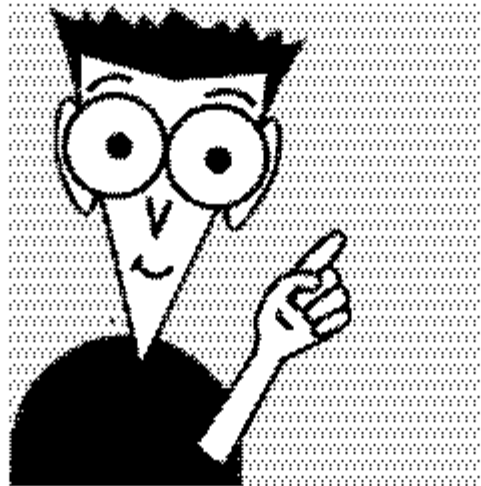


IP skozi ethernet omrežje



Marko RIZVIČ, S54PM

14.4.2012

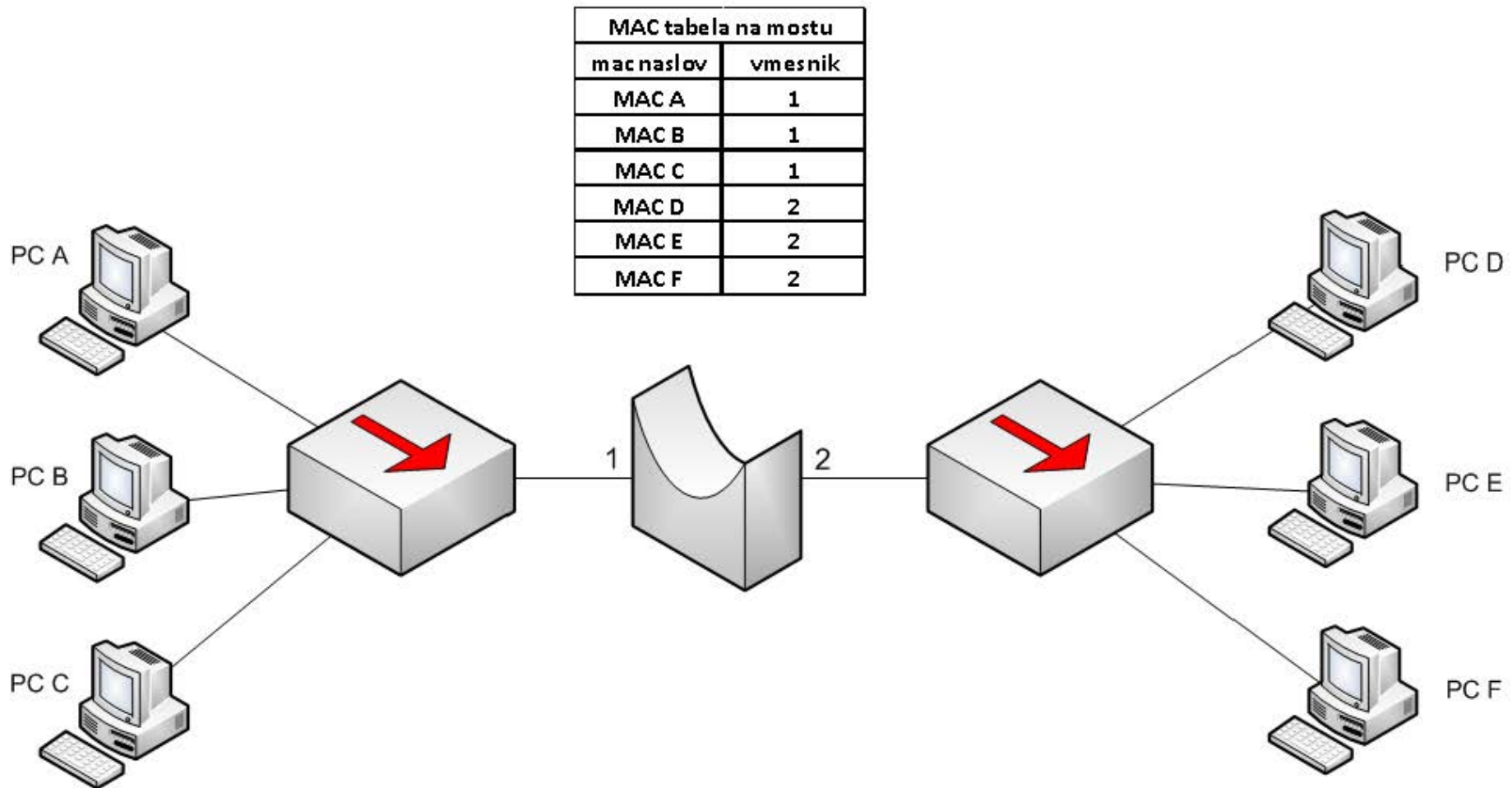
Delovanje ethernet stikala

Predhodniki ethernet stikal

Delovanje ethernet stikala

Predhodniki ethernet stikal

Delovanje ethernet stikala

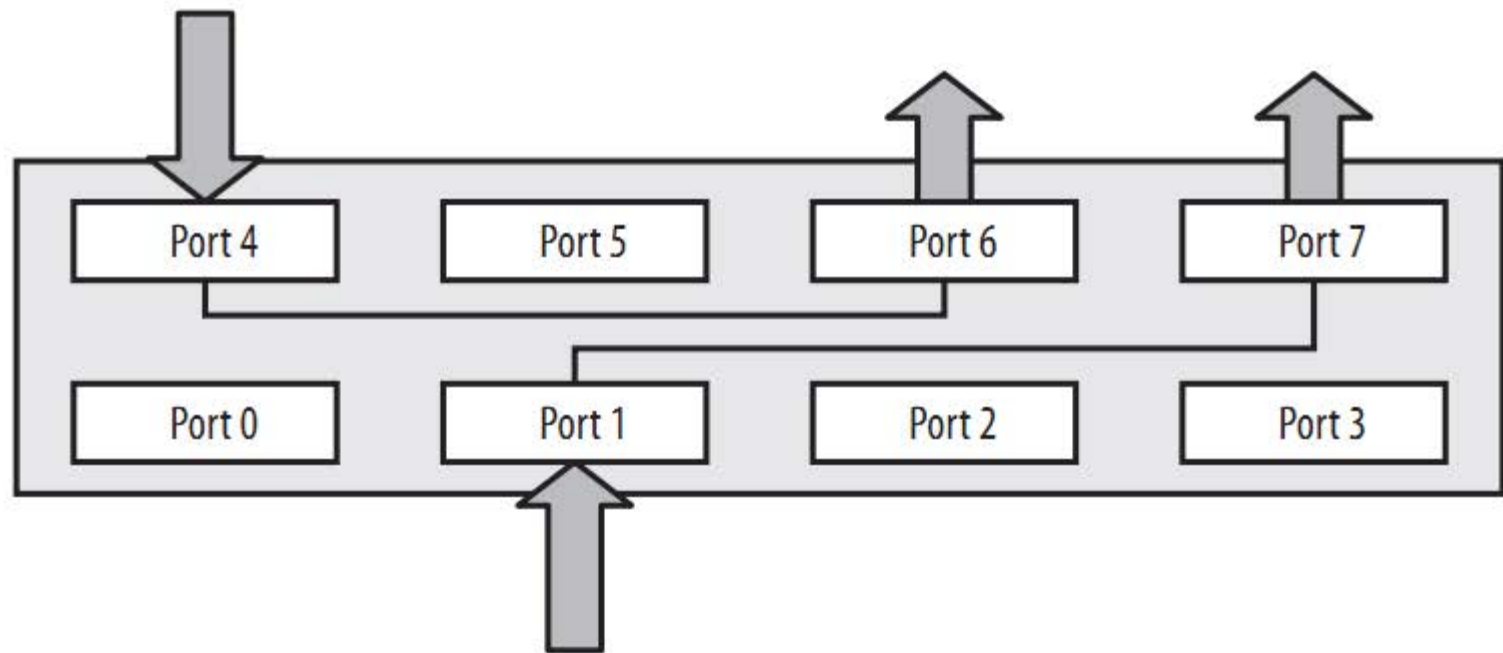


Delovanje ethernet stikala

Switch – bridge z več vmesniki:

- Posamezen vmesnik je svoja collision domena
- Pomni MAC naslove na vmesnikih
- VLAN funkcionalnost omogoča delitev broadcast domen

Delovanje ethernet stikala



Delovanje ethernet stikala

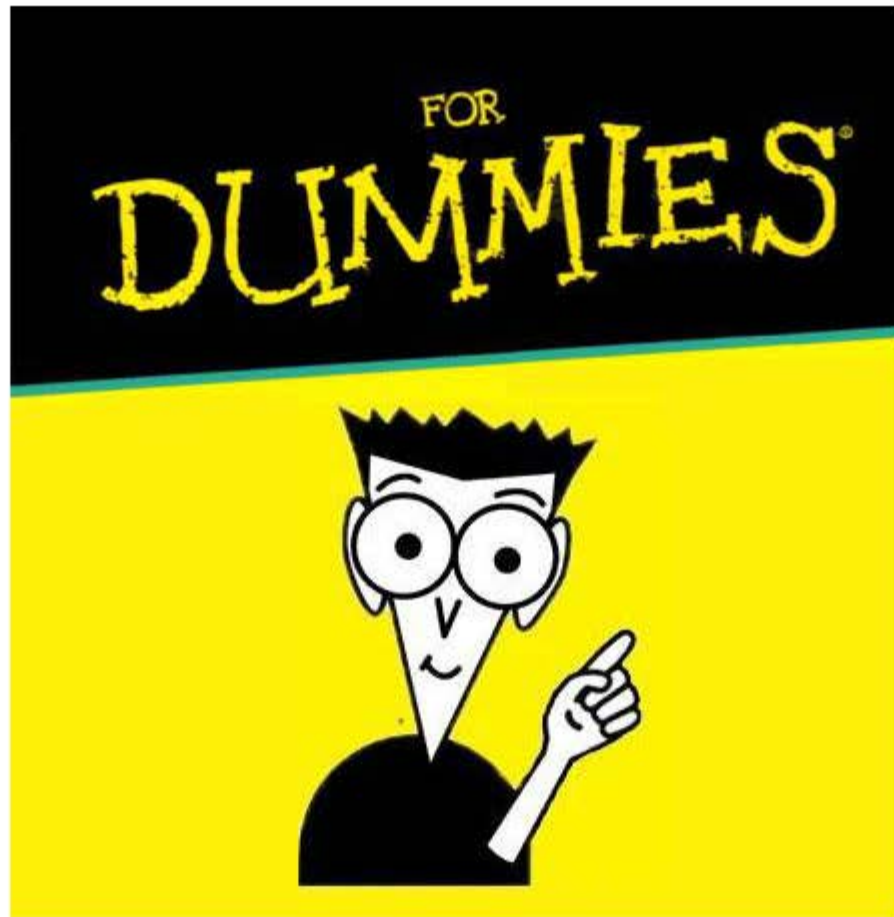
Sprejem in oddaja okvirjev v stikalu:

- Cut-through – takoj ko v okvirju zazna ciljni MAC naslov prične s pošiljanjem proti cilju
- Fragment free – podobno kot cut-through, prebere prvih 64 bytov okvirja
- Store and forward - sprejme okvir v celoti, preveri CRC, pošlje proti cilju

Delovanje ethernet stikala

- Repeater – ojačevalec vhodnega signala
- Hub – repeater z več vmesniki
- Bridge – ločuje collision domene
- Switch – bridge z več vmesniki

Delovanje ethernet stikala



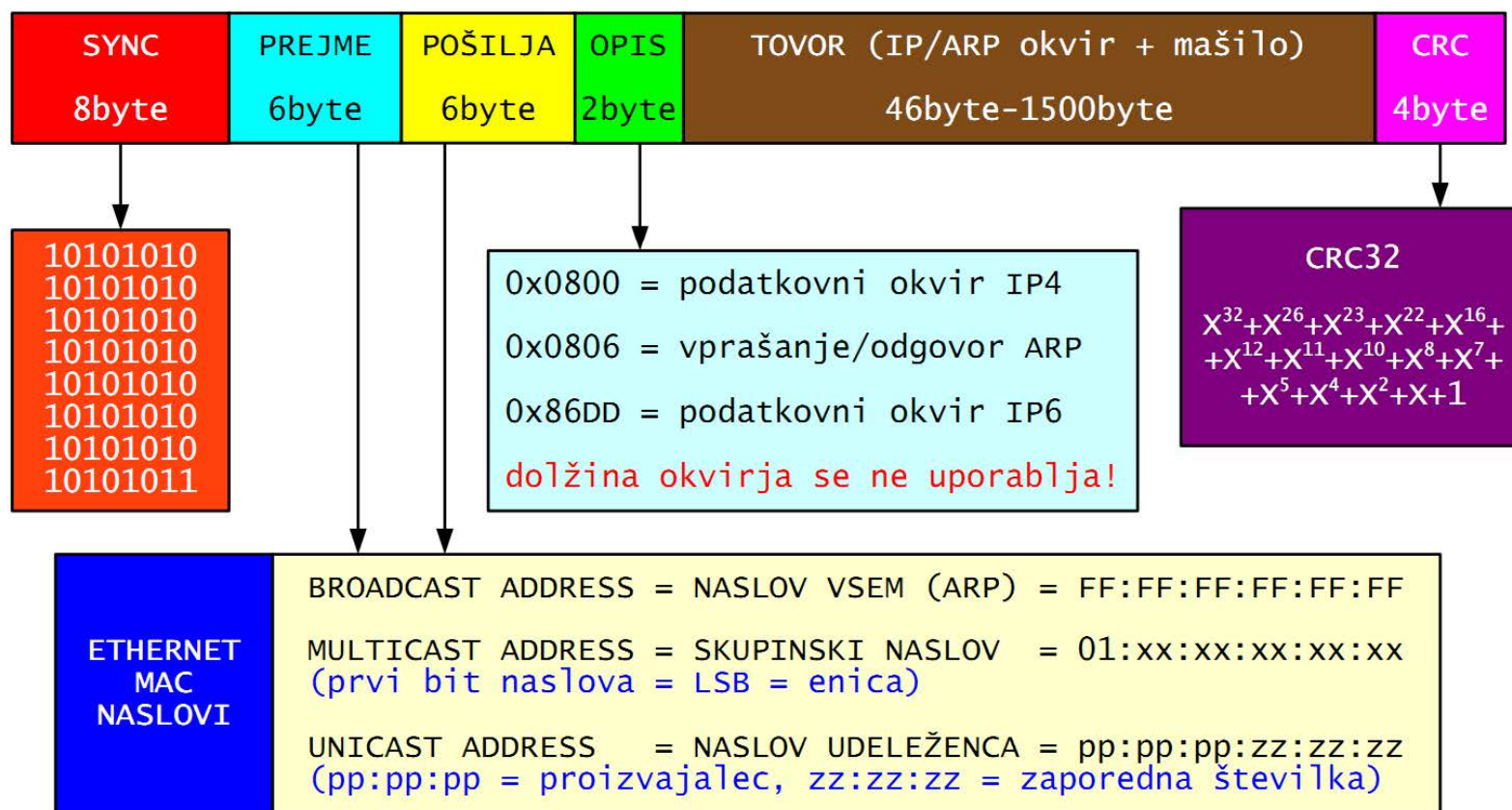
Po domače rečeno...

Address resolution protocol

Ethernet naslavljanje

Address resolution protocol

Posebni MAC naslovi:



Address resolution protocol

Layer 2: ethernet, ARP

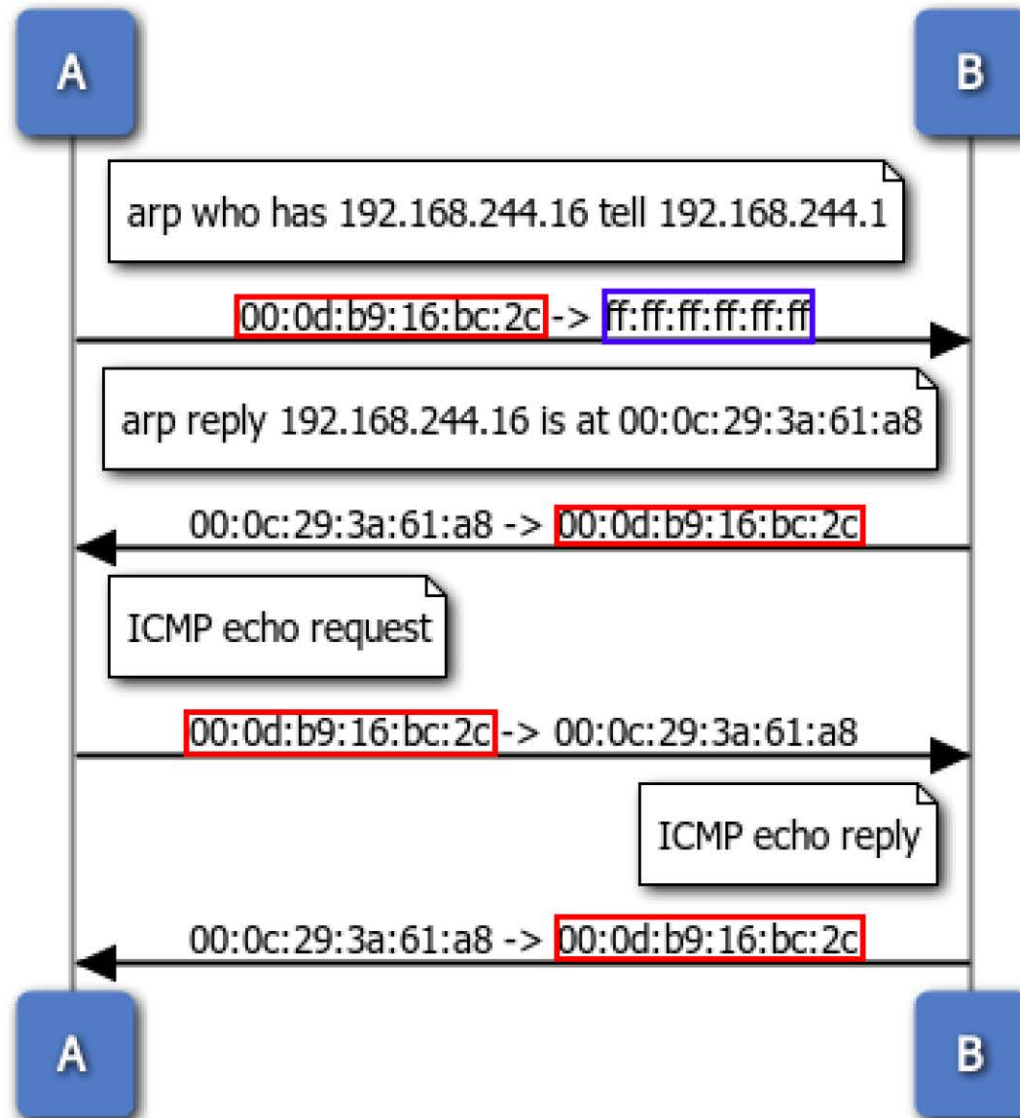
Layer 3: IPv4, ICMP, IGMP

32-bit Internet address



48-bit Ethernet address

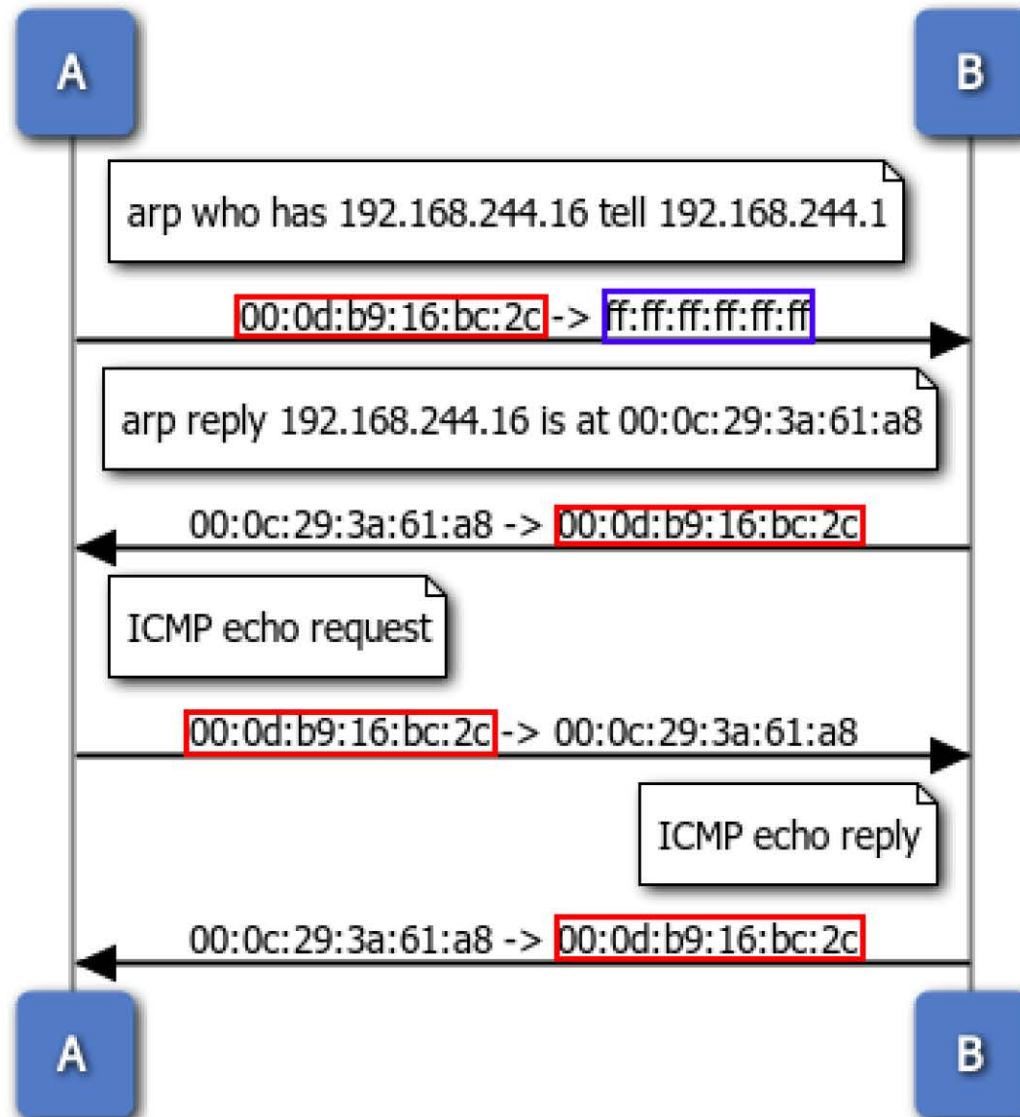
Address resolution protocol



Address resolution protocol

```
monolith$ arp 192.168.244.16  
192.168.244.16 (192.168.244.16) -- no entry
```

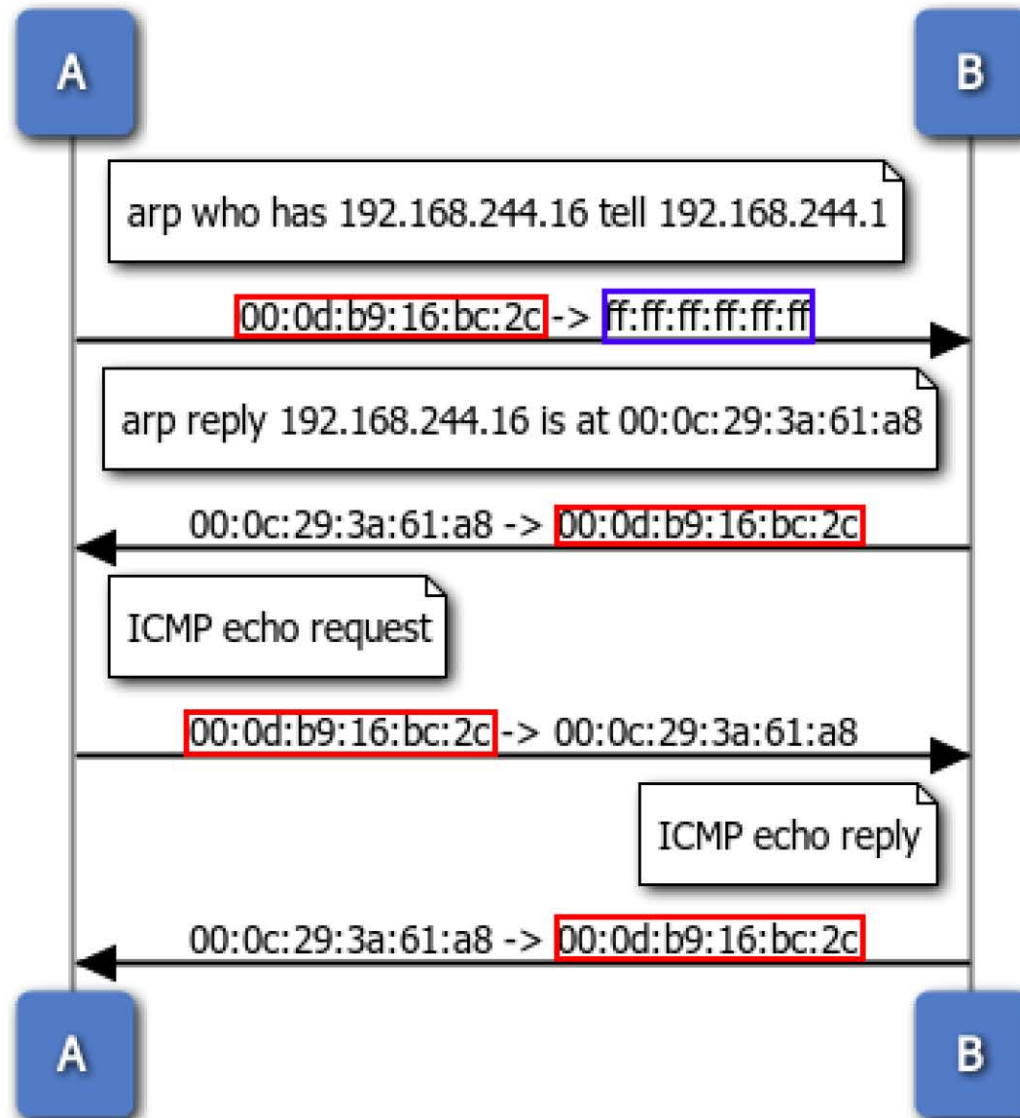
Address resolution protocol



Address resolution protocol

```
monolith$ sudo arp -d 192.168.244.16  
192.168.244.16 (192.168.244.16) deleted
```


Address resolution protocol



Address resolution protocol

```
monolith$ sudo arp -d 192.168.244.16  
192.168.244.16 (192.168.244.16) deleted
```

```
monolith$ ping 192.168.244.16  
PING 192.168.244.16 (192.168.244.16): 56 data bytes  
64 bytes from 192.168.244.16: icmp_seq=0 ttl=64 time=2.081 ms  
64 bytes from 192.168.244.16: icmp_seq=1 ttl=64 time=0.951 ms  
64 bytes from 192.168.244.16: icmp_seq=2 ttl=64 time=0.898 ms  
64 bytes from 192.168.244.16: icmp_seq=3 ttl=64 time=0.951 ms  
64 bytes from 192.168.244.16: icmp_seq=4 ttl=64 time=0.892 ms  
64 bytes from 192.168.244.16: icmp_seq=5 ttl=64 time=0.951 ms  
64 bytes from 192.168.244.16: icmp_seq=6 ttl=64 time=0.894 ms  
64 bytes from 192.168.244.16: icmp_seq=7 ttl=64 time=0.892 ms  
^C  
--- 192.168.244.16 ping statistics ---  
8 packets transmitted, 8 packets received, 0.0% packet loss  
round-trip min/avg/max/stddev = 0.892/1.064/2.081/0.385 ms
```

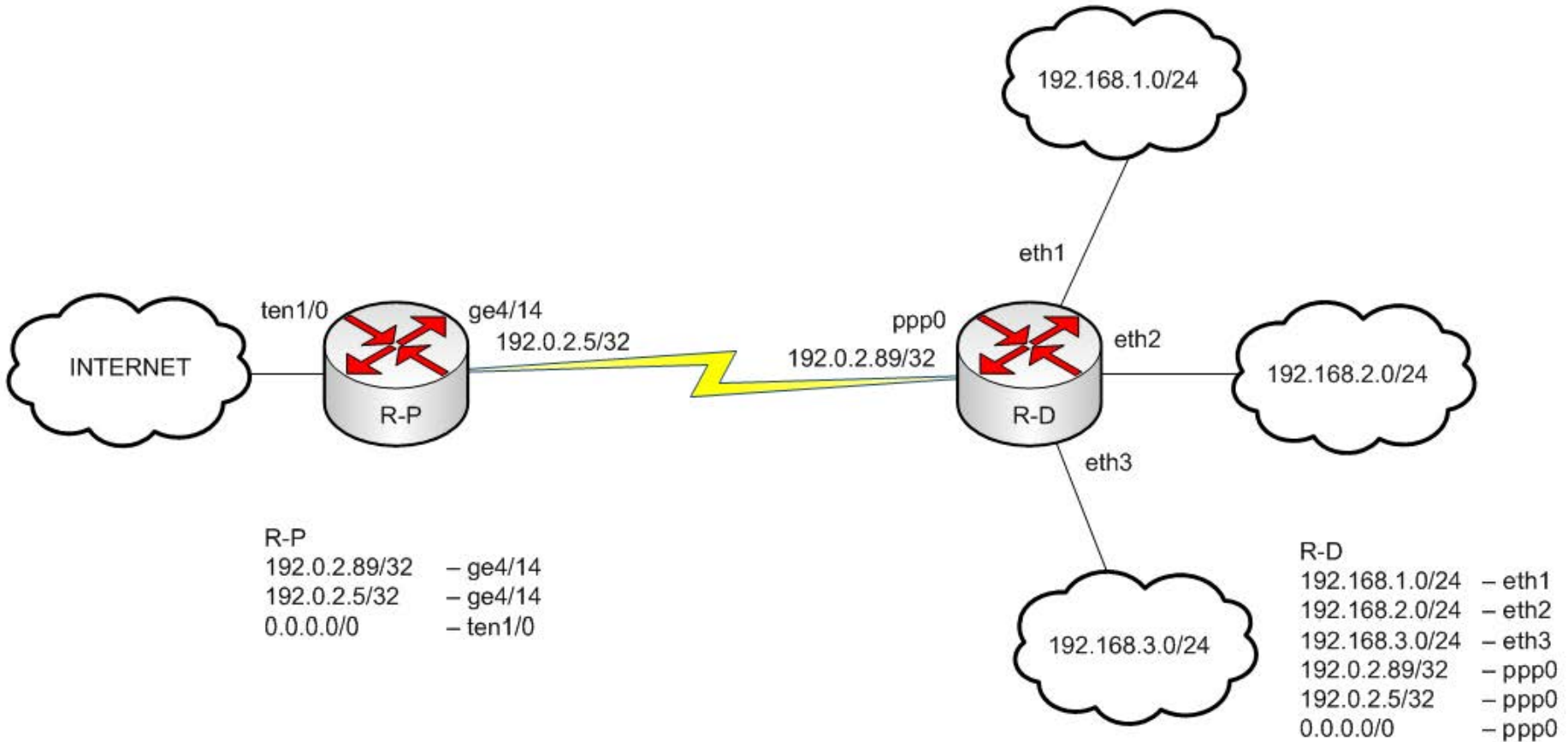
Načrtovanje IPv4 naslovov z maskami

(<http://jodies.de/ipcalc>)

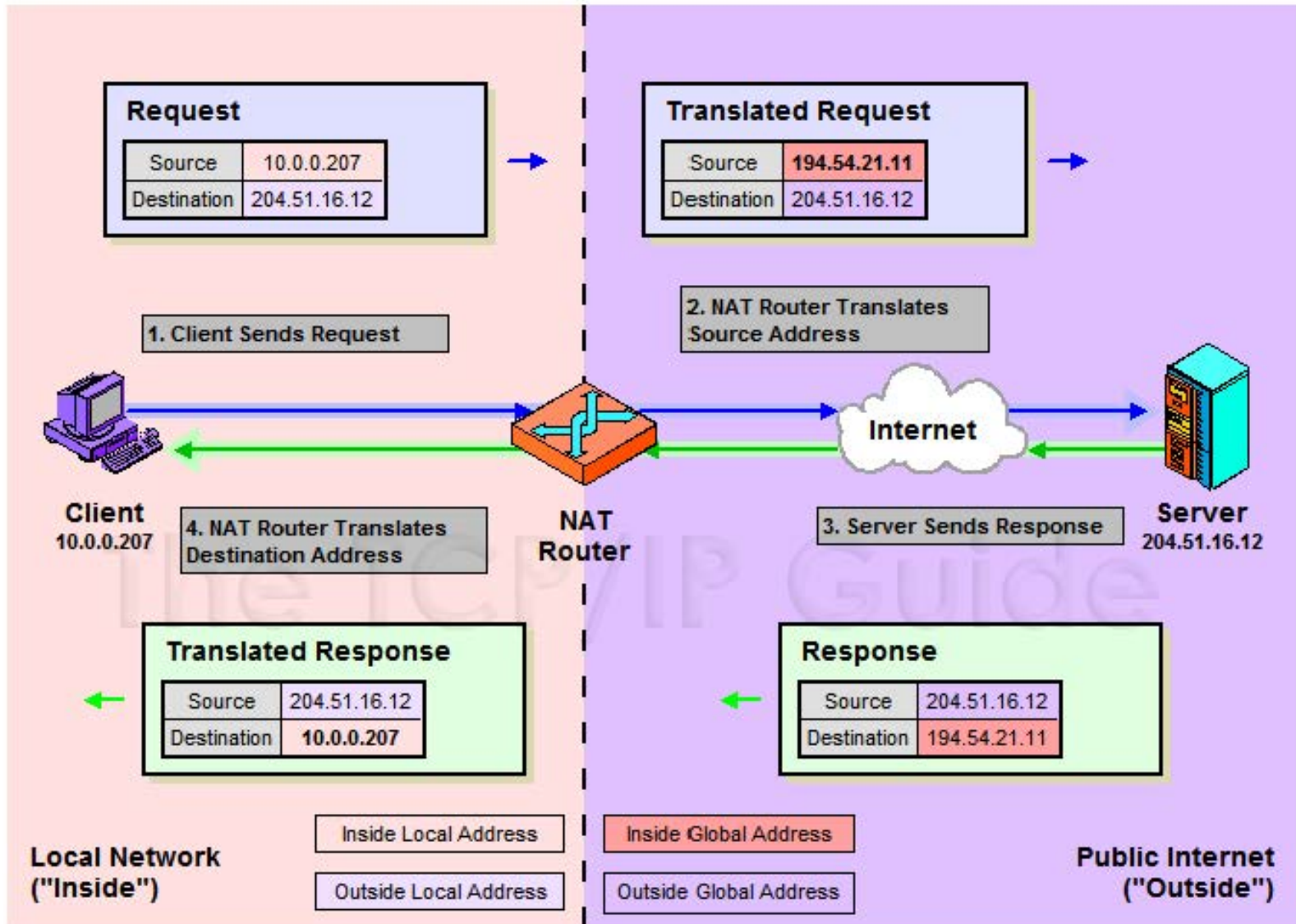
```
Address:    44.150.0.0           00101100.10010110 .00000000.00000000
Netmask:    255.255.0.0 = 16     11111111.11111111 .00000000.00000000
Wildcard:   0.0.255.255         00000000.00000000 .11111111.11111111
=>
Network:    44.150.0.0/16       00101100.10010110 .00000000.00000000
Broadcast:  44.150.255.255     00101100.10010110 .11111111.11111111
HostMin:    44.150.0.1          00101100.10010110 .00000000.00000001
HostMax:    44.150.255.254     00101100.10010110 .11111111.11111110
Hosts/Net:  65534
```

Privzeti prehod in maska

(usmerjevalna tabela)

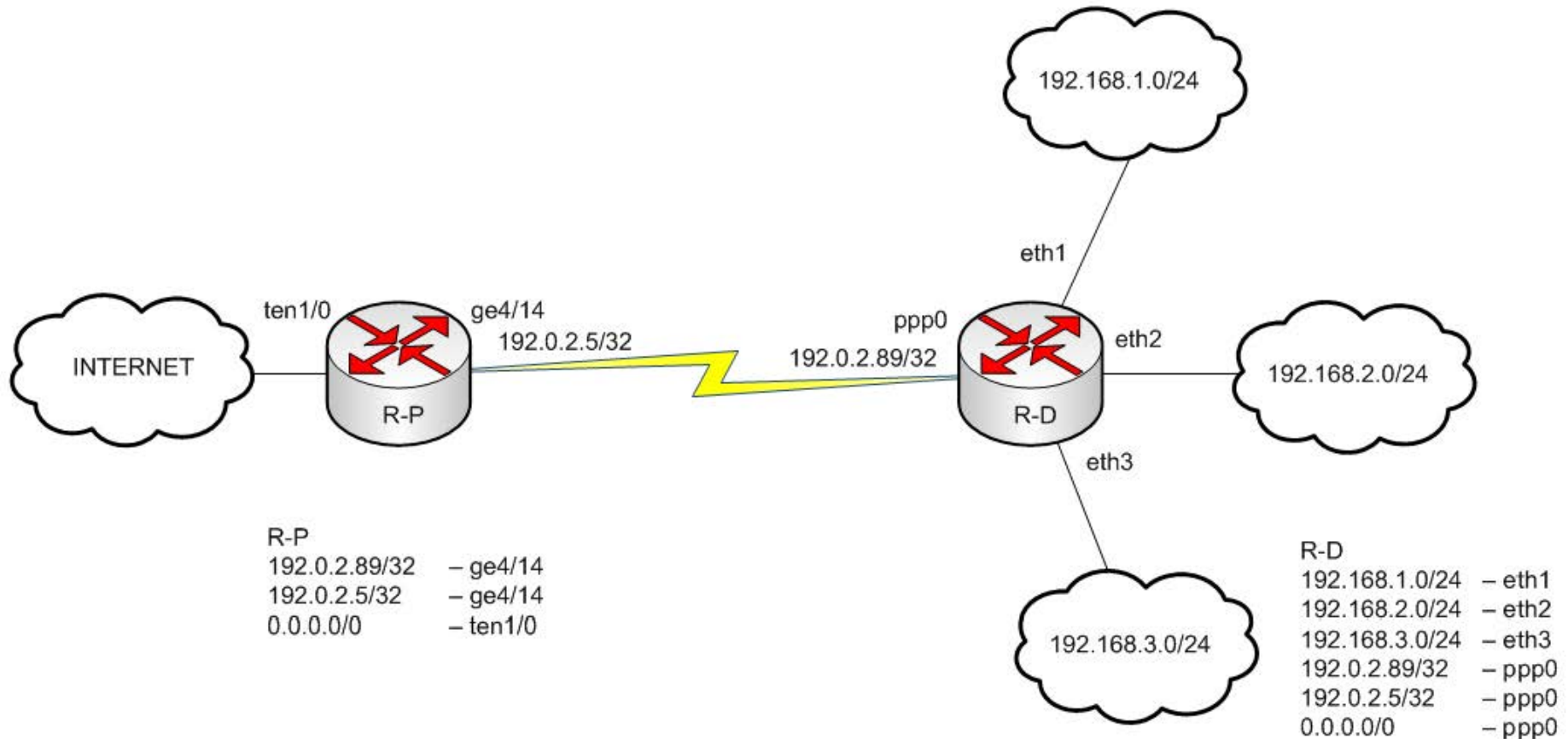


NAT

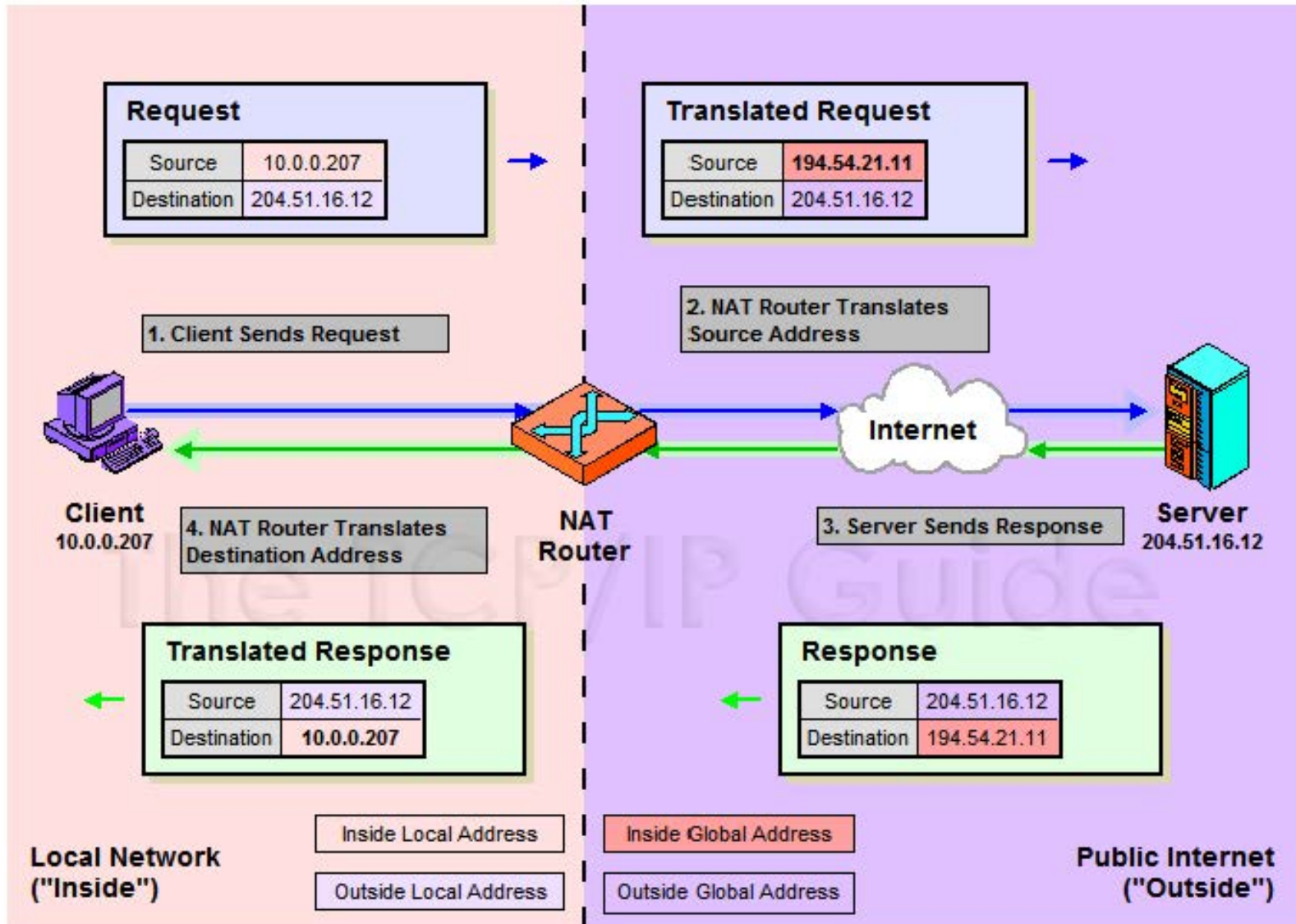


Privzeti prehod in maska

(usmerjevalna tabela)



NAT



NAT

Značilnosti IPv4

Slabosti:

- Pomanjkanje naslovov
- Ni hierarhičnega naslavljanja
- Velike usmerjevalne tabele
- **NAT onemogoča neposredno povezavo dveh končnih naprav**
- Lažen občutek varnosti NAT mehanizma

NAT

Značilnosti IPv4



Načrtovanje IPv4 naslovov z maskami

(<http://jodies.de/ipcalc>)

```
Address: 44.150.0.0          00101100.10010110 .00000000.00000000
Netmask: 255.255.0.0 = 16    11111111.11111111 .00000000.00000000
Wildcard: 0.0.255.255       00000000.00000000 .11111111.11111111
=>
Network: 44.150.0.0/16      00101100.10010110 .00000000.00000000
Broadcast: 44.150.255.255  00101100.10010110 .11111111.11111111
HostMin: 44.150.0.1        00101100.10010110 .00000000.00000001
HostMax: 44.150.255.254    00101100.10010110 .11111111.11111110
Hosts/Net: 65534
```