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Computer Networks

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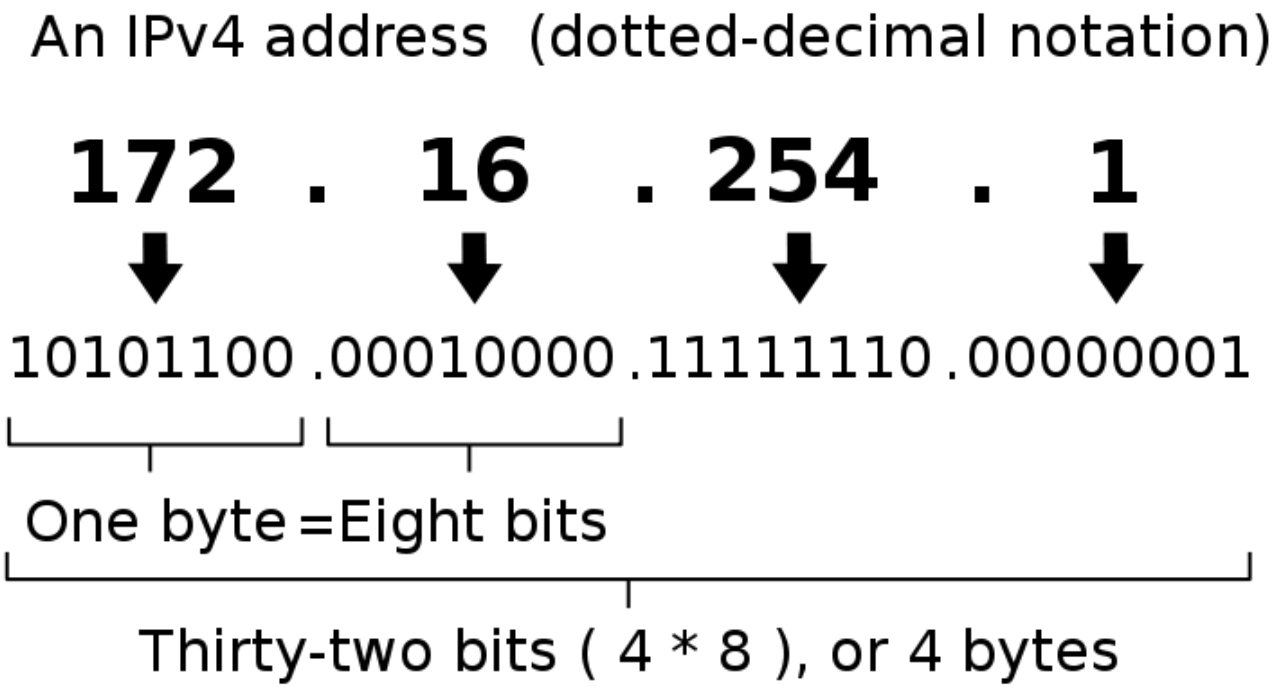
IP Addressing

- Why ?
- What’s the purpose ?

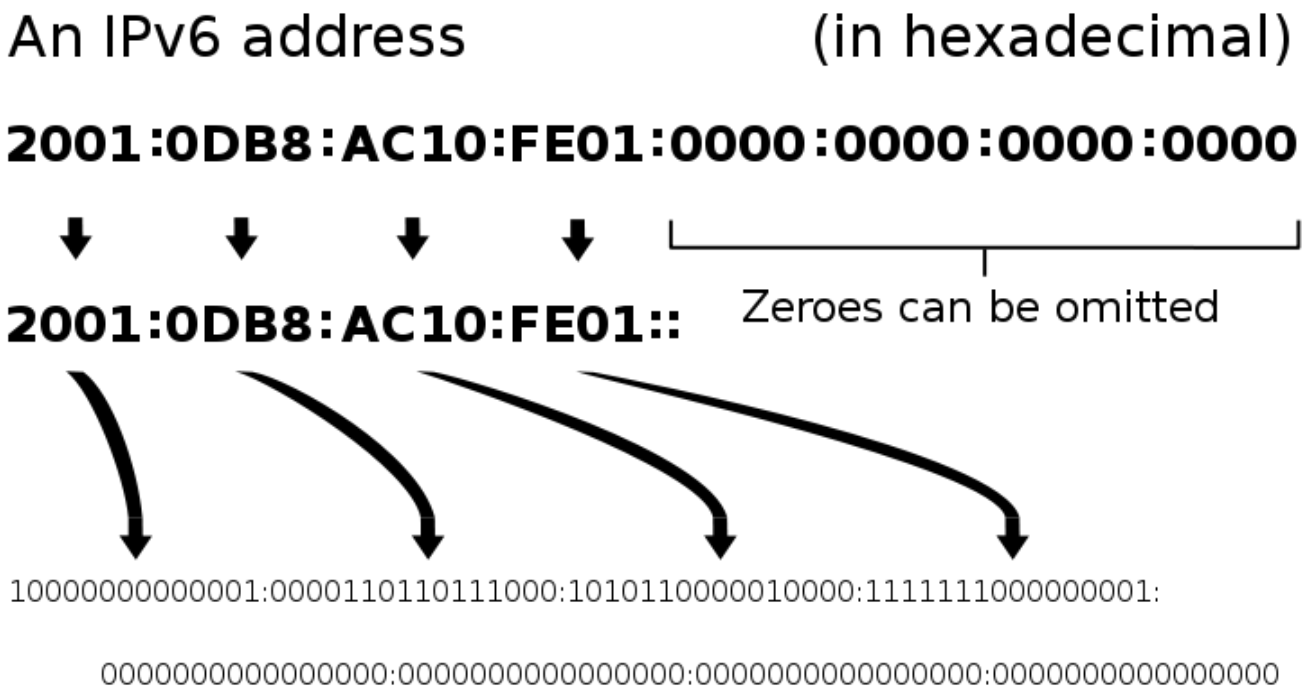
IP Addressing

- IPv4 address
  - 32-bits or 4 byte
  - 2^32 addresses possible



IP Addressing

- IPv6 address
  - 128 bits or 16 byte
  - 2^128 addresses possible (!!!)



IP Addressing

- IPv4 address assigning
  - Static addressing
  - Dynamic addressing via DHCP
    - Dynamic Host Configuration Protocol
    - DHCP reservation …
  - APIPA, automatic private IP addressing
    - IPv4 : 169.254.x.x/16
    - IPv6 : fe80::/10

IP Addressing

- IPv6 address assigning
  - Static addressing
  - Static addressing with DHCPv6 (Stateless)
    - DHCPv6 options only
  - Dynamic addressing via DHCPv6 (Stateful)
    - IP address and DHCPv6 options (DNS servers, …)
  - SLAAC alone
    - **S**tate**l**ess **A**ddress **A**uto**c**onfiguration
  - SLAAC with DHCPv6 (Stateless)
    - DHCPv6 options only

IP Addressing

- IPv4 subnetting
  - Classful network design
  - Obsolete ! (see further)

Class	First bits	First byte	Subnetmask	Prefix	Nw vs Host
A	0xxxxxxx	1-127	255.0.0.0	/8	N.H.H.H
B	10xxxxxx	128-191	255.255.0.0	/16	N.N.H.H
C	110xxxxx	192-223	255.255.255.0	/24	N.N.N.H
D	1110xxxx	224-239	Multicast	n/a	n/a
E	1111xxxx	240-255	Reserved	n/a	n/a

IP Addressing

- IPv4 subnetting
  - Private IP addresses (RFC 1918)

Class	Start	End	Prefix
A	10.0.0.0	10.255.255.255	/8
B	172.16.0.0	172.31.255.255	/12
C	192.168.0.0	192.168.255.255	/16

  - Address not private = public address
  - Home routers : 192.168.0.1 …
  - NAT (Network Address Translation)

IP Addressing

- IPv4 subnetting, the sequel …
  - Classful network design is not scalable
  - Replaced by CIDR through VLSM
    Classless Inter-Domain Routing
    Variable-Length Subnet Masking
  - eg. 172.23.0.0/23

IP Addressing

- IPv4 subnetting, the sequel …
  - example 172.23.8.15/16
  - two major addresses can be deducted
    - the network address (NA)
      - start of the subnet
    - the broadcast address (BA)
      - end of the subnet
  - network and broadcast address can NOT be used for a host

IP Addressing

- IPv4 subnetting, the sequel …
  - deducting the **network address**
    - binary "and" between IP address and subnet mask

X	Y	X and Y
0	0	0
0	1	0
1	0	0
1	1	1

    - network address can NOT be assigned to a host

IP Addressing

- IPv4 subnetting, the sequel …
  - classful example 172.23.9.15/16

N <- -> H

10101100.00010111.00001001.00001111

11111111.11111111.00000000.00000000

10101100.00010111.00000000.00000000

Network address is 172.23.0.0

IP Addressing

- IPv4 subnetting, the sequel …
  - CIDR example 172.23.9.15/23

N <--> H

10101100.00010111.00001001.00001111

11111111.11111111.11111110.00000000

10101100.00010111.00001000.00000000

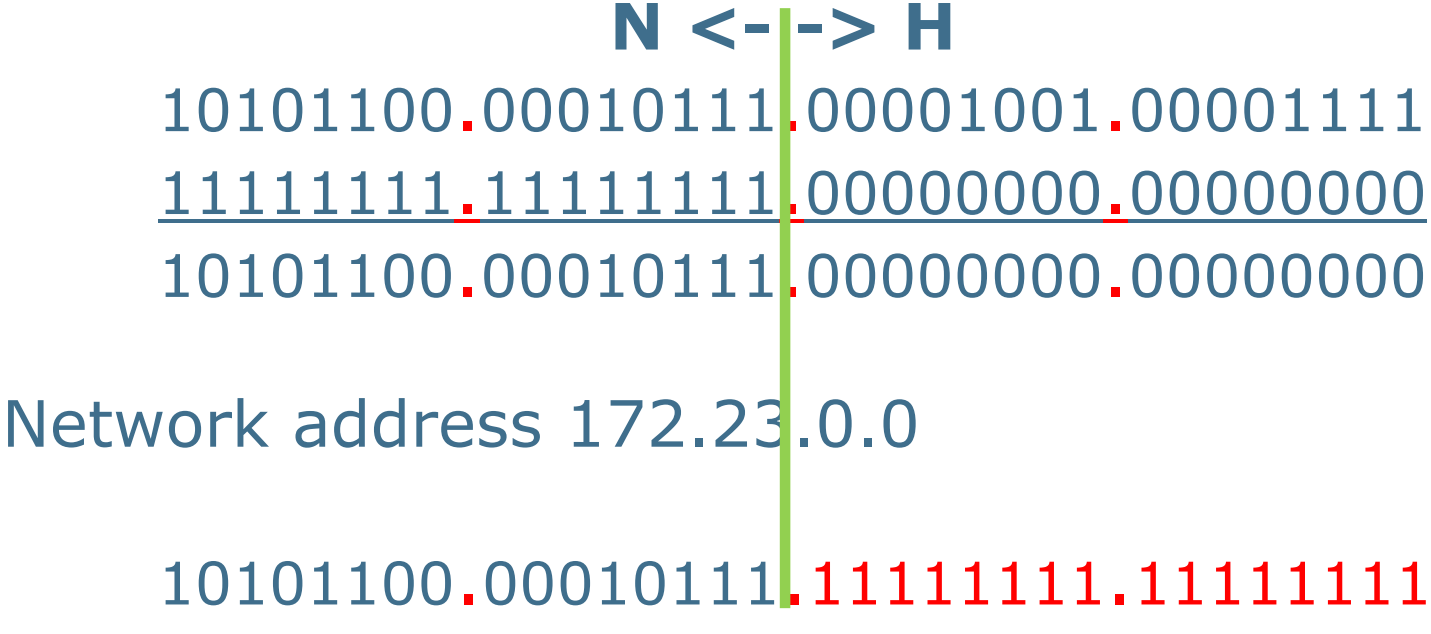
Network address is 172.23.8.0

IP Addressing

- IPv4 subnetting, the sequel …
  - deducting the **broadcast address**
    - invert the host bits of the network address
  - broadcast address can NOT be assigned to a host

IP Addressing

- IPv4 subnetting, the sequel …
  - classful example 172.23.9.15/16



IP Addressing

- IPv4 subnetting, the sequel …
  - CIDR example 172.23.9.15/23

N <--> H

10101100.00010111.00001001.00001111

11111111.11111111.11111110.00000000

10101100.00010111.00001000.00000000

Network address 172.23.8.0

10101100.00010111.00001001.11111111

Broadcast address 172.23.9.255

IP Addressing

- IPv4 subnetting, the sequel …
  - classful example 192.168.0.101/24
  - extra deductions we can make
    - class ? C
    - private / public ? private
    - classful mask ? /24 or 255.255.255.0
    - # hosts / subnet

      32 – 24 (network bits) = 8 (host bits)

      ⇒2^8 = 256 – 2 = 254 hosts

      ⇒ - 2 (network and broadcast address)

IP Addressing

- IPv4 subnetting, the sequel …
  - CIDR example 172.123.9.15/23
  - extra deductions we can make
    - class ? B
    - private / public ? public
    - classful mask ? /16 or 255.255.0.0
    - # hosts / subnet

      32 – 23 (network bits) = 9 (host bits)

      ⇒2^9 = 512 – 2 = 510 hosts

      ⇒ - 2 (network and broadcast address)
    - # subnets in the classful network

      23 – 16 (class network bits) = 7

      => 2^7 = 128 subnets

IP Addressing

- IPv4 local routing decision
  - http://www.google.be
  - my IP address 192.168.0.101/24 (source IP)
  - IP address of www.google.be 74.125.77.99 (destination IP)

1. source IP AND my subnet mask=192.168.0.0
2. destination IP AND my subnet mask = 74.125.77.0
3. NOT equal = destination IP is not in own subnet !
4. Give the packet to the default gateway !

IP Addressing

- What is my own IPv4 address ?
  - ipconfig in Windows // ip address in Linux

```
Wireless LAN adapter Wireless:

   Connection-specific DNS Suffix  . : local
   Link-local IPv6 Address . . . . . : fe80::30f6:da89:1964:39c1%11
   IPv4 Address. . . . . . . . . . . : 172.23.25.147
   Subnet Mask . . . . . . . . . . . : 255.255.252.0
   Default Gateway . . . . . . . . . : 172.23.24.1
```

  - No default gateway = packet dropped !

IP Addressing

Links

- http://en.wikipedia.org/wiki/IP_address
- http://en.wikipedia.org/wiki/IPv4_subnetting_reference
- http://en.wikipedia.org/wiki/Subnetwork
- http://en.wikipedia.org/wiki/Classless_Inter-Domain_Routing

IP Addressing