

# IPv4 addressing and routing



Tecnologie e Servizi di Rete

Computer Network Technologies and Services

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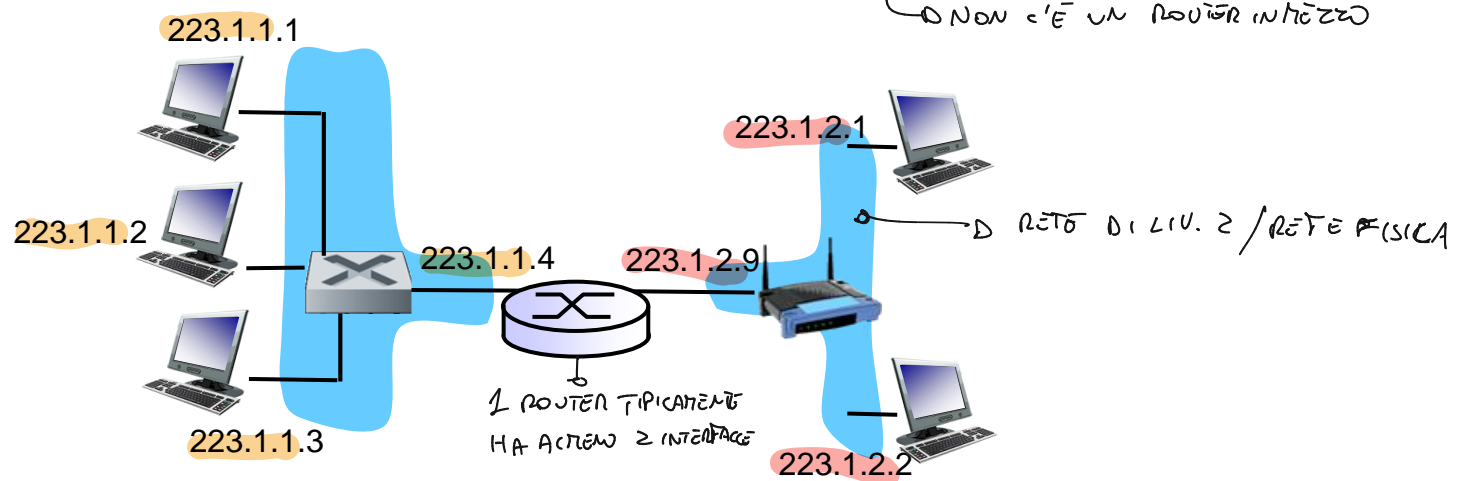
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# IP addressing: terminology

- ❑ *IP address*: 32-bit identifier for host, router interfaces
- ❑ *Network part*: high order bits of the IP address + SIGNIFICATIVA
- ❑ *Host part*: low order bits of the IP address - SIGNIFICATIVA
- ❑ *IP<sup>RETE IP</sup> network*: set of IP devices whose interfaces
  - ❑ Have the same network part of the IP address
  - ❑ Are connected to the same physical (link-layer) network



# IP addressing: special addresses

PRIMO DI  
UNA RETE  
↓



the (sub)network ID



limited broadcast (local net)

raggiungo tutti nella mia rete fisica

ULTIMO DI  
UNA RETE  
↓



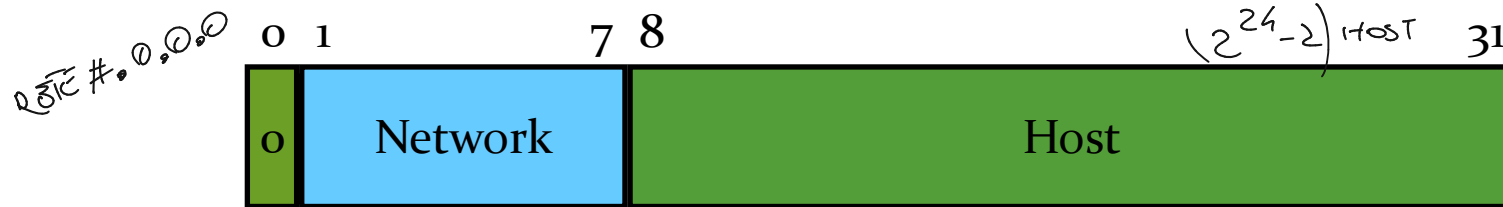
directed broadcast for net



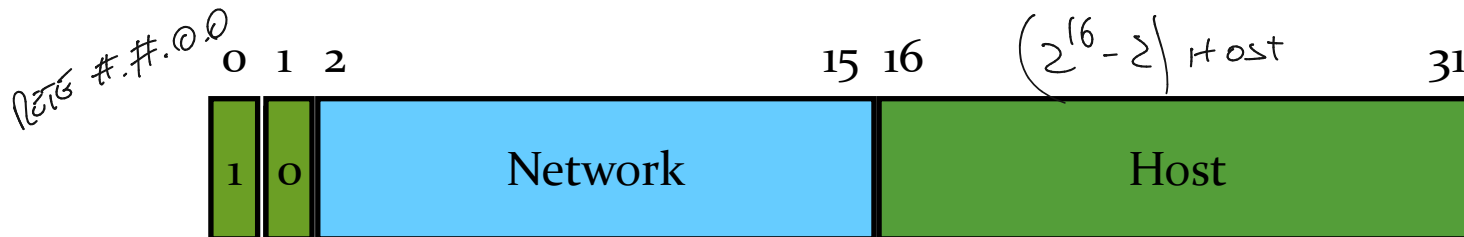
loopback

↳ LOCAL-HOST ↳ inviare il pacchetto al livello 3  
e poi all'applicazione

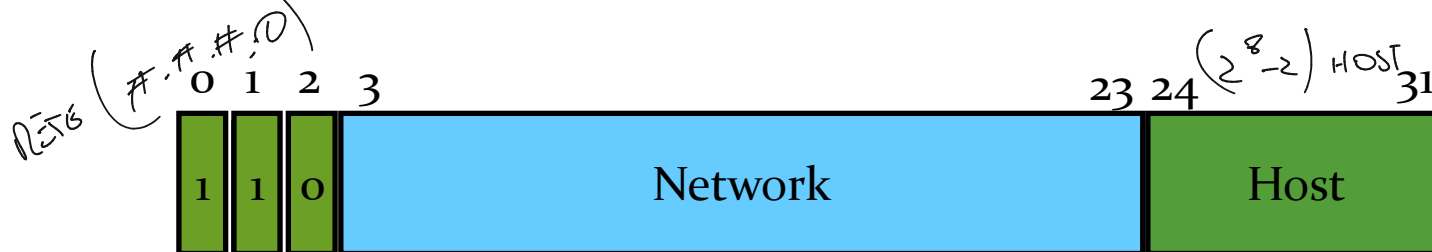
# IP addressing classes



**Class A** – 128 networks – 1<sup>st</sup> byte: 0-127



**Class B** – 16K networks – 1<sup>st</sup> byte: 128-191



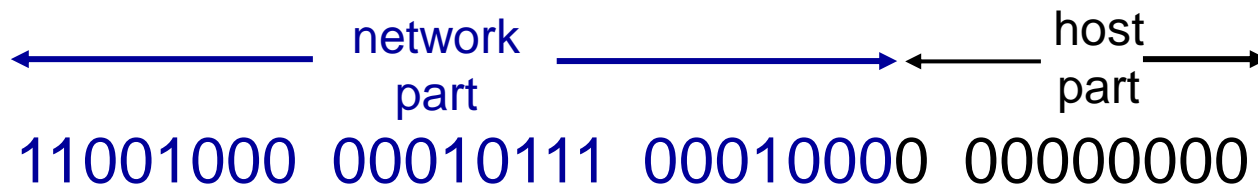
**Class C** – 2M networks - 1<sup>st</sup> byte: 192-223

# IP addressing: CIDR

- POSSO DEFINIRE DIMENSIONI DE TO A MIA SCELTA  
MA DEVO USARE LA NETMASK

## ❑ CIDR: Classless InterDomain Routing

- ❑ network portion of address of arbitrary length
- ❑ address format: *network ID* + *prefix length* or *netmask*
  - ❑ *prefix length*: /x, where x is # bits in network portion of address
  - ❑ *netmask*: all '1s' in the network part, all '0s' in the host part



200.23.16.0/23

prefix length  
notation

200.23.16.0 255.255.254.0

netmask  
notation

# IP addressing: CIDR

- Valid *netmasks*: possible values in the 4 bytes composing the address

0	0000	0000	(256)
---	------	------	-------

128	1000	0000	(128)
-----	------	------	-------

192	1100	0000	(64)
-----	------	------	------

224	1110	0000	(32)
-----	------	------	------

240	1111	0000	(16)
-----	------	------	------

248	1111	1000	(8)
-----	------	------	-----

252	1111	1100	(4)
-----	------	------	-----

254	1111	1110	(2)
-----	------	------	-----

255	1111	1111	(1)
-----	------	------	-----

9/30  
(4) Smaller usable netmasks

(2) not valid in the 4<sup>th</sup> byte

(1) Represent the single device

Lo es: nelle tabelle di routing quando  
voglio inserire una entry specifica  
per un dispositivo

# IP addressing: CIDR

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## ❑ *Some examples*

- ❑ 130.192.0.0/16 – 130.192.0.0 255.255.0.0
- ❑ 130.192.0.0/24 – 130.192.0.0 255.255.255.0
- ❑ 130.192.0.0/25 – 130.192.0.0 255.255.255.128
- ❑ 130.192.2.0/23 – 130.192.2.0 255.255.254.0
- ❑ 130.192.1.4/30 – 130.192.1.4 255.255.255.252
- ❑ ~~130.192.1.0/31 – 130.192.1.0 255.255.255.254~~


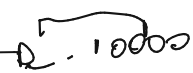
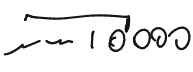
! Each IP network *must* contain at least the network ID and the broadcast address!

/31 NOT VALID core net






# IP addressing: CIDR

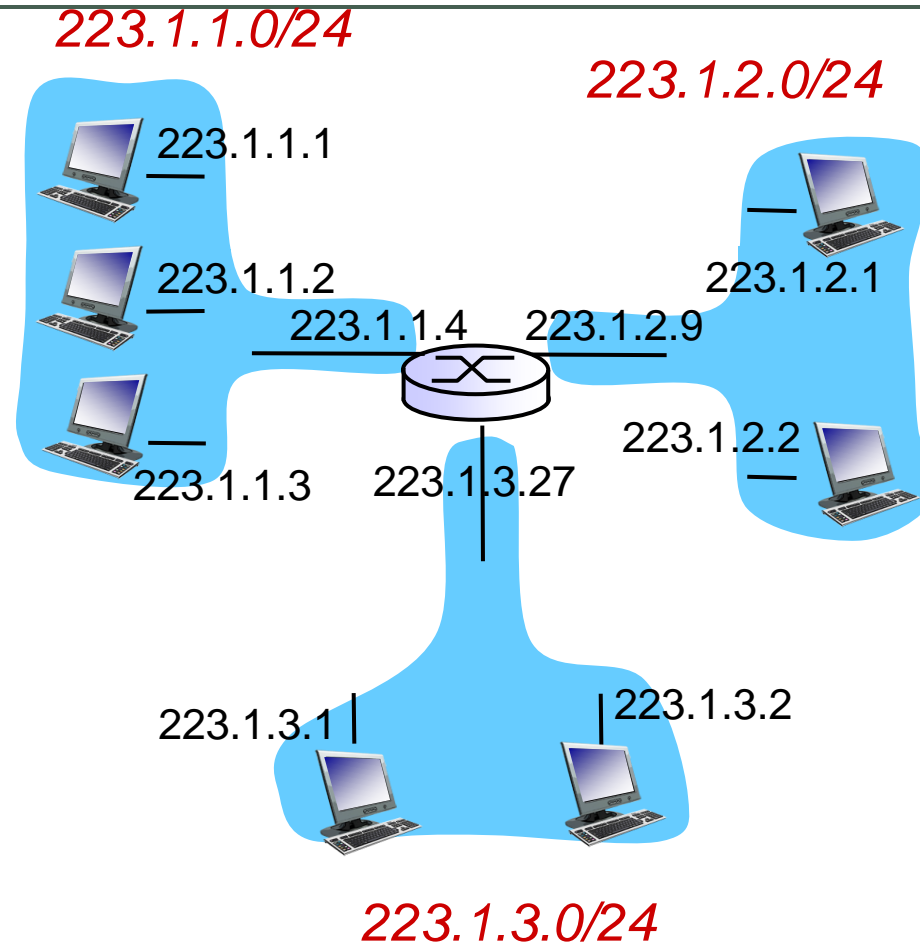
## Valid Network ID

- 130.192.1.4/30 
- 130.192.1.16/30 
- 130.192.1.16/29 

## Not valid Network ID

- 130.192.1.1/30 
- 130.192.1.4/29 
- 130.192.1.24/28 

# IP addressing: a real example



netmask: 255.255.255.0

# IP routing

## ❑ *The general rules:*

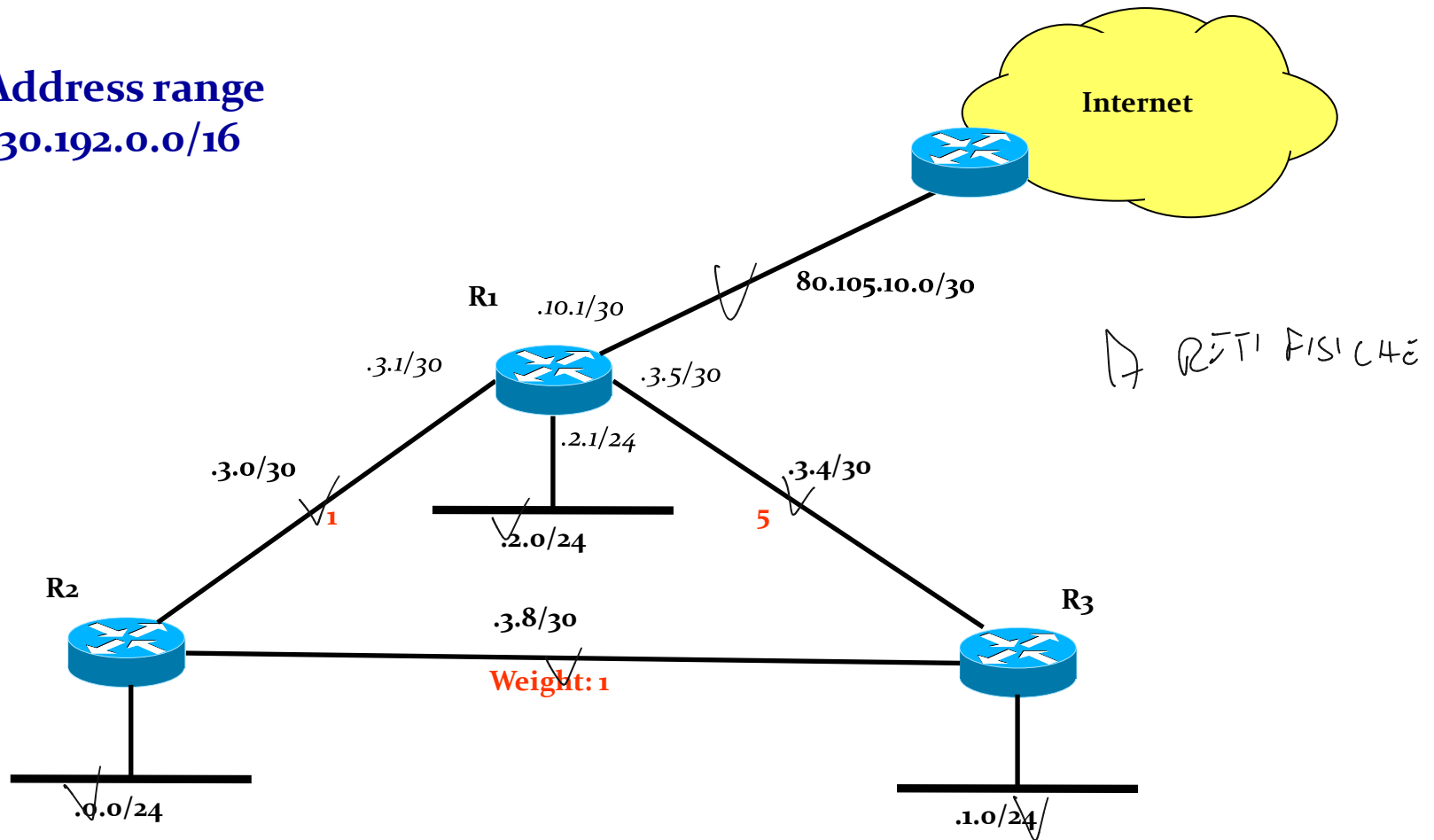
- ❑ Given a destination IP address to reach, an IP device search its own routing table, looking for a *match*
- ❑ In case of multiple matches, it selects the most specific one (*longest prefix matching*)

routing table	
destination	output link
200.23.16.0/20	1
200.23.18.0/23	2
199.31.0.0/16	2

*Handwritten notes:* A bracket on the left side of the first two rows indicates a comparison. To the right of the first row, the text "SE COMBACIA COM ENTRAMBE, VA NELLA /23" is written.

# IP routing: an example

Address range  
130.192.0.0/16



# IP routing: an example

R1 routing table

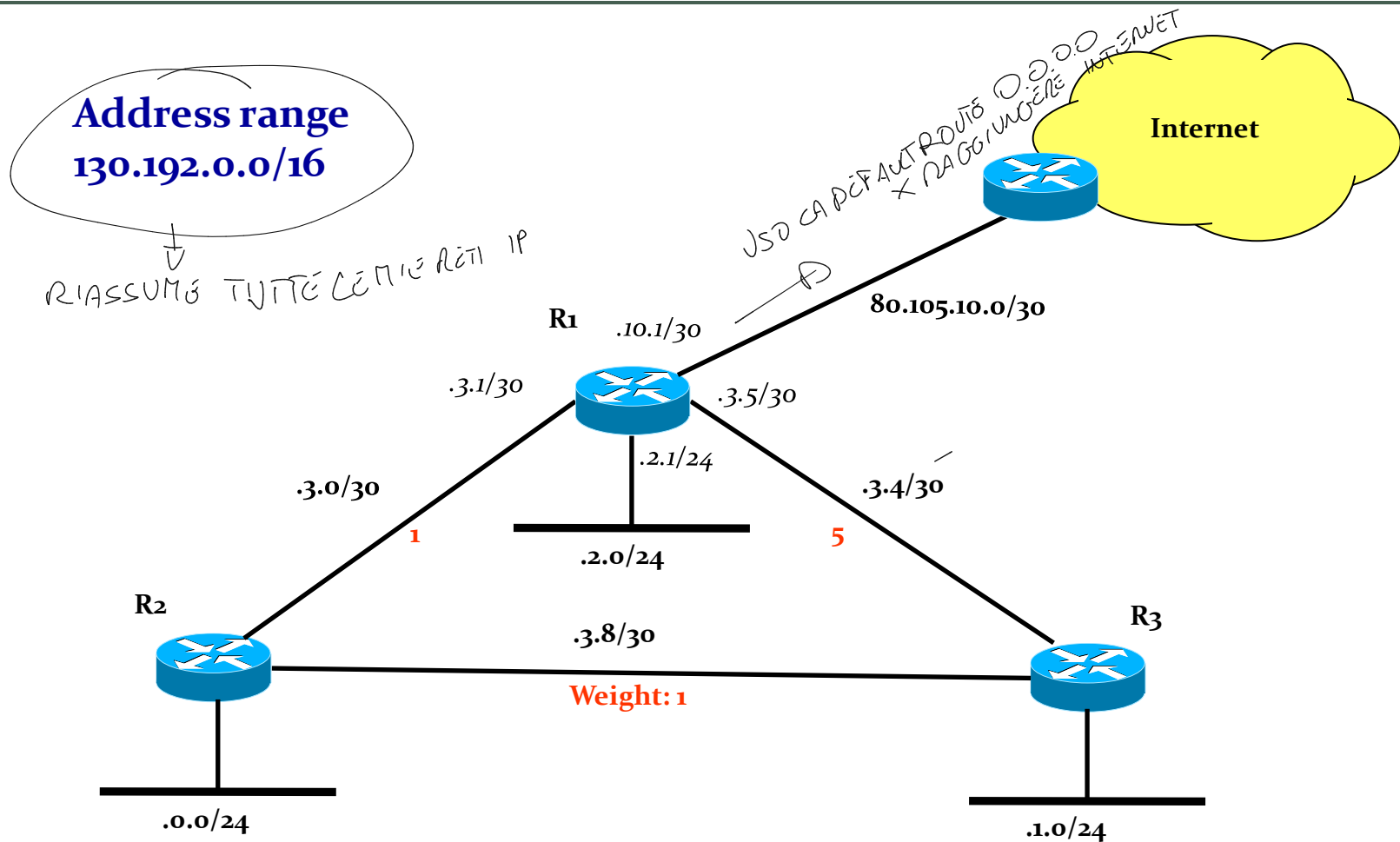
<i>Type</i>	<i>Destination</i>	<i>Next-hop</i>	<i>Cost</i>
S	130.192.0.0/24	130.192.3.2	2
S	130.192.1.0/24	130.192.3.2	2
S	130.192.3.8/30	130.192.3.2	2
S	0.0.0.0/0	80.105.10.2	2
D	130.192.2.0/24	130.192.2.1	1
D	130.192.3.0/30	130.192.3.1	1
D	130.192.3.4/30	130.192.3.5	1
D	80.105.10.0/30	80.105.0.1	1

remote  
interface!!

AS 20106

local  
interface!!

# IP routing: an example of AGGREGATION



# IP routing: an example

R1 routing table

Type	Destination	Next-hop	Cost
S	130.192.0.0/24	130.192.3.2	2
S	130.192.1.0/24	130.192.3.2	2
S	130.192.3.8/30	130.192.3.2	2
S	0.0.0.0/0	80.105.10.2	2
D	130.192.2.0/24	130.192.2.1	1
D	130.192.3.0/30	130.192.3.1	1
D	130.192.3.4/30	130.192.3.5	1
D	80.105.10.0/30	80.105.0.1	1

PACKETS IN 130.192.0.0/22 HIT THE HAND STRESS  
NEXT-HOP

remote  
interface!!

DEFAULT ROUTE

local  
interface!!