

Principle of IP addressing

Decimal notation

Special addresses

Sub Netting

IPv4 addressing course 2nd year professional license

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#### Presentation Overview

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subnet masks Membership of a machine to a subnet



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### Addressing Purpose

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The purpose of addressing is to provide a universal communication service allowing any machine to communicate with any other machine. Machines must be accessible by both humans and other machines. A machine must therefore be able to be identified by :

• a name (mnemonic for users),



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- a name (mnemonic for users),
- an address which must be a universal machine identifier,
- a route specifying how the machine can be reached.



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### Principle of IP addressing



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IP addresses are used to identify both networks and machines. An IP version 4 address consists of 32 bits structured in two parts : network identifier and machine identifier.

0 31 Network identifier Machine identifier

IP addresses are organized into five classes :

	0	8	16	24 31
<u>Classe A</u>	0 Net-id		Host-id	
<u>Classe B</u>	10 N	et-id	Но	st-id
<u>Classe C</u>	1 1 0	Net-id		Host-id
<u>Classe D</u>	1 1 1 0 Multicast			
<u>Classe E</u>	1 1 1 1 0	ŀ	<b>lé</b> servé	



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- Class E is an experimental class, reserved for trial use or future use.



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#### Decimal notation



### Decimal notation

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Binary IP addresses are difficult to handle, so decimal notation is used which represents the IP address in the form of four decimal values between 0 and 255 representing the values of the four bytes of the binary address.

0000000	00001010	00000010	00011110
128	10	$^{2}$	30

We write : 128.10.2.30 Exemple





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#### Special addresses

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In each class, there are addresses reserved for a particular use and which cannot be attributed to any machine and which have a particular meaning. In general :

• An address field (Netid or Hostid) all 1 means all objects (networks or machines) (used for broadcasting)

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- An address field (Netid or Hostid) all 1 means all objects (networks or machines) (used for broadcasting)
- An address field (Netid or Hostid) all 0 means this object (machine or network) (used in case of ignorance of identifiers)



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Examples:

• The network address has a machine identifier value where all bits are zero (0).



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- Class A addresses from 10.0.0.0 to 10.255.255.255, class B addresses from 172.16.0.0 to 172.31.255.255 and class C from 192.168.0.0 to 192.168.255.255 are reserved for networking private otherwise called intranet.



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# Addressing

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- The task of managing IP addresses is enormous
- Routing tables become gigantic or even saturated.
- Class C (2 million networks) quickly became insufficient.
- The use of class B also generates problems : the number of networks is insufficient and the management of 65000 machines within each network is very difficult.

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Membership of a machine to a subnet Hence the need to subdivide. Subnet addressing or subnetting is a standardized technique in IP addressing, it allows the use of a single network address with several networks (subnetworks) by cutting out the part reserved for the address of the machines on a network into two parts, the first of which will be a subnet identifier. Thus a single class B network, on which we could name 65536 machines, can be broken down into 254 subnets of 254 machines.



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#### Sub Netting subnet masks Membership of a

For the Internet, there is only one network 128.10.0.0 and all routers treat datagrams destined to this network in the same way. On the other hand, the router R uses the third byte (equal to 1 or 2) of the address contained in the datagrams which come to it to direct them towards the subnetwork for which they are intended thus ensuring a hierarchical routing.

0			
NetID	HostID		Old IP address
Partie Internet	Local part		
Internet Part	sub net	Host	New IP address

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#### Sub Netting subnet masks Membership of a

The choice of the number of bits representing the subnet identifier is left to the local administrator. If this number is fixed for all the sub-networks, then one speaks of fixed sub-addressing, otherwise one speaks of variable sub-addressing. Variable sub-addressing is used when a company, for example, has both small and large networks. In fixed addressing (often used), a compromise must be made between the number of networks and the number of machines.

Number of bits	Number of subs	Number of hosts	
of subnet	network		
2	2	16382	
3	6	8190	
4	14	4094	

# Sub Netting (subnet masks)

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#### Sub Netting

#### subnet masks

Membership of a machine to a subnet The TCP/IP standard indicates that a site that uses subnetting must choose a mask (subnet mask) for each subnet that will be registered on each machine. The mask allows a machine to know the number of bits assigned to the identifier of the subnet and to that of the machine. A subnet mask is a 32-bit word containing bits at 1 instead of the identifier network and subnet and bits to 0 instead of the machine identifier. Examples of masks

11111111	11111111	11111111	00000000
	Host		
255	255	255	0
11111111	11111111	11110000	00000000
	Host		
255	255	240	0
11111111	11111111	11111111	11110000
	Host		
255	255	255	240

# Sub Netting (Membership of a machine to a subnet)

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Sub Netting subnet masks Membership of a machine to a subnet So, from the address of a datagram and its subnet mask a machine can determine if the datagram is intended for a machine on its own subnet, for a machine on another subnet of its network or to a machine outside its subnet. To verify that the machine with address IPDest belongs to the subnet with address IPRes having the mask N, we calculate

# $V = IPdest \wedge N$

If V = IP res then the machine is in the same subnet and the messages are sent to it, otherwise the messages are sent to a gateway (router) which transmits them to the rest of the network which is responsible for routing them to their destination