 00101101 00110111

255.255.255.240 (28)        11111111 11111111 11111111 11110000

192.168.45.48                    11000000 10101000 00101101 00110000

7

0111

rfc 950 – adresa podsítě nesmí být samé 0, nebo 1

rfc 1878 – adresa podsítě můžou být samé 0, nebo 1



# Supernet

192.168.45.55	11000000 10101000 00101101 00110111
255.255.240.0 (20)	11111111 11111111 11110000 00000000
192.168.32.0	11000000 10101000 00100000 00000000
3383	1101 00110111

# Speciální adresy

00..0	tento počítač na této síti
00..0.node	počítač na této síti
síť.00..0	adresa síť
síť.subsíť.00..0	adresa subsítě
síť.11..1	broadcast do síť (do všech subsítí)
síť.subsíť.11..1	broadcast do subsítě
11..1	broadcast na lokální síti
127.xx	loopback (127.0.0.1)
169.254.0.0/16	Link Local [RFC3330]

# Privátní sítě - intranet

- vyhrazené adresy
- nesmí se vyskytovat v Internetu
- filtrování, překlad adres

A	10.0.0.0/8	10.0.0.0	–	10.255.255.255
B	172.16.0.0/12	172.16.0.0	–	172.31.255.255
C	192.168.0.0/16	192.168.0.0	–	192.168.255.255

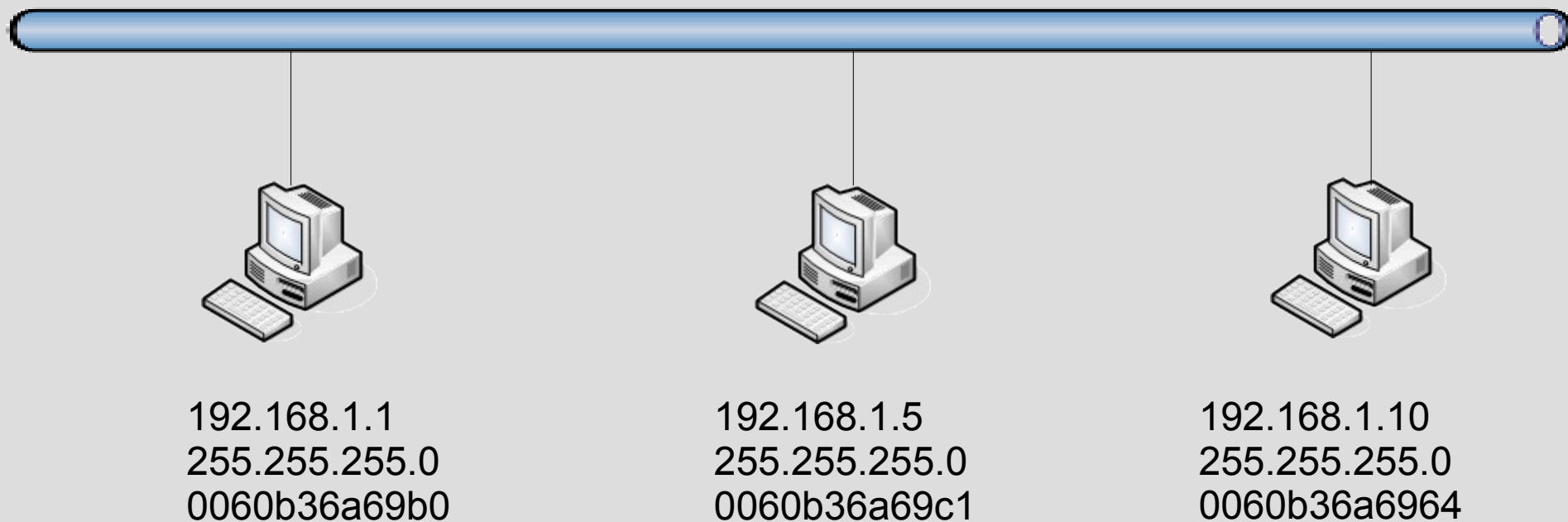


# Adresace

- 195.23.45.12/26
- 10.10.10.10/8
- 10.255.255.255/16
- 195.13.13.20/28

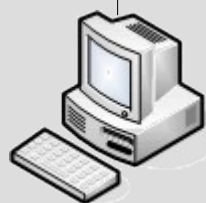


# Komunikace

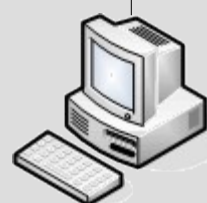


# Komunikace

192.168.1.1 -> 192.168.1.10



192.168.1.1  
255.255.255.0  
0060b36a69b0



192.168.1.5  
255.255.255.0  
0060b36a69c1



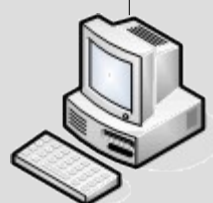
192.168.1.10  
255.255.255.0  
0060b36a6964

# Komunikace

192.168.1.1 -> 192.168.1.10



192.168.1.1  
255.255.255.0  
0060b36a69b0



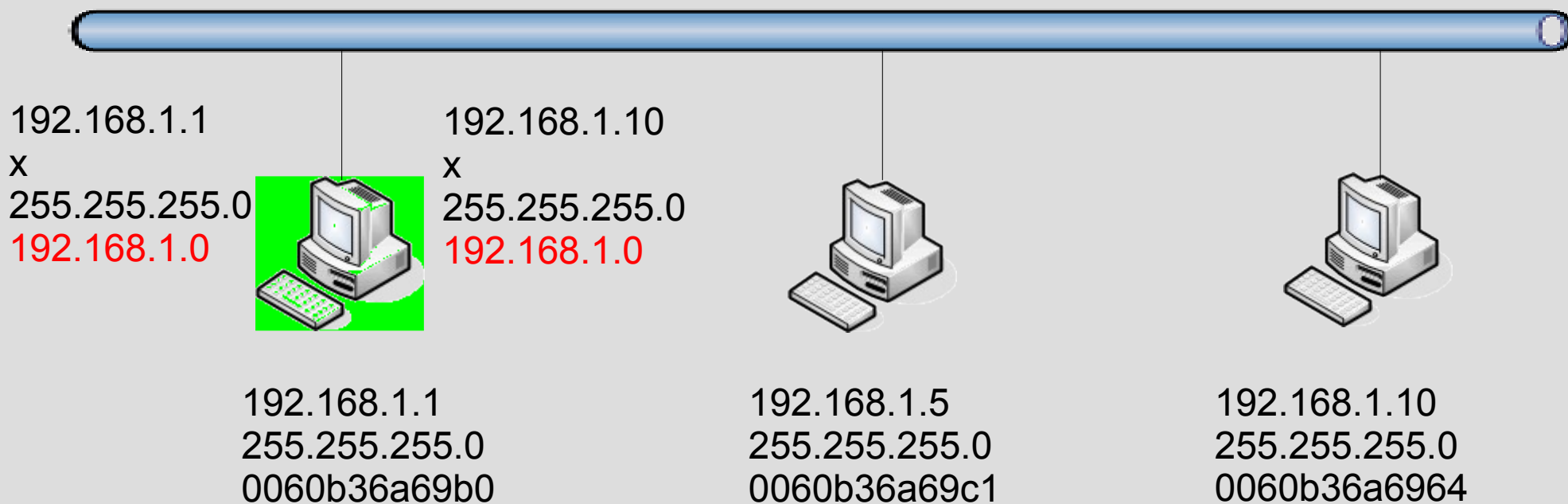
192.168.1.5  
255.255.255.0  
0060b36a69c1



192.168.1.10  
255.255.255.0  
0060b36a6964

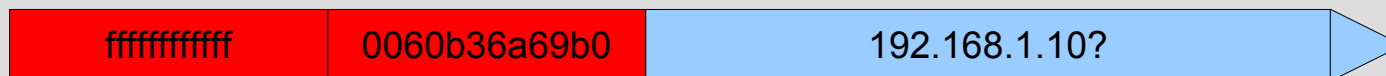
# Komunikace

192.168.1.1 -> 192.168.1.10



# Komunikace

192.168.1.1 -> 192.168.1.10



192.168.1.1  
X  
255.255.255.0  
192.168.1.0



192.168.1.10  
X  
255.255.255.0  
192.168.1.0



192.168.1.1  
255.255.255.0  
0060b36a69b0

192.168.1.5  
255.255.255.0  
0060b36a69c1

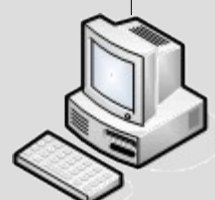
192.168.1.10  
255.255.255.0  
0060b36a6964

# Komunikace

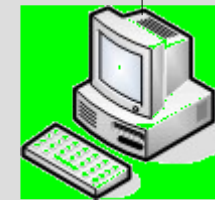
192.168.1.1 -> 192.168.1.10



192.168.1.1  
255.255.255.0  
0060b36a69b0



192.168.1.5  
255.255.255.0  
0060b36a69c1



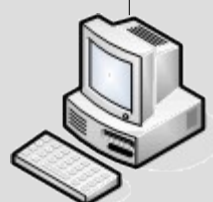
192.168.1.10  
255.255.255.0  
0060b36a6964

# Komunikace

192.168.1.1 -> 192.168.1.10



192.168.1.1  
255.255.255.0  
0060b36a69b0



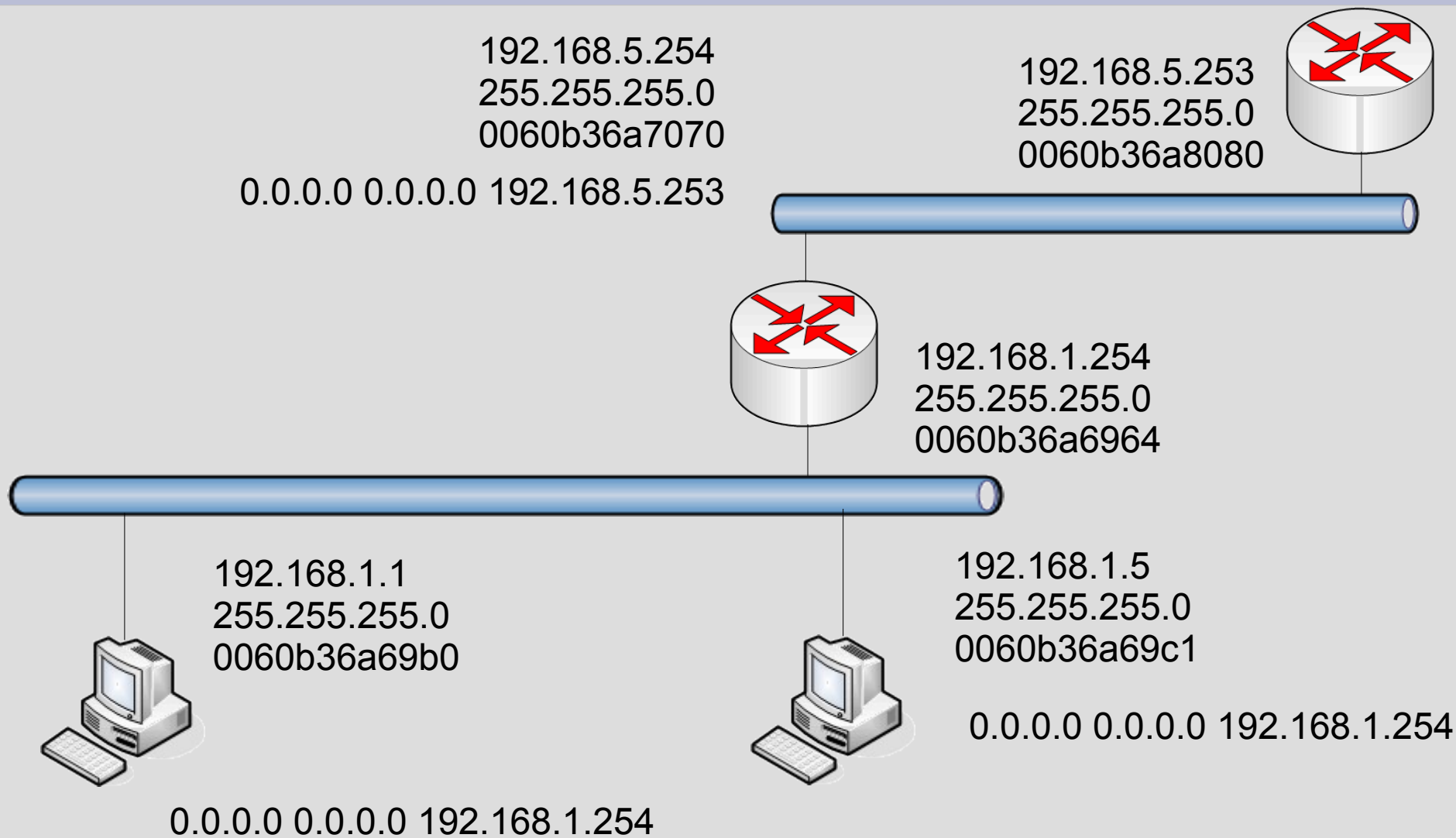
192.168.1.5  
255.255.255.0  
0060b36a69c1



192.168.1.10  
255.255.255.0  
0060b36a6964

# Komunikace

192.168.1.1 -> 147.32.83.10







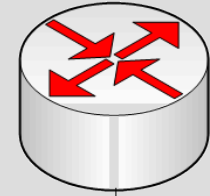
dsn

# Komunikace

192.168.1.1 -> 147.32.83.10

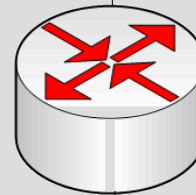
192.168.5.254  
255.255.255.0  
0060b36a7070

192.168.5.253  
255.255.255.0  
0060b36a8080



0.0.0.0 0.0.0.0 192.168.5.253

???	0060b36a69b0	147.32.83.10	192.168.1.1	data
-----	--------------	--------------	-------------	------



192.168.1.254  
255.255.255.0  
0060b36a6964



192.168.1.1  
255.255.255.0  
0060b36a69b0



192.168.1.5  
255.255.255.0  
0060b36a69c1



0.0.0.0 0.0.0.0 192.168.1.254

0.0.0.0 0.0.0.0 192.168.1.254

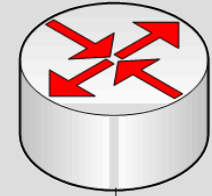


# Komunikace

192.168.1.1 -> 147.32.83.10

192.168.5.254  
255.255.255.0  
0060b36a7070

192.168.5.253  
255.255.255.0  
0060b36a8080

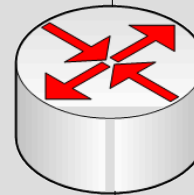


0.0.0.0 0.0.0.0 192.168.5.253

???	0060b36a69b0	147.32.83.10	192.168.1.1	data
-----	--------------	--------------	-------------	------



192.168.1.1      147.32.83.10  
X                    X  
255.255.255.0    255.255.255.0  
**192.168.1.0**    ≠    **147.32.83.0**

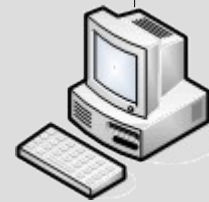


192.168.1.254  
255.255.255.0  
0060b36a6964



192.168.1.1  
255.255.255.0  
0060b36a69b0

192.168.1.5  
255.255.255.0  
0060b36a69c1



0.0.0.0 0.0.0.0 192.168.1.254

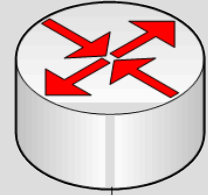
0.0.0.0 0.0.0.0 192.168.1.254

# Komunikace

192.168.1.1 -> 147.32.83.10

192.168.5.254  
255.255.255.0  
0060b36a7070

192.168.5.253  
255.255.255.0  
0060b36a8080

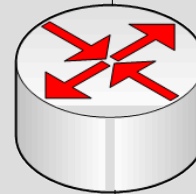


0.0.0.0 0.0.0.0 192.168.5.253

???	0060b36a69b0	147.32.83.10	192.168.1.1	data
-----	--------------	--------------	-------------	------



192.168.1.1	147.32.83.10
X	X
255.255.255.0	255.255.255.0
192.168.1.0	≠ 147.32.83.0

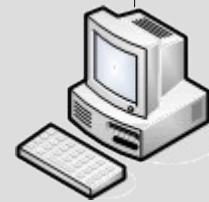


192.168.1.254  
255.255.255.0  
0060b36a6964



192.168.1.1  
255.255.255.0  
0060b36a69b0

192.168.1.5  
255.255.255.0  
0060b36a69c1

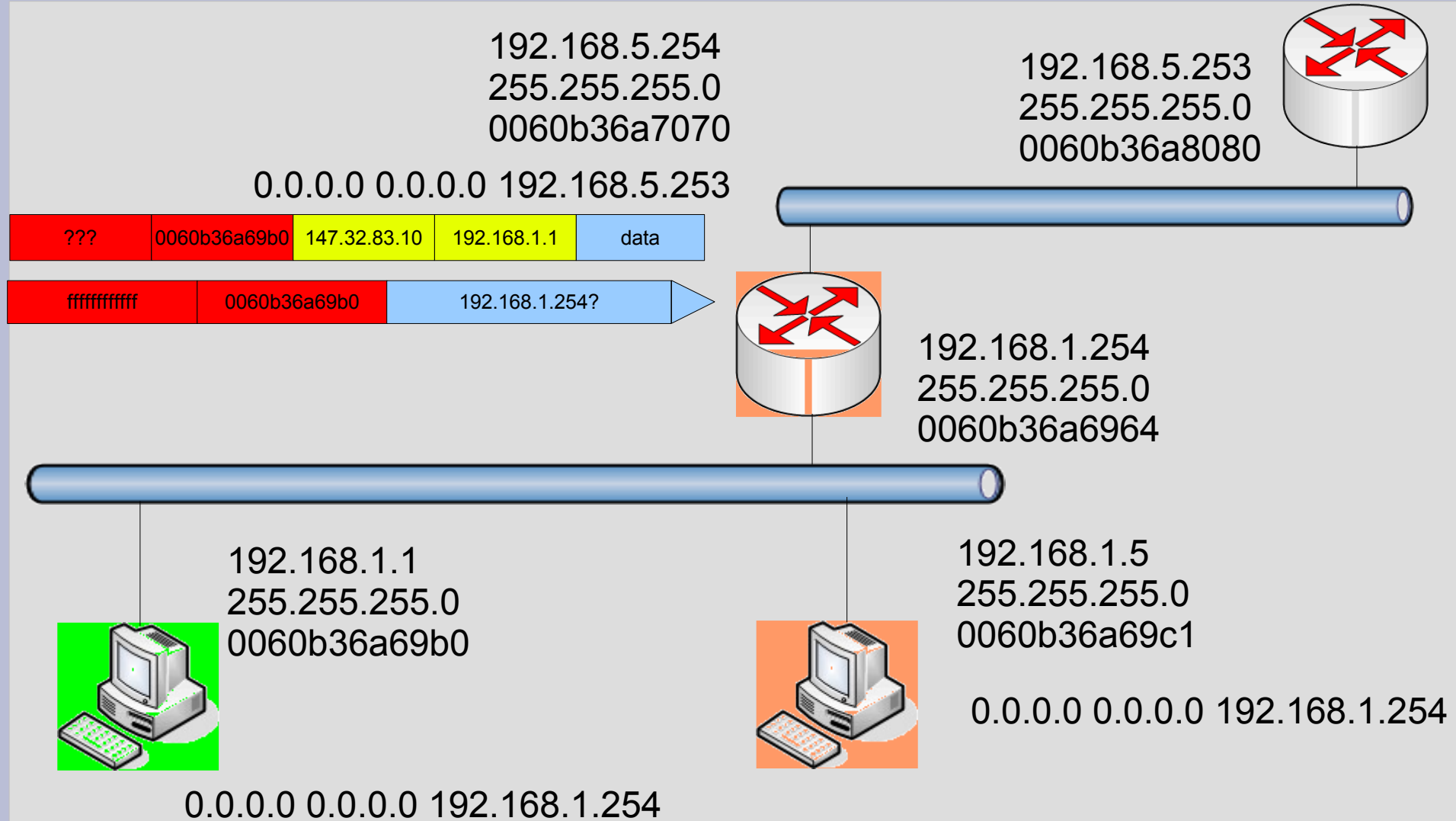


0.0.0.0 0.0.0.0 192.168.1.254

0.0.0.0 0.0.0.0 192.168.1.254

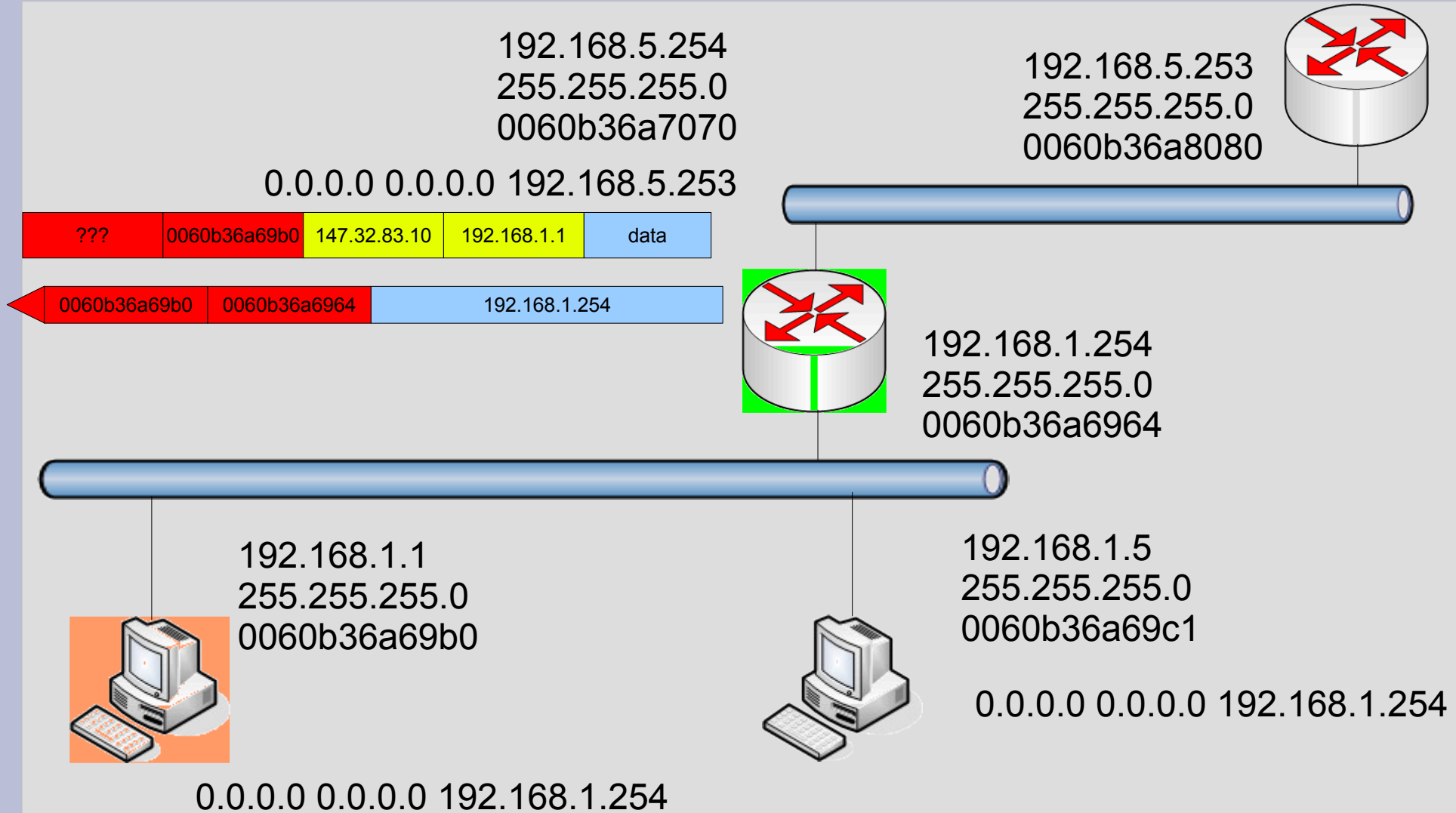
# Komunikace

192.168.1.1 -> 147.32.83.10



# Komunikace

192.168.1.1 -> 147.32.83.10

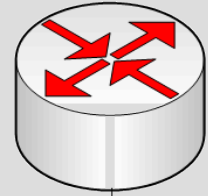


# Komunikace

192.168.1.1 -> 147.32.83.10

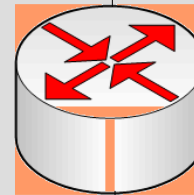
192.168.5.254  
255.255.255.0  
0060b36a7070

192.168.5.253  
255.255.255.0  
0060b36a8080



0.0.0.0 0.0.0.0 192.168.5.253

0060b36a6964	0060b36a69b0	147.32.83.10	192.168.1.1	data
--------------	--------------	--------------	-------------	------



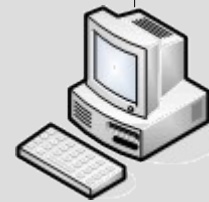
192.168.1.254  
255.255.255.0  
0060b36a6964



192.168.1.1  
255.255.255.0  
0060b36a69b0



192.168.1.5  
255.255.255.0  
0060b36a69c1

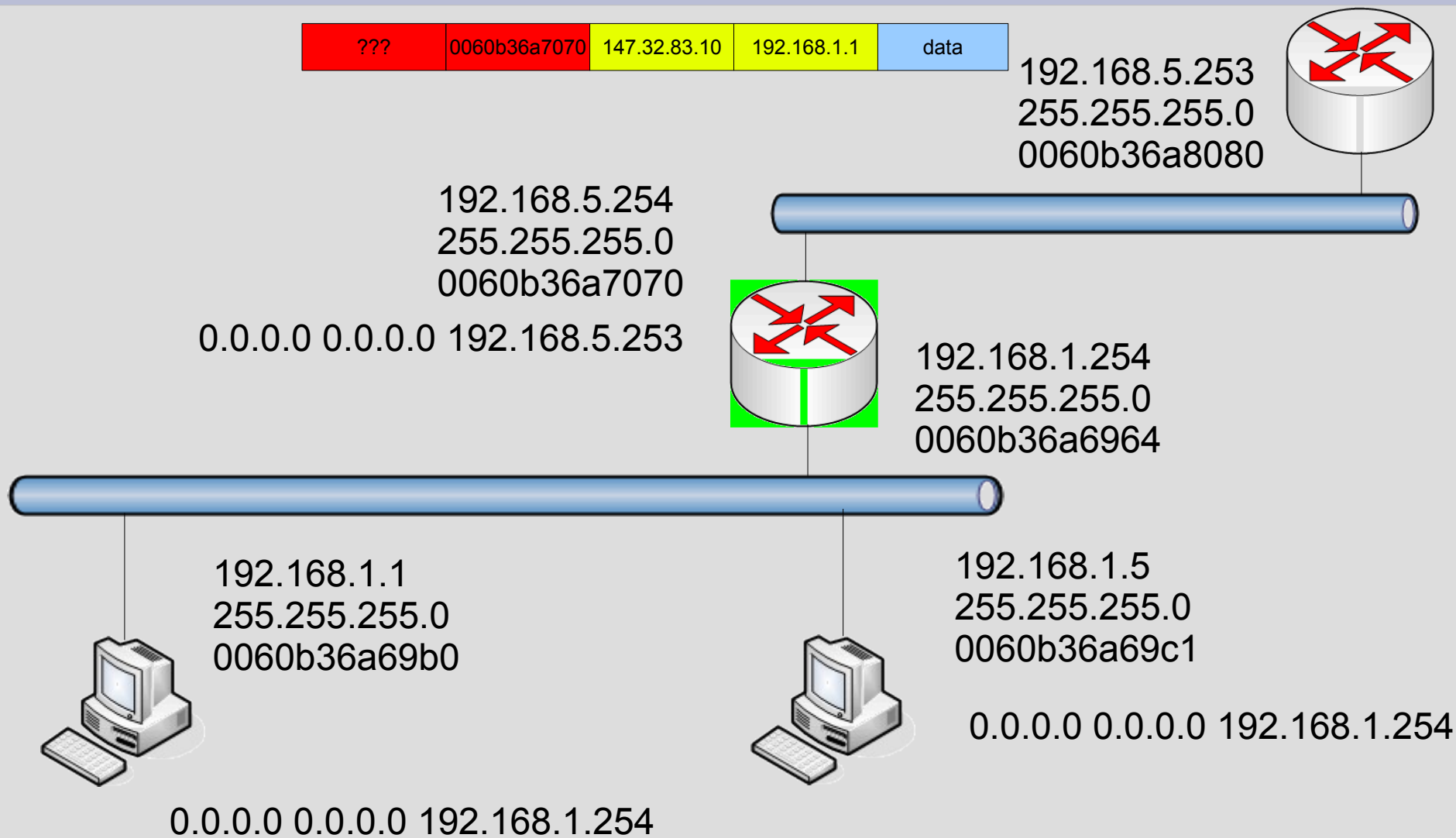


0.0.0.0 0.0.0.0 192.168.1.254

0.0.0.0 0.0.0.0 192.168.1.254

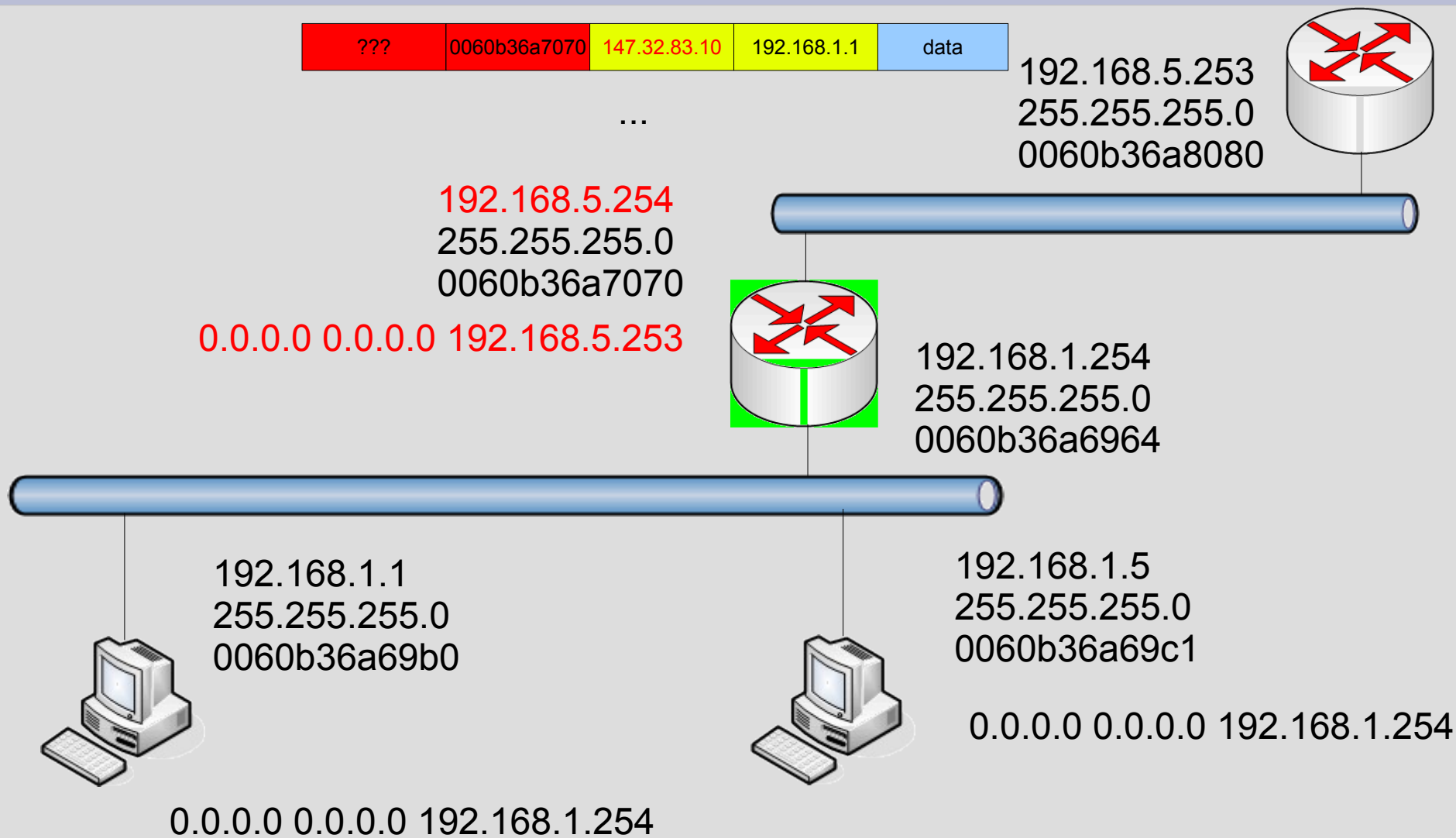
# Komunikace

192.168.1.1 -> 147.32.83.10



# Komunikace

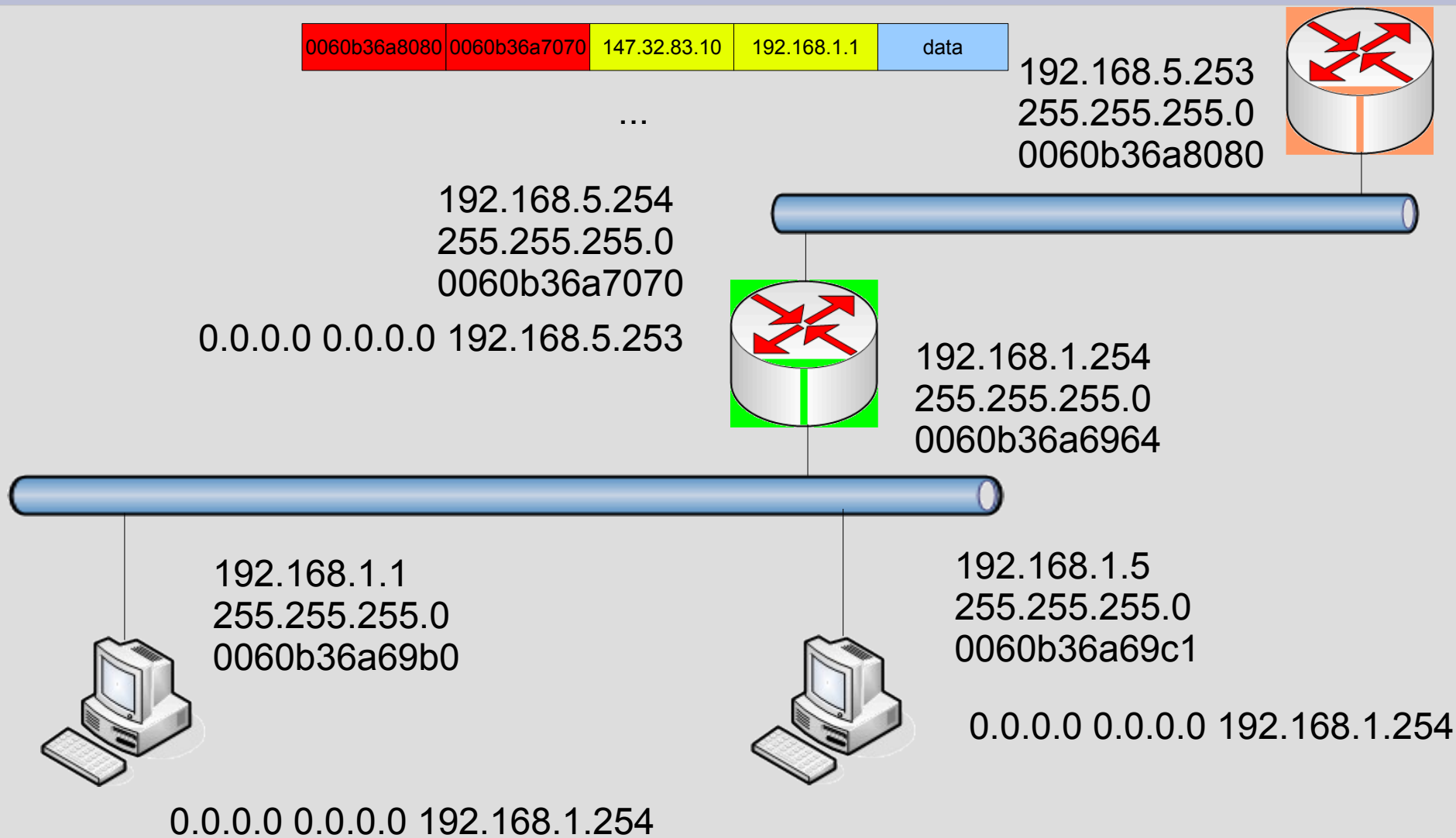
192.168.1.1 -> 147.32.83.10





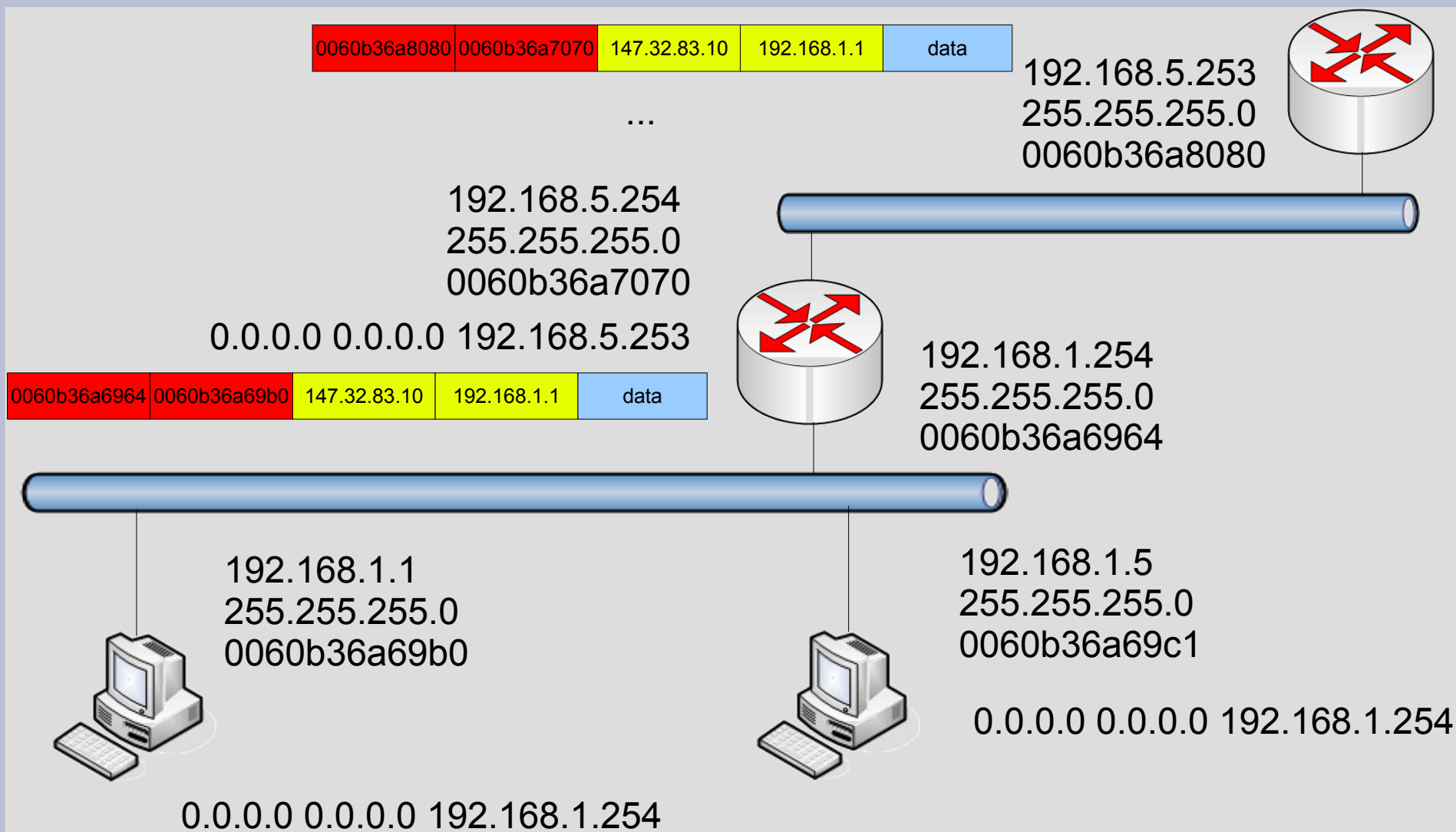
# Komunikace

192.168.1.1 -> 147.32.83.10



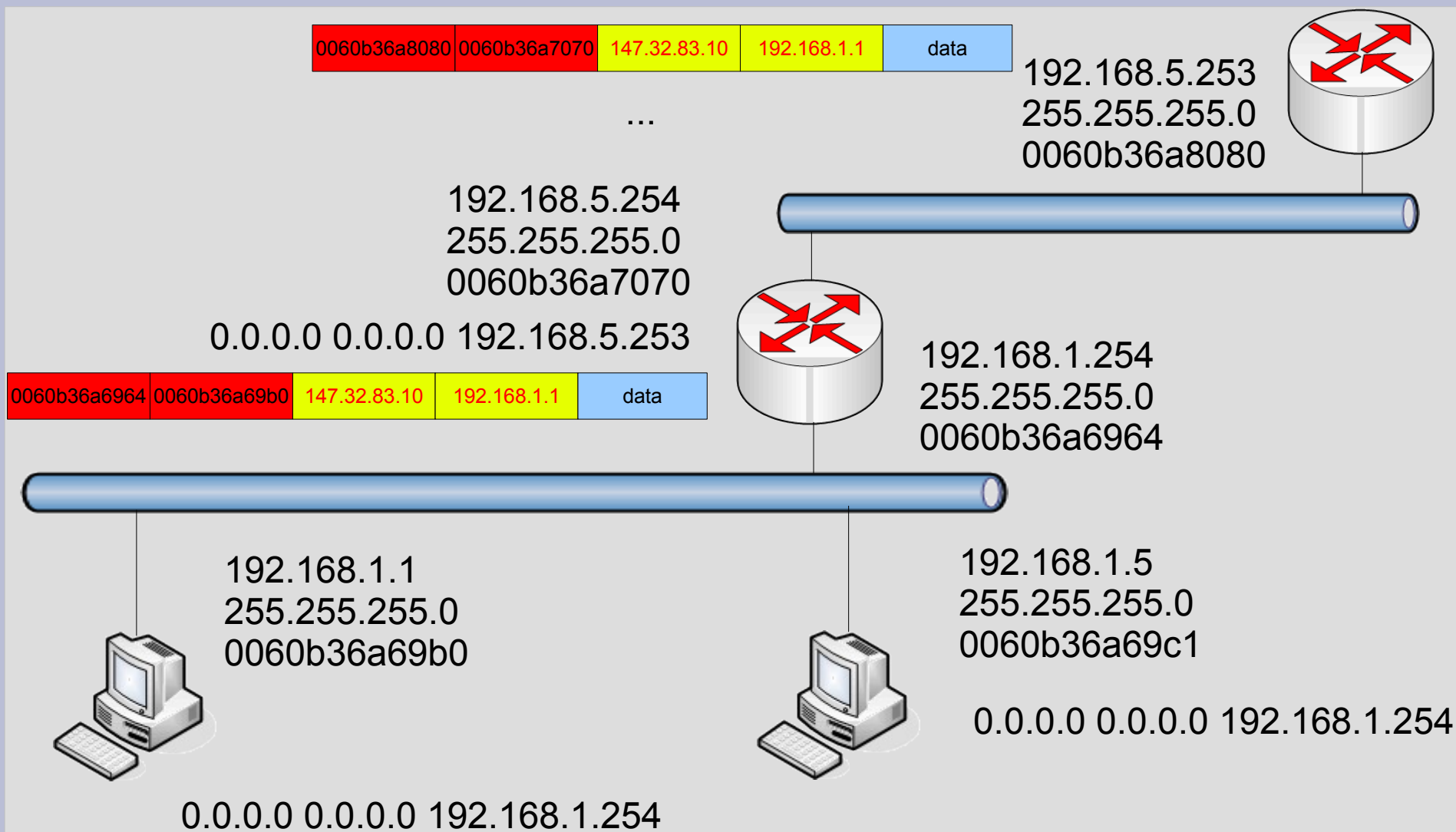
# Komunikace

192.168.1.1 -> 147.32.83.10



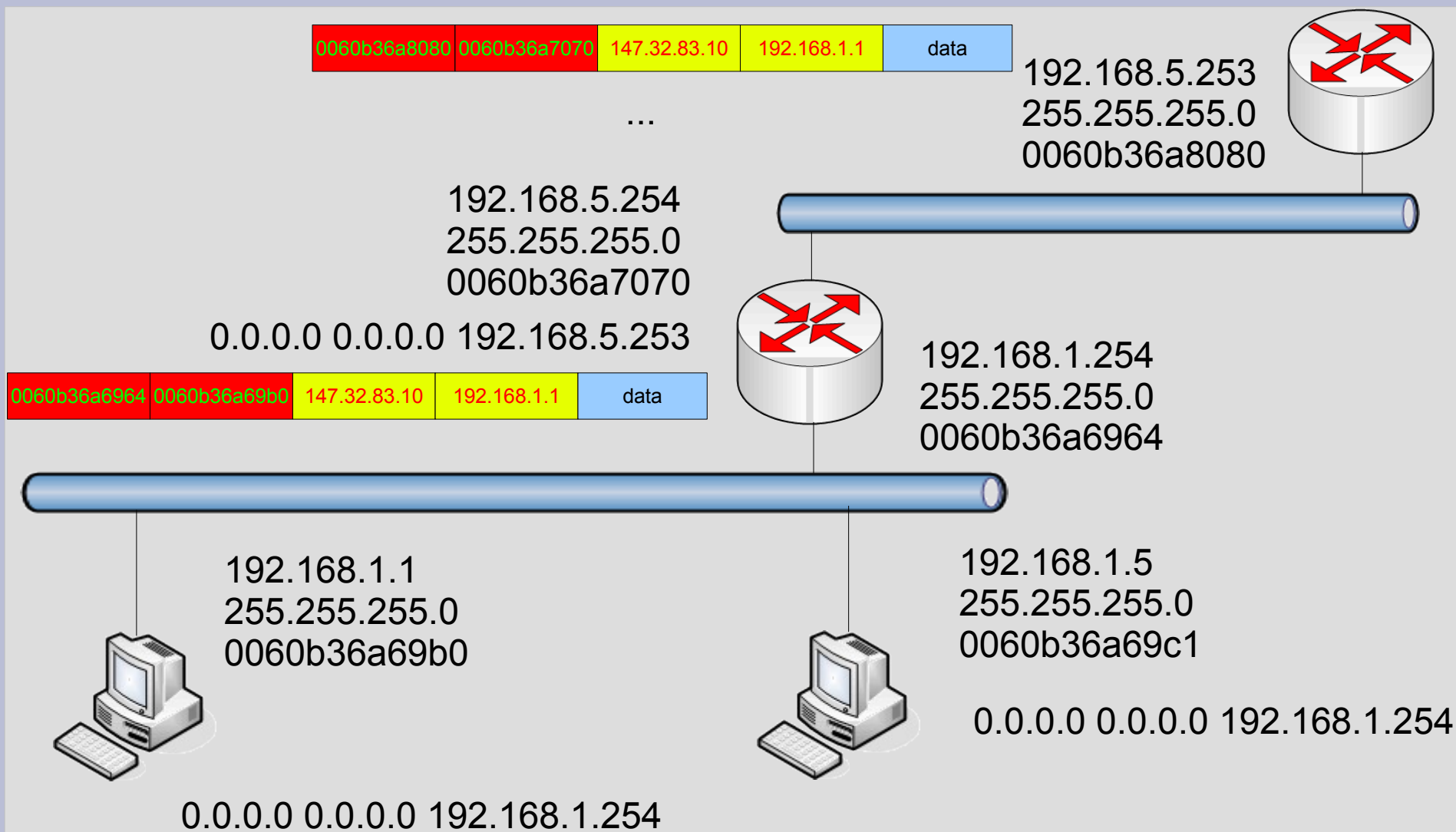
# Komunikace

192.168.1.1 -> 147.32.83.10



# Komunikace

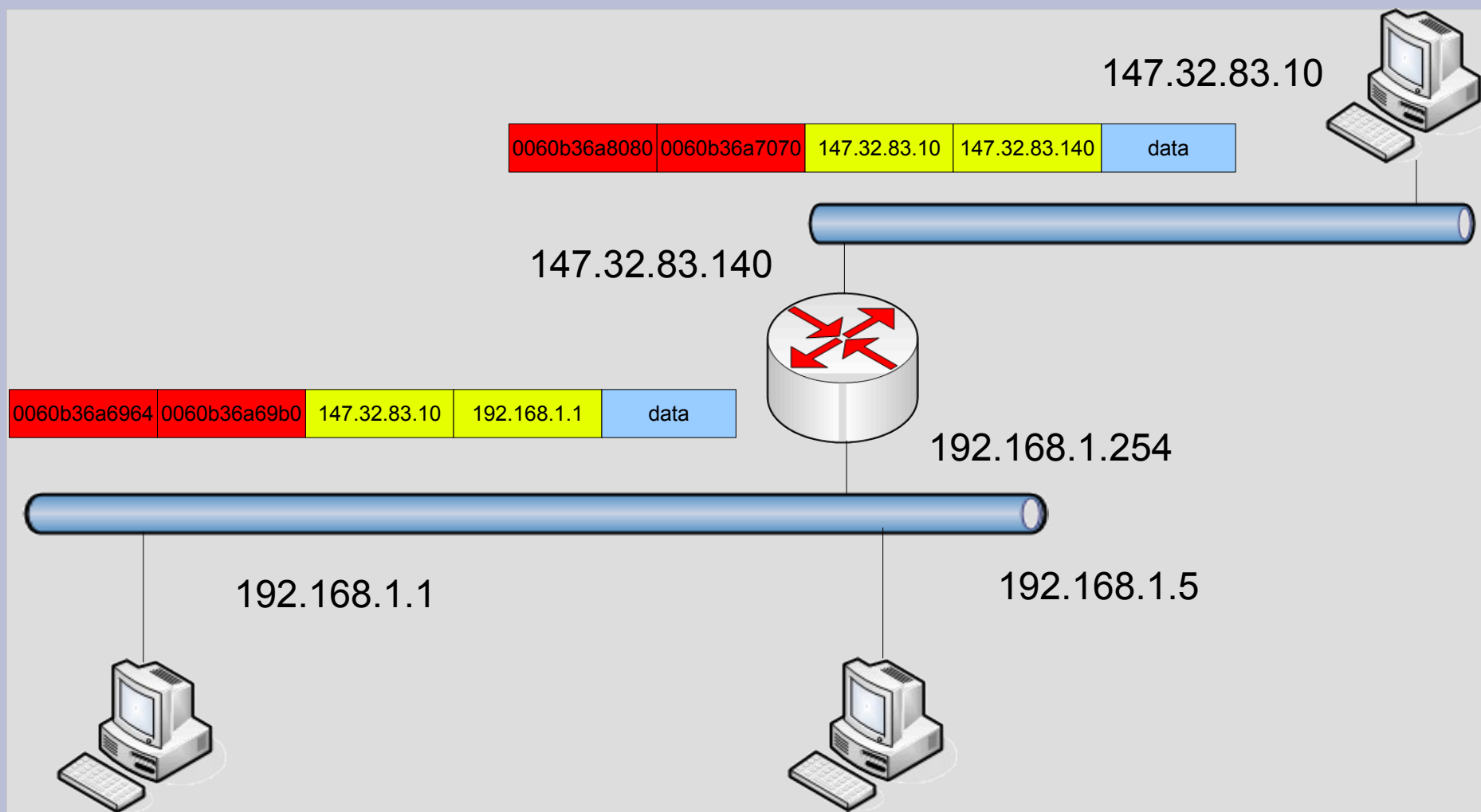
192.168.1.1 -> 147.32.83.10



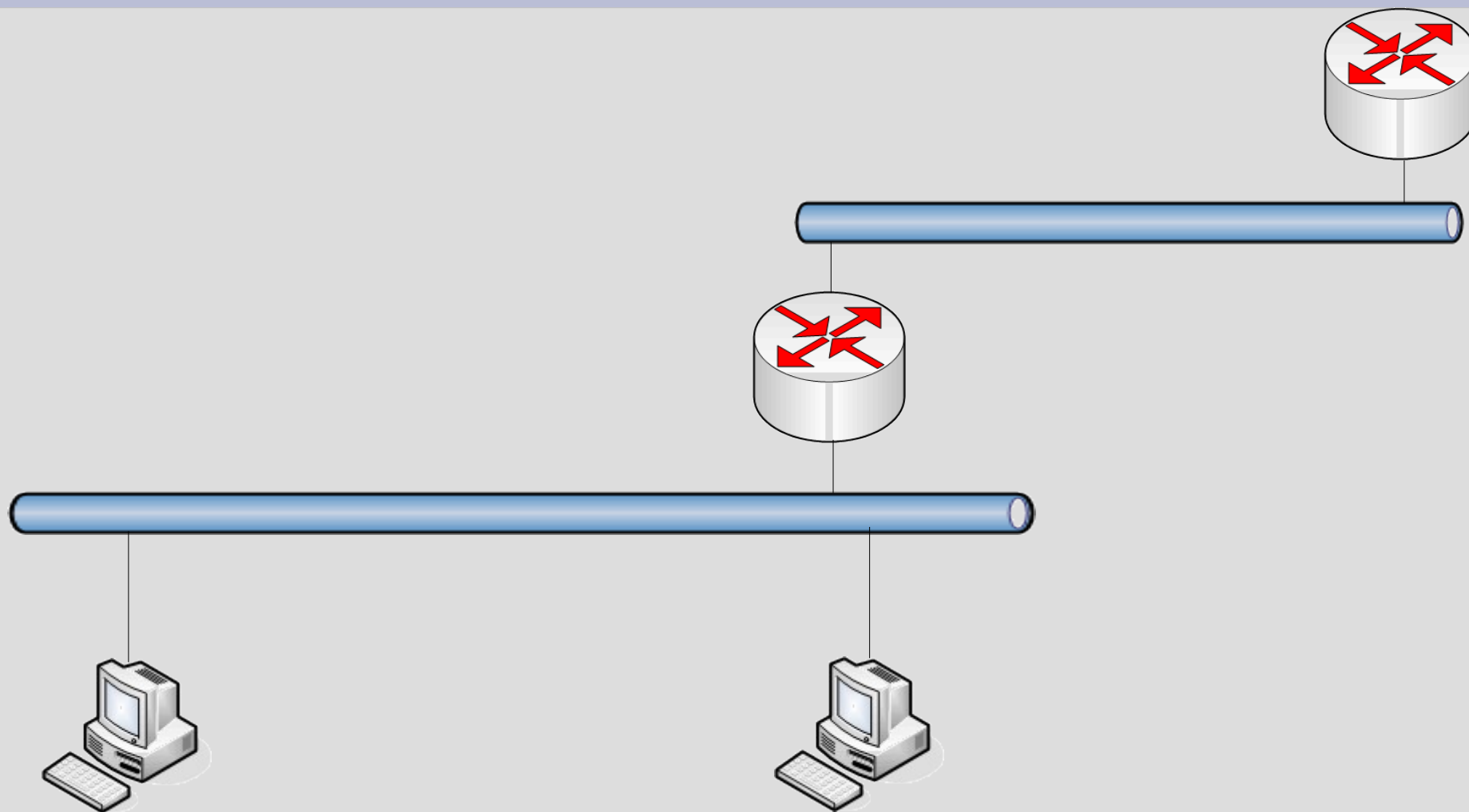
# Překlad adres - NAT

- vnitřní, vnější síť
- překlad zdrojové, cílové adresy
- překlad zdrojového, cílového portu
- statický, dynamický překlad
- masquerade

# NAT

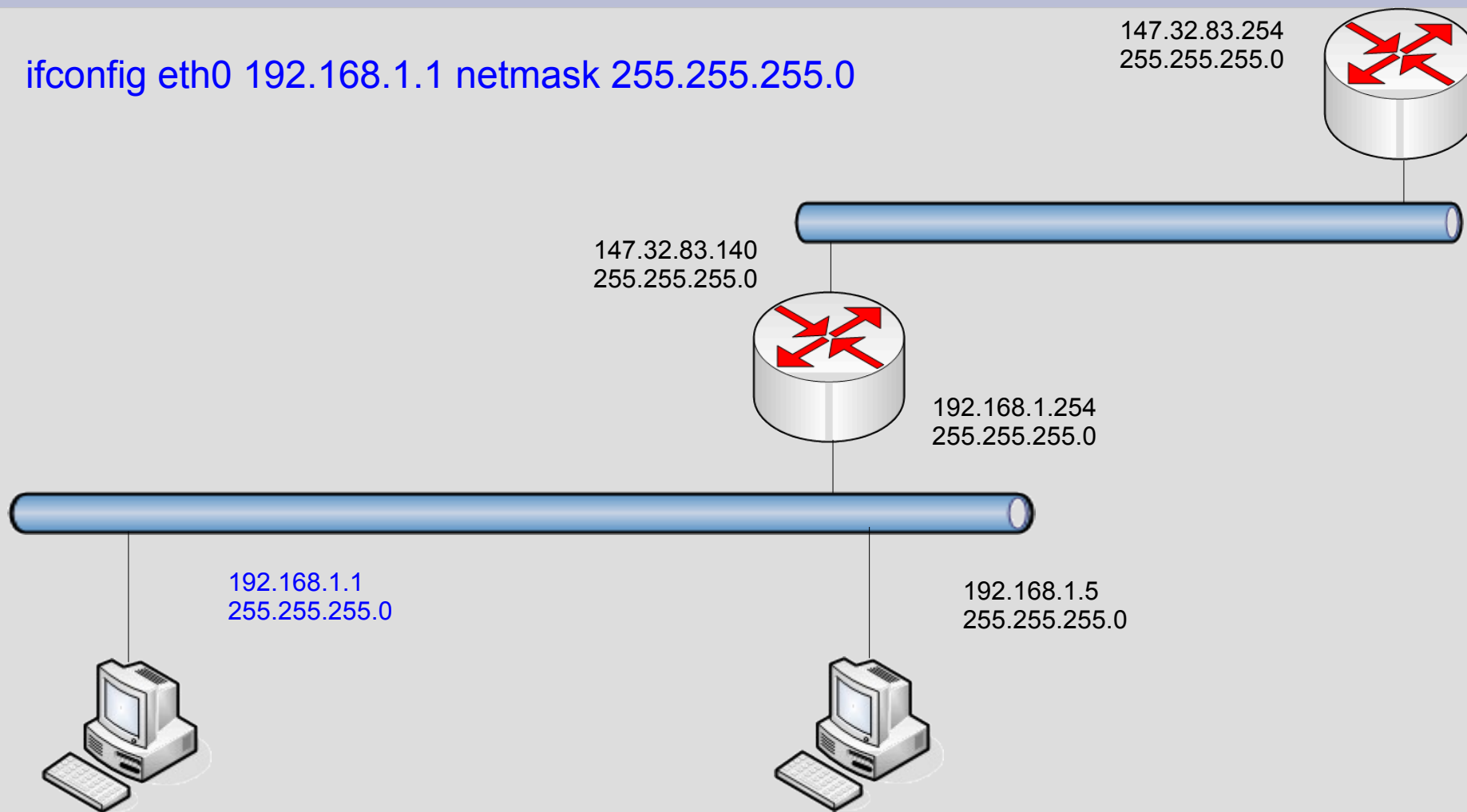


# Konfigurace



# Konfigurace - adresy

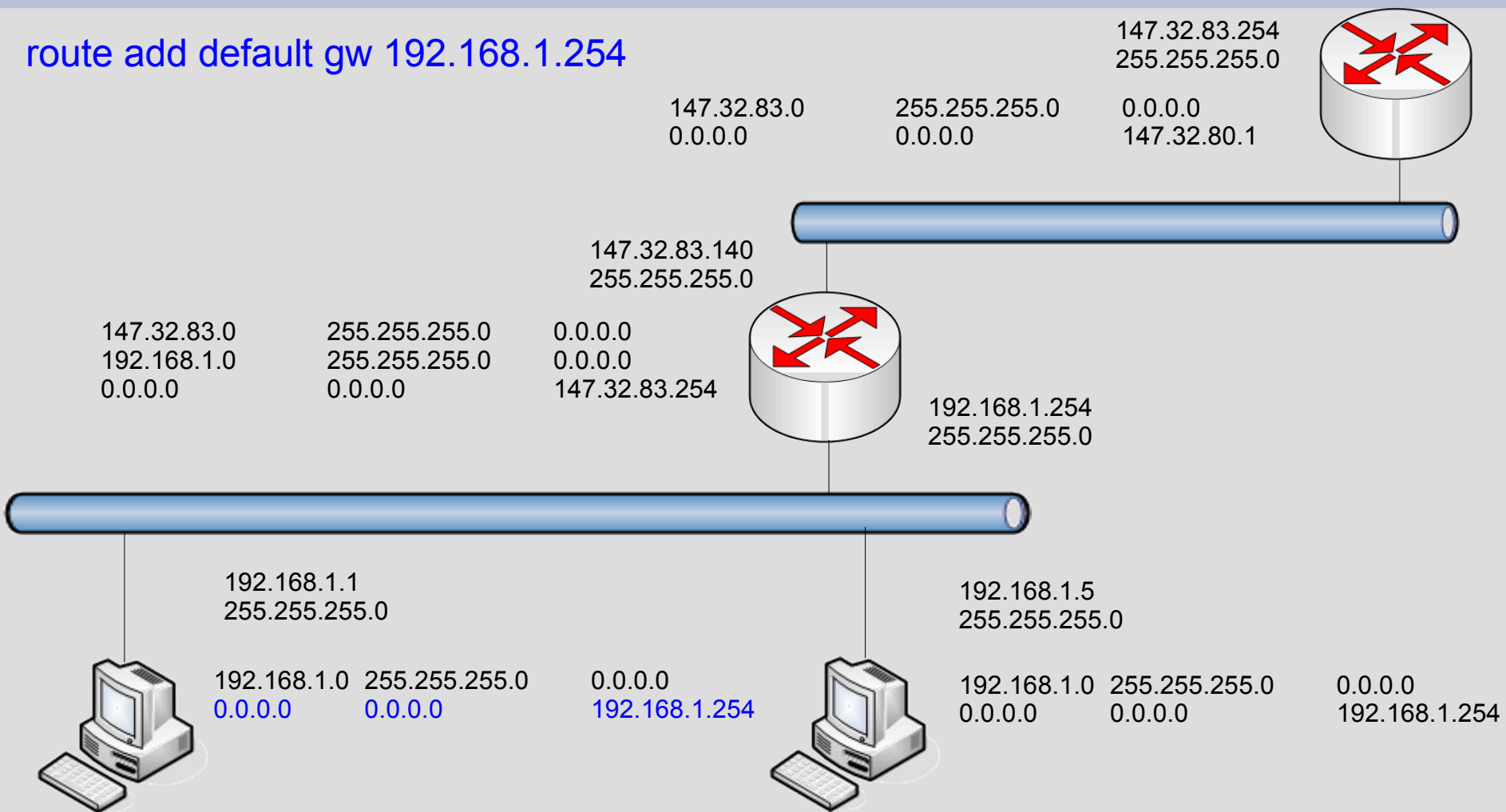
```
ifconfig eth0 192.168.1.1 netmask 255.255.255.0
```





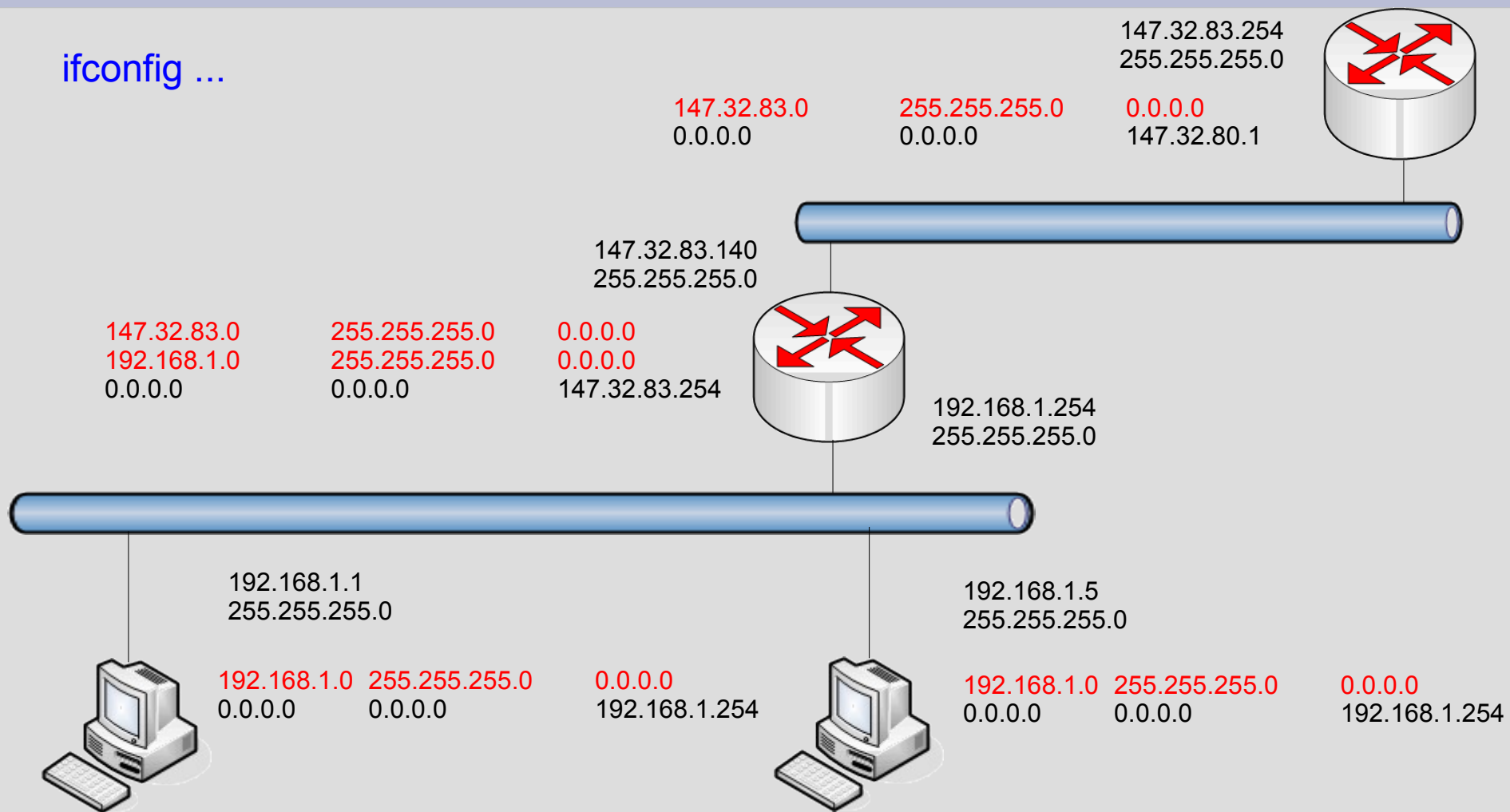
# Konfigurace - směrování

route add default gw 192.168.1.254



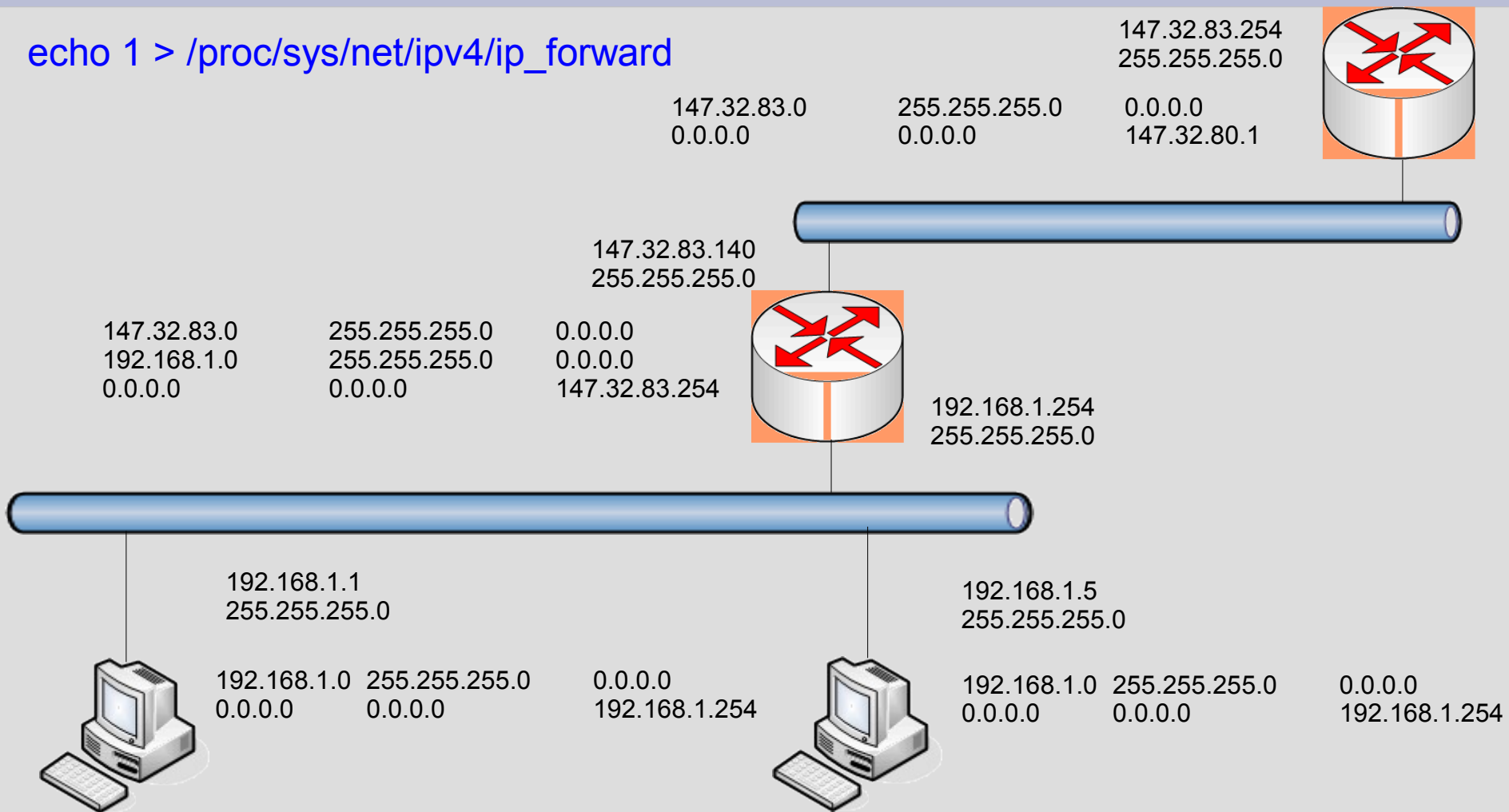
# Konfigurace - směrování

ifconfig ...



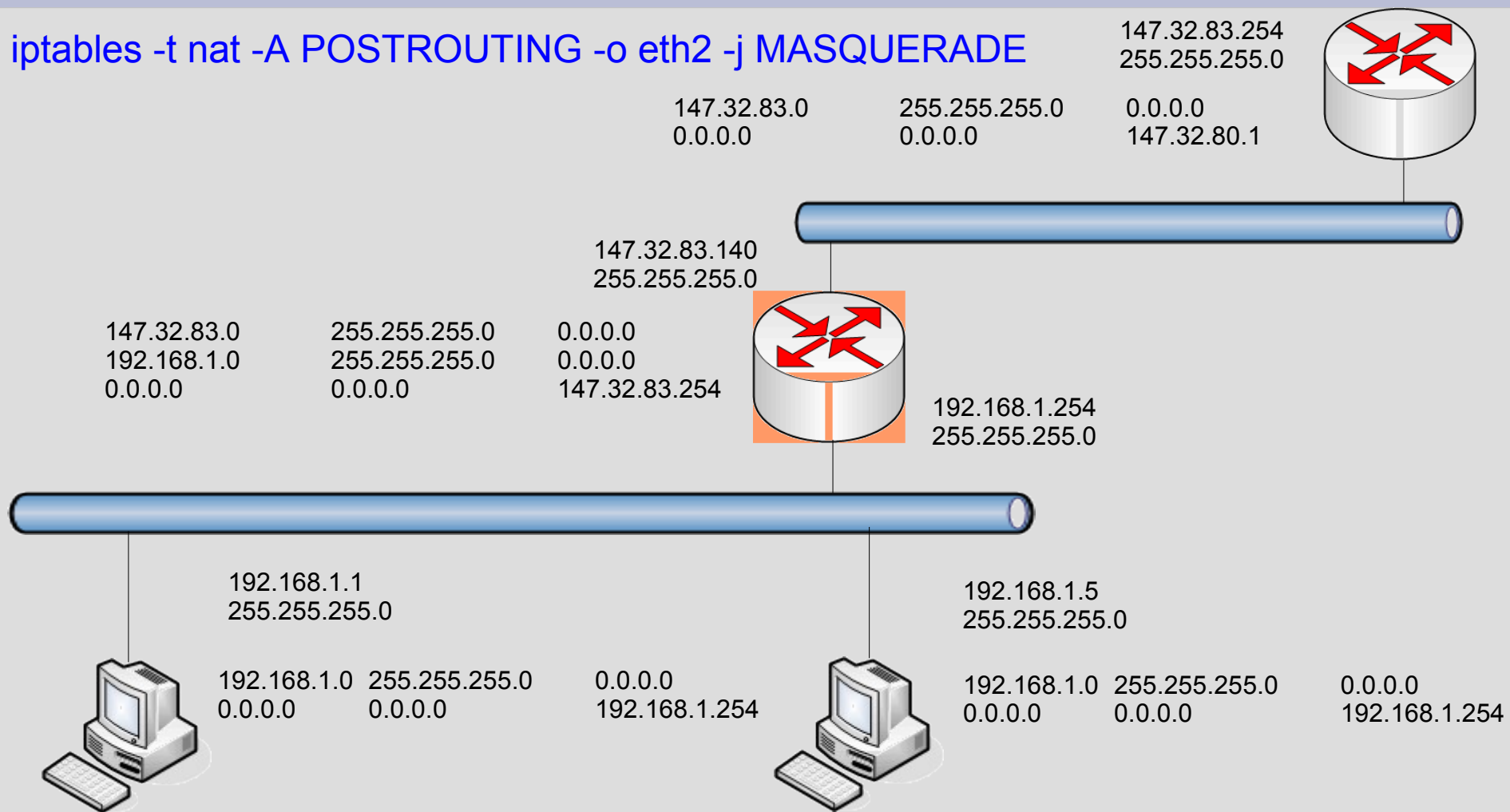
# Konfigurace - forwarding

```
echo 1 > /proc/sys/net/ipv4/ip_forward
```



# Konfigurace - NAT

```
iptables -t nat -A POSTROUTING -o eth2 -j MASQUERADE
```



# Pomocné protokoly

- ICMP (Internet Control Message Protocol) rfc792
- IGMP (Internet Group Management Protocol) rfc3376
- ARP (Address Resolution Protocol) rfc826
- RARP (Reverse Address Resolution Protocol) rfc903
- BOOTP (Bootstrap Protocol) rfc951
- DHCP (Dynamic Host Configuration Protocol) rfc2131
- RIP (Routing Information Protocol) rfc1721
- OSPF (Open Shortest Path First Routing Protocol) rfc2328
- EGP (Exterior Gateway Protocol) rfc827
- BGP (Border Gateway Protocol) rfc1771
- ...
- ...
- <http://www.networksorcery.com/enp/topic/ipsuite.htm>