MikroTik, what it is and what it is for

- Mikrotik (Latvian: Mikrotīkls) is a Latvian company engaged in the production and sale of network equipment and software "RouterOS".

- These products are used by Internet Service Providers and other individuals and legal entities to organize, manage and monitor their computer network and complete network infrastructure.

- Their goal is to make existing Internet technologies accessible to everyone, much faster for the widest possible range of users

Where are they?

- MikroTik company is located in Eastern Europe.
- City of Riga, State of Latvia

RouterBoard

- It is hardware produced by the company MikroTik. Together with the software called **RouterOS** and the licenses that give certain privileges and opportunities to the given device, it makes a complete product of the mentioned company.

- There is a considerable range of RBs in use today, ranging from SOHO routers to routers used in various corporations.

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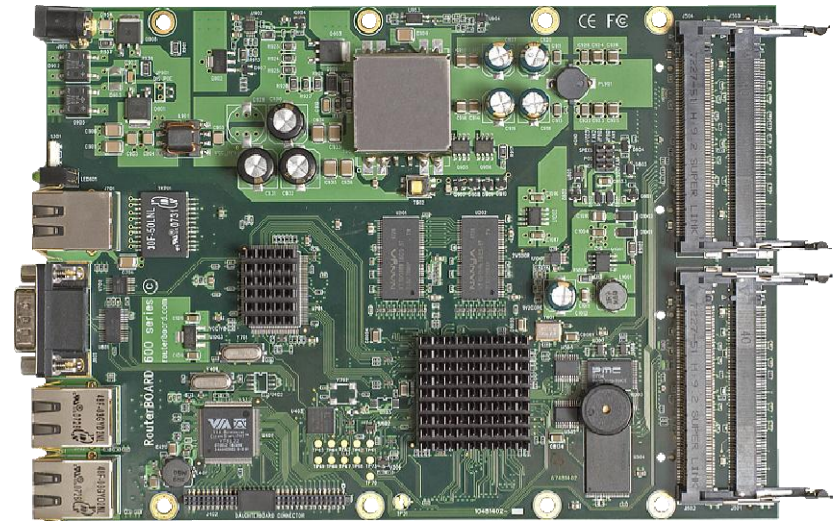
RouterOS

- "MikroTik RouterOS "is the operating system of" MikroTik RouterBoard "hardware.

- "RouterOS" can also be installed on a personal computer and thus turn it into a router with all the advanced features and functions.

- "RouterOS" is based on the Linux v3.3.5 version of the kernel and is "stand-alone", ie. standalone operating system, which aims to provide all the basic and advanced functions of a single router with a simple and understandable interface and easy installation.
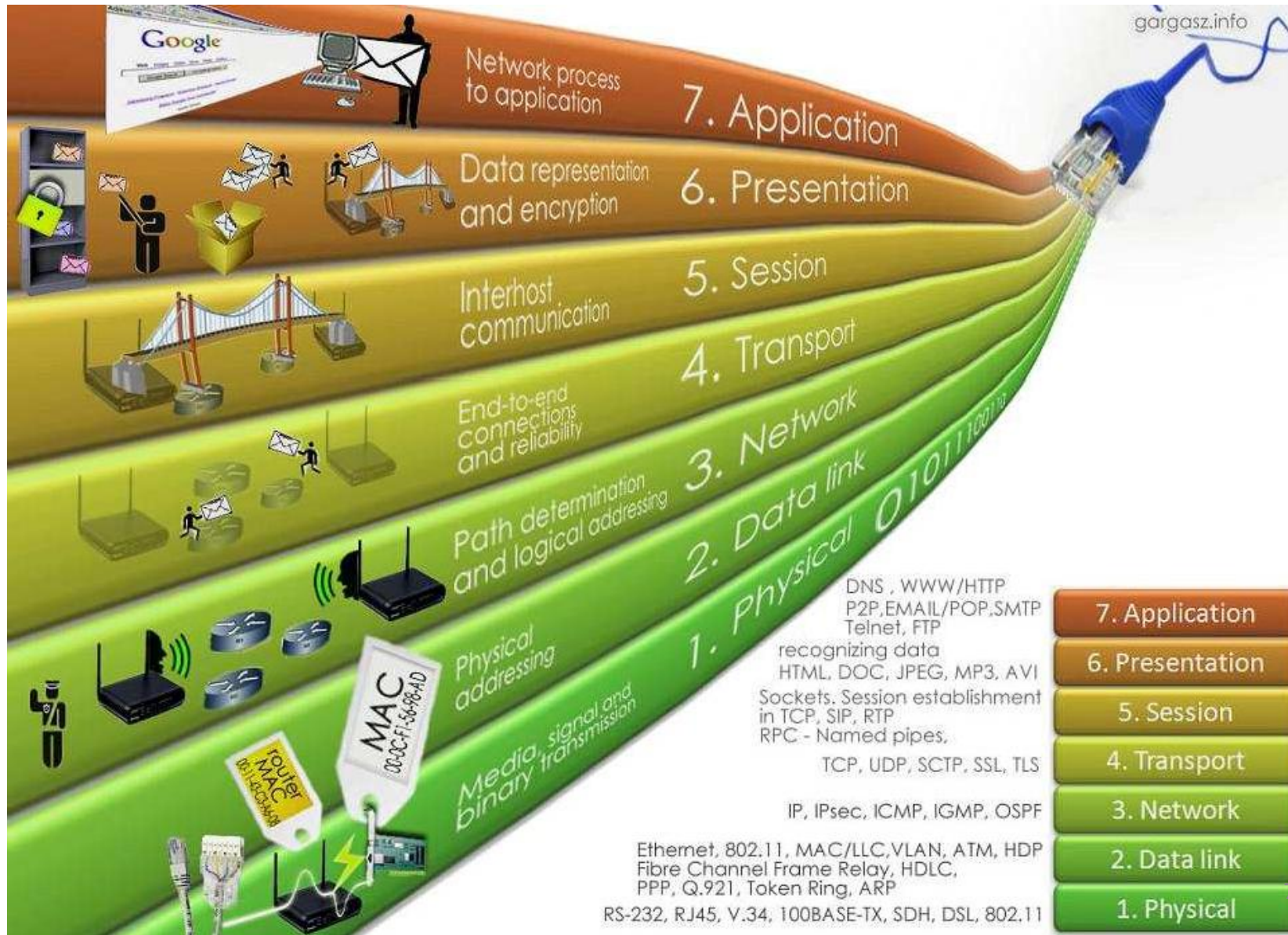
Useful links

- http://www.mikrotik.com/
- http://routerboard.com/
- http://wiki.mikrotik.com
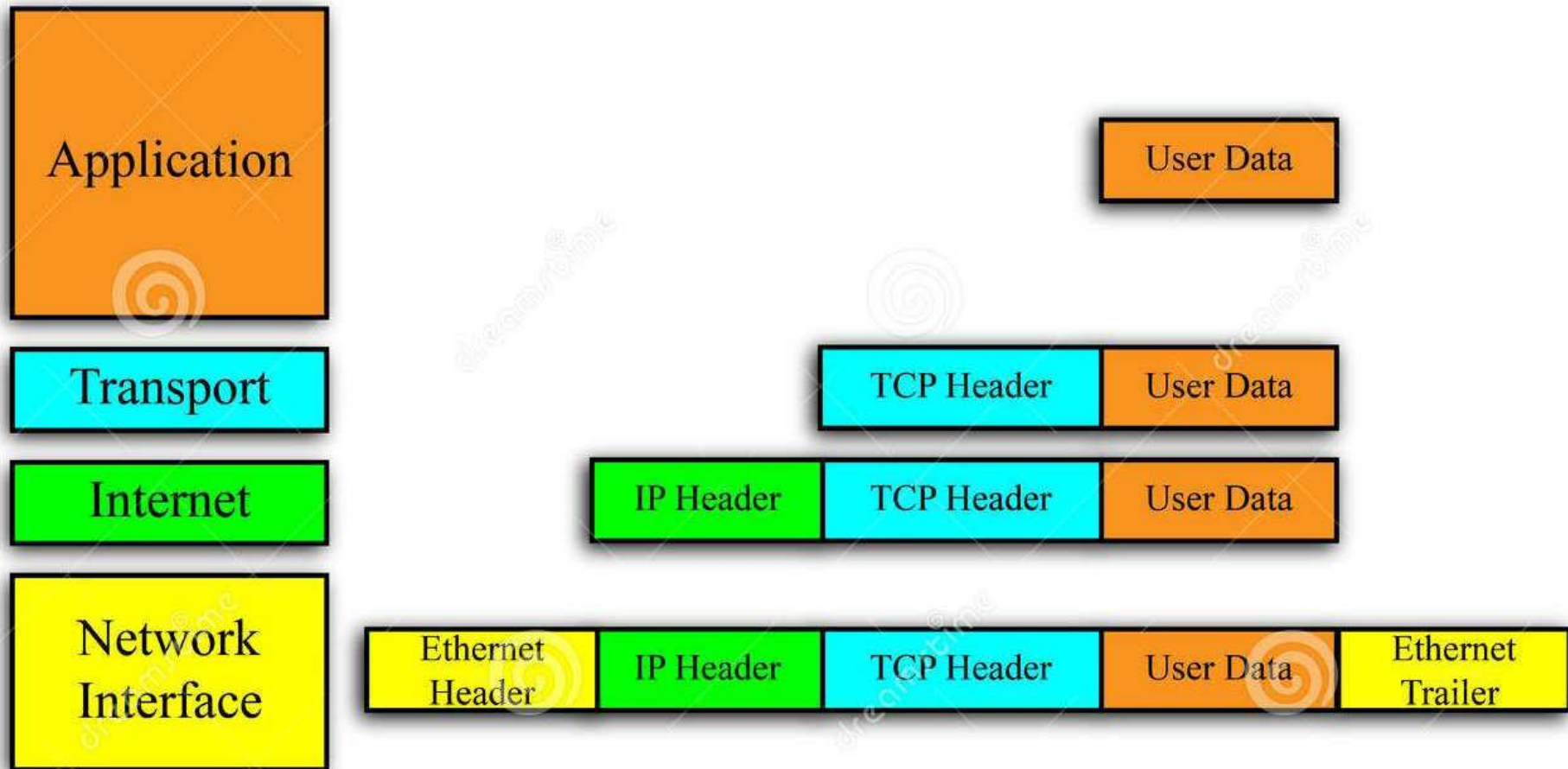- http://forum.mikrotik.com/
- http://www.tiktube.com/

OSI Model

TCP / IP Model (industry standard)

OSI Layer 1

- Physical layer, information is transmitted in a stream (0,1)

- Transmission media are: Copper, Glass, Ether (air)

- The devices of the first layer are: wireless cards, network cards, optical transceivers (media converters), repeaters
- The data on this layer is called being

OSI Layer 2

- Data link (or data layer).

- The physical address of the device, ie the MAC address, is bound to this layerIt is unique for each device (or network card),
- It is 48 bits long

- **Example 00: 0C: 42: 20: 97: 68, 000C.4220.9768, 00-0C-42-20-97-68**

- The devices of the second layer are: switch, bridge, hubThe data on this layer is called frames.

OSI Layer 3

- Network layer.

- Work with IP addresses is performed on this layer
- The IP address is the logical address of the device.
- It is 32 bits (4 bytes) long and is represented in decimal form
- Example 147.91.216.2
- The data on this layer is called packets

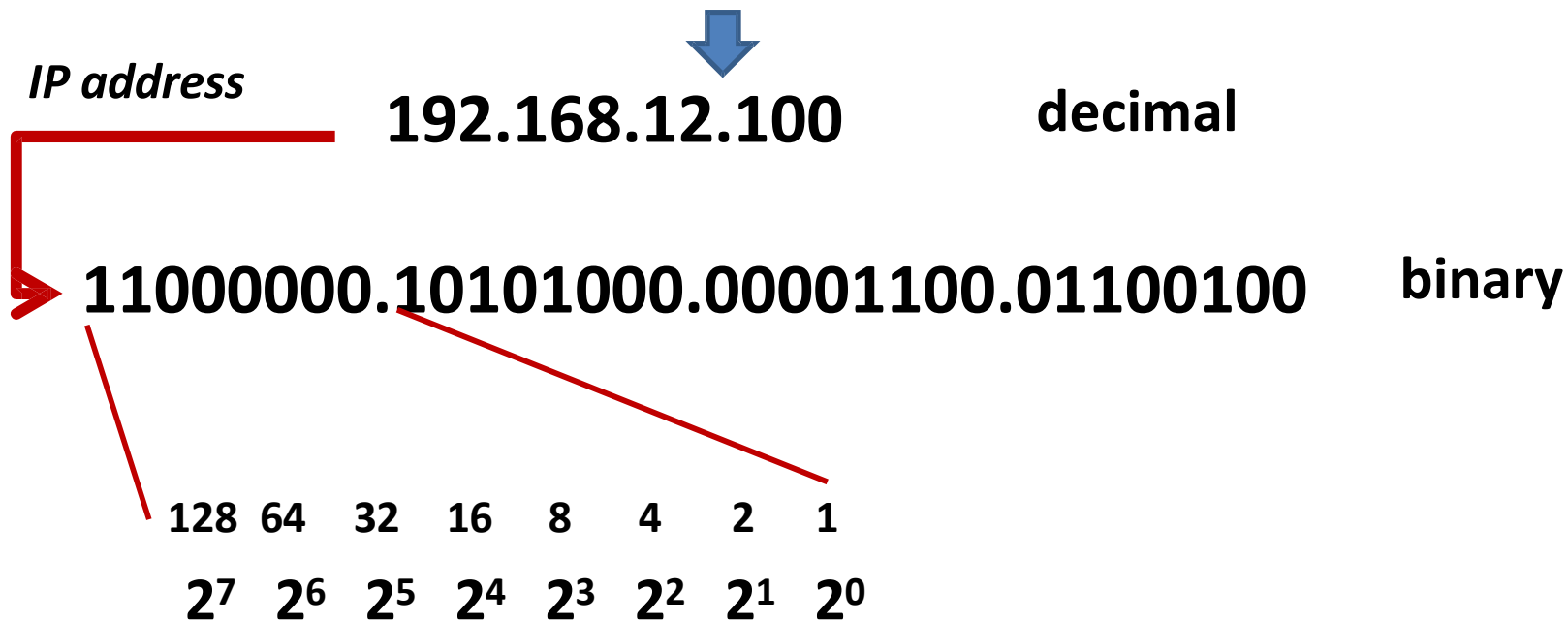# OSI Layer 4

- Transport layer
- Two basic protocols, TCP and UDP, operate on this layer
- TCP is a reliable protocol that in case of packet loss, requires retransmission to be repeated, while in UDP this is not the case.
- These protocols are used by higher layer protocols.

IPv4 addressing

IP address - 32 bits, 4 bytes, 1 byte = 8 bits

Example of one IP address

IP address

192.168.12.100 decimal

11000000.10101000.00001100.01100100 binary

128 64   32   16   8   4   2   1

2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0

192.168.12.100 / 28

IP adresa 192.168.12.100 / 28 *Subnet mask*

11000000.10101000.00001100.01100100

11111111.11111111.11111111.11110000

Network ID *Host ID*

11000000.10101000.00001100.01100100
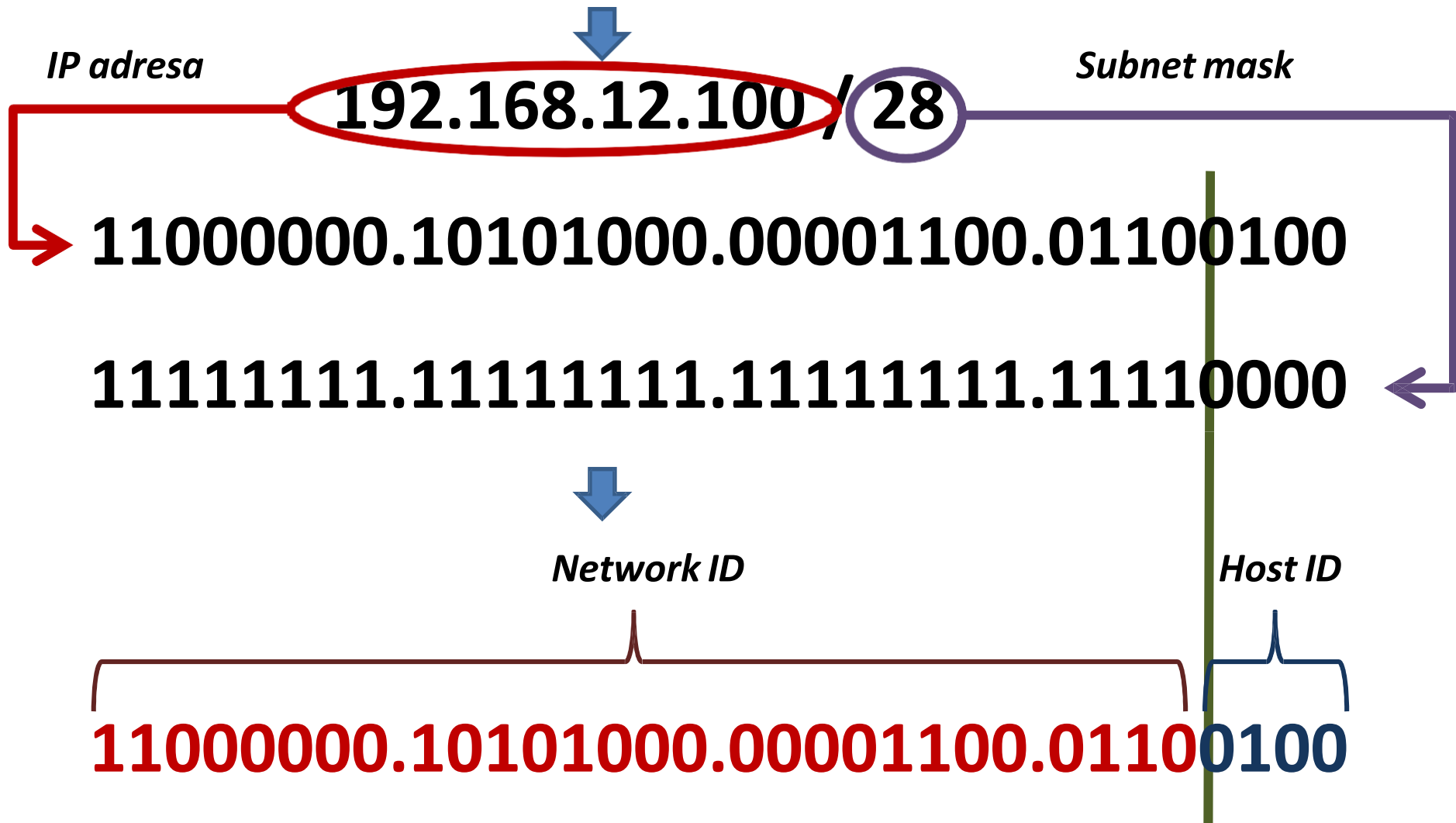
Network ID = first 28 bits within the IP address

Host ID = last 4 bits within the IP address

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Network ID **Host ID**

11000000.10101000.00001100.0110xxxx

11000000.10101000.00001100.0110**0000** ← **IP adresa mreže** → **0000**

192.168.12.64

0001
0010
0011
0100

Total number of IP addresses within the network
$16 = 2^{\text{number of bits in the part of Hosts}}$

Useful IP addresses within the network $14 = 2^{\text{number of bits in the part of Hosts}} - 2$

1101
1110

192.168.12.79

11000000.10101000.00001100.0110**1111** ← **Broadcast adresa** → **1111**

Private IP addresses

- 10.0.0.0 – 10.255.255.255

- 172.16.0.0 – 172.31.255.255

- 192.168.0.0 – 192.168.255.255

Classfull networks (subnet)

Class	Leading bits	Size of *network number* bit field	Size of *rest* bit field	Number of networks	Addresses per network	Start address	End address
Class A	0	8	24	$128\ (2^7)$	$16{,}777{,}216\ (2^{24})$	0.0.0.0	127.255.255.255
Class B	10	16	16	$16{,}384\ (2^{14})$	$65{,}536\ (2^{16})$	128.0.0.0	191.255.255.255
Class C	110	24	8	$2{,}097{,}152\ (2^{21})$	$256\ (2^8)$	192.0.0.0	223.255.255.255
Class D (multicast)	1110	not defined	not defined	not defined	not defined	224.0.0.0	239.255.255.255
Class E (reserved)	1111	not defined	not defined	not defined	not defined	240.0.0.0	255.255.255.255

Classless Inter-Domain Routing (CIDR)

IPv4 CIDR Chart — RIPE NCC

IP Addresses	Bits	Prefix	Subnet Mask
1	0	/32	255.255.255.255
2	1	/31	255.255.255.254
4	2	/30	255.255.255.252
8	3	/29	255.255.255.248
16	4	/28	255.255.255.240
32	5	/27	255.255.255.224
64	6	/26	255.255.255.192
128	7	/25	255.255.255.128
256	8	/24	255.255.255.0
512	9	/23	255.255.254.0
1 K	10	/22	255.255.252.0
2 K	11	/21	255.255.248.0
4 K	12	/20	255.255.240.0
8 K	13	/19	255.255.224.0
16 K	14	/18	255.255.192.0
32 K	15	/17	255.255.128.0
64 K	16	/16	255.255.0.0
128 K	17	/15	255.254.0.0
256 K	18	/14	255.252.0.0
512 K	19	/13	255.248.0.0
1 M	20	/12	255.240.0.0
2 M	21	/11	255.224.0.0
4 M	22	/10	255.192.0.0
8 M	23	/9	255.128.0.0
16 M	24	/8	255.0.0.0
32 M	25	/7	254.0.0.0
64 M	26	/6	252.0.0.0
128 M	27	/5	248.0.0.0
256 M	28	/4	240.0.0.0
512 M	29	/3	224.0.0.0
1024 M	30	/2	192.0.0.0
2048 M	31	/1	128.0.0.0
4096 M	32	/0	0.0.0.0

K = 1,024 • M = 1,048,576

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Subnet Lab1

LAB

- Calculate following parameters for given IP addresses:
  network address, broadcast address, number of valid hosts, subnet mask in decimal notation.

- 172.18.36.87/18, 192.168.45.34/24, 10.11.12.13/14

Subnet Lab2
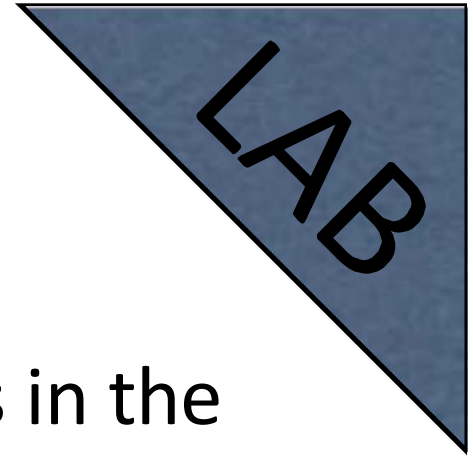
- What are valid IP addresses for hosts in the same subnet with the host with
  IP address: 192.168.1.91/28

- 192.168.1.89

- 192.168.1.78

- 192.168.1.80
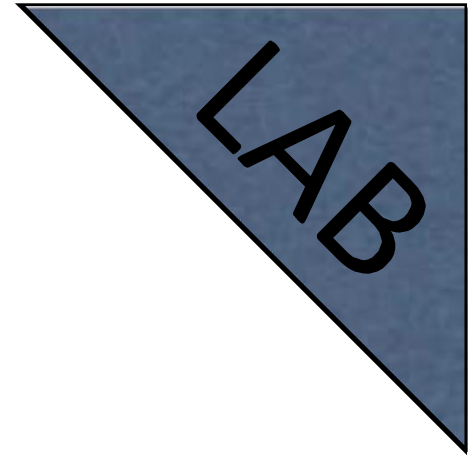
- 192.168.1.95

- 192.168.1.97

Subnet Lab3

- ISP has allocated to your company IP address space 84.52.180.0/24

- Split your address space into right sizes

- In location A, you have 20 hosts, in B 32 hosts and in C 10 hosts

Subnet Lab4

LAB

- Aggregating practice

  – 172.18.1.0/22, 172.18.2.0/23, 172.18.4.0/24