IPv4 addressing and routing

Tecnologie e Servizi di Rete

Computer Network Technologies and Services

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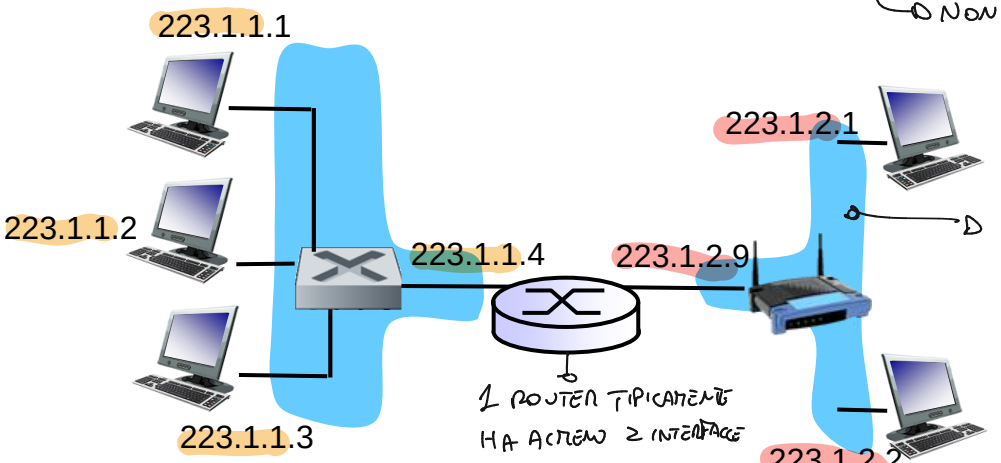
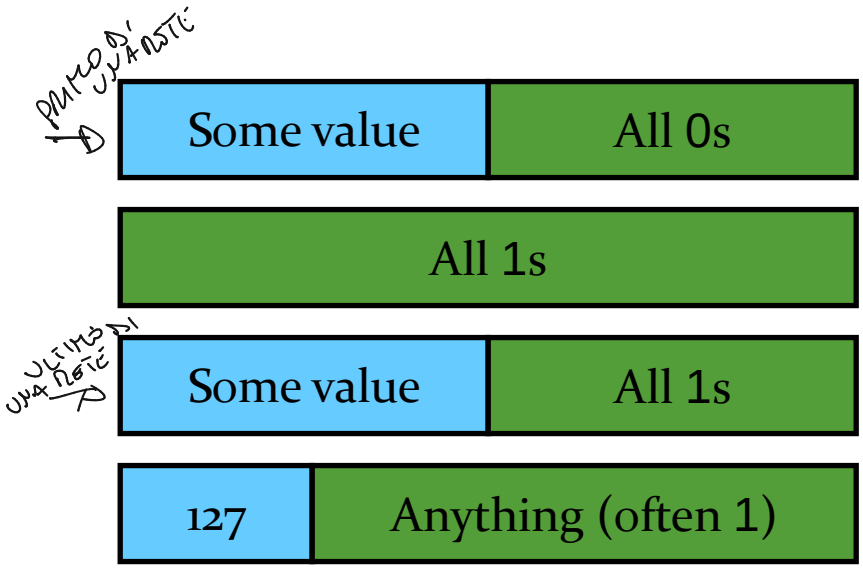
IP addressing: terminology

- *IP address*: 32-bit identifier for host, router interfaces
- *Network part*: high order bits of the IP address
- *Host part*: low order bits of the IP address
- *IP 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



the (sub)network ID

limited broadcast (local net)

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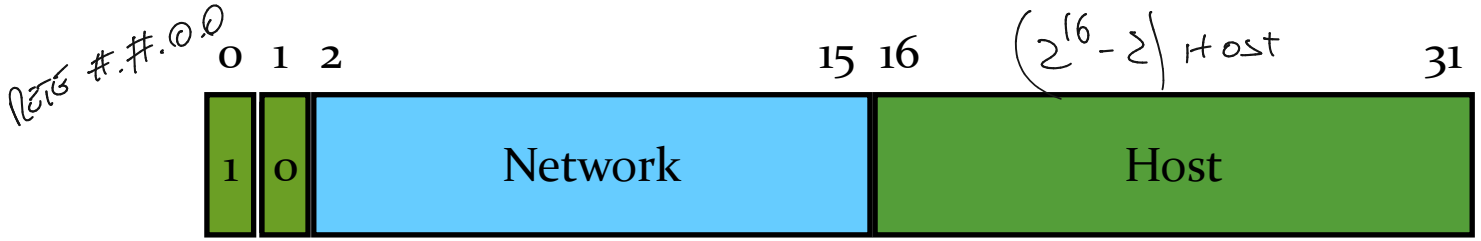
directed broadcast for net

loopback

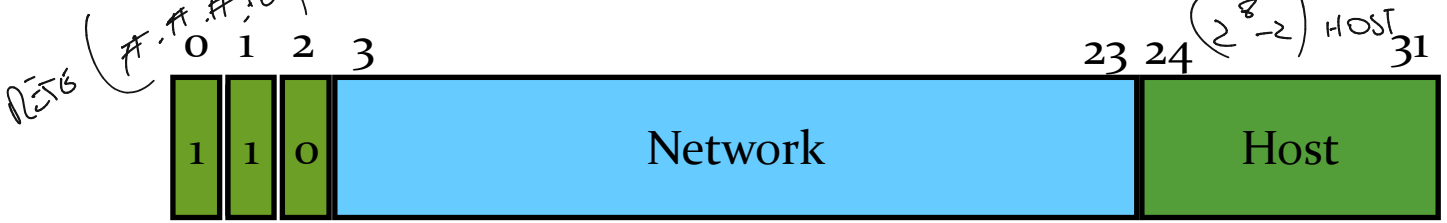
→ LOCAL-HOST → INVIARE IL PACCHETTO AL LIVELLO 3 E POI ALL'APPLICAZIONE

IP addressing classes

Class A – 128 networks – 1° byte: 0-127



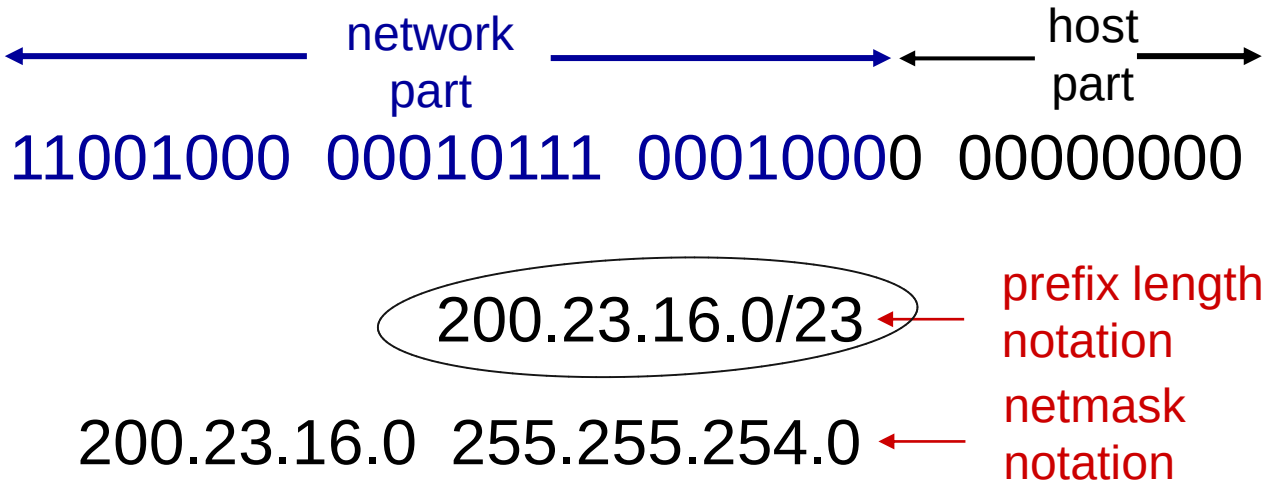
Class B – 16K networks – 1° byte: 128-191



Class C – 2M networks - 1° byte: 192-223

IP addressing: CIDR

- 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



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) **Smaller usable netmasks**
254	1111 1110	(2) **not valid in the 4°byte**
255	1111 1111	(1) **Represent the single device**

/30

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

IP addressing: CIDR

- *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!

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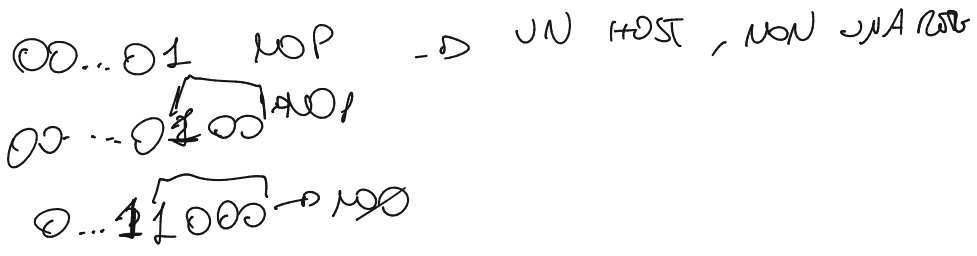
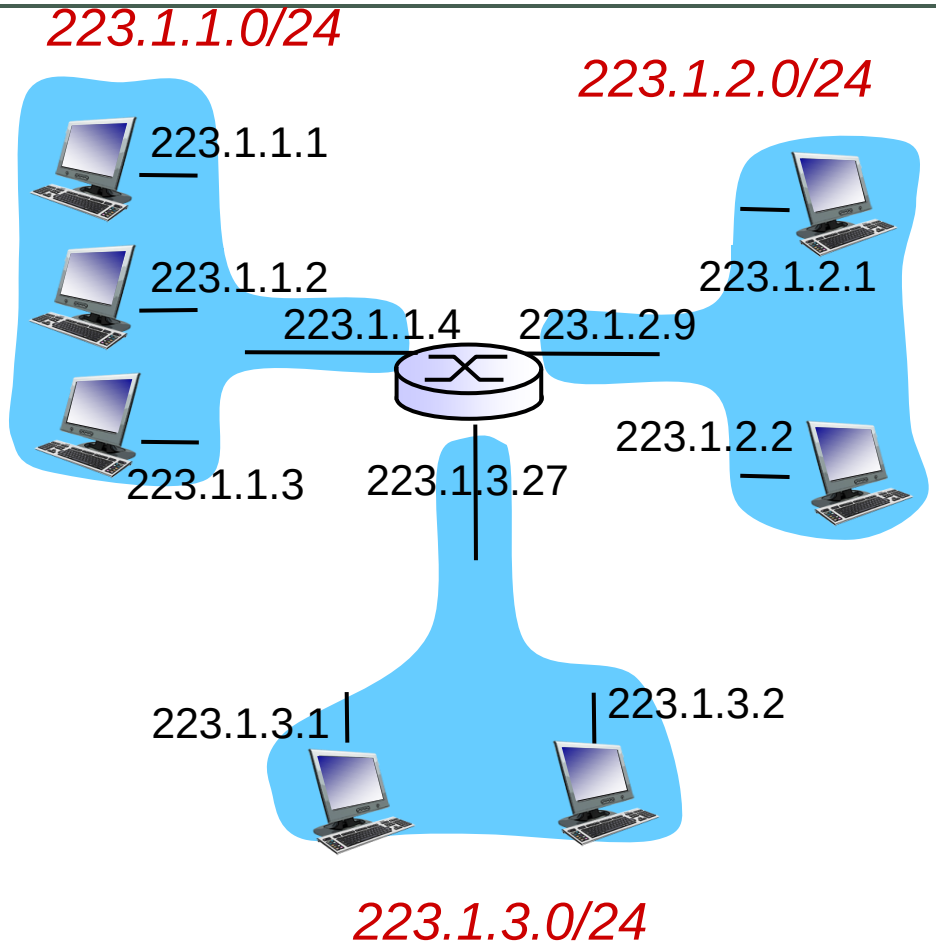
IP addressing: CIDR

- **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

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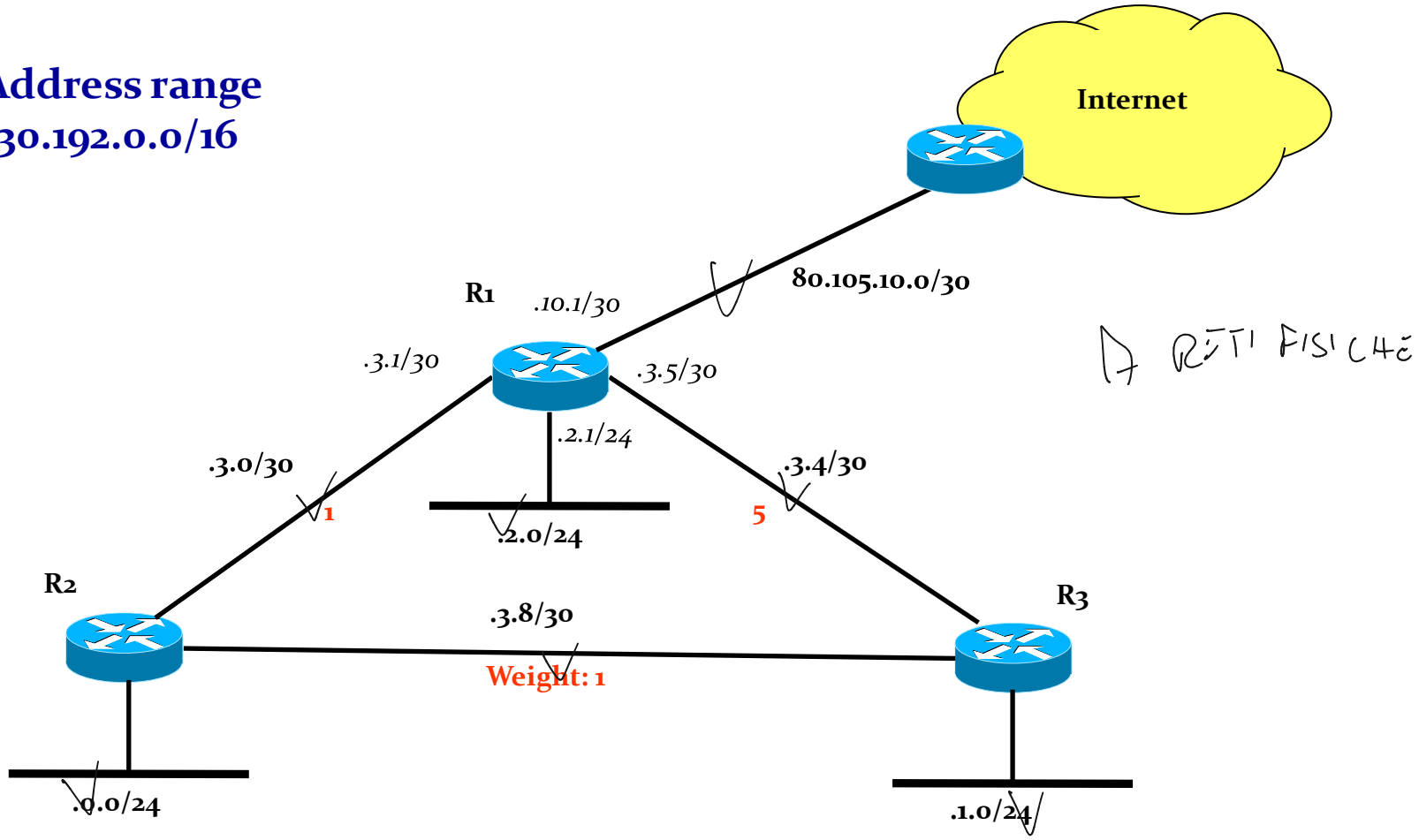
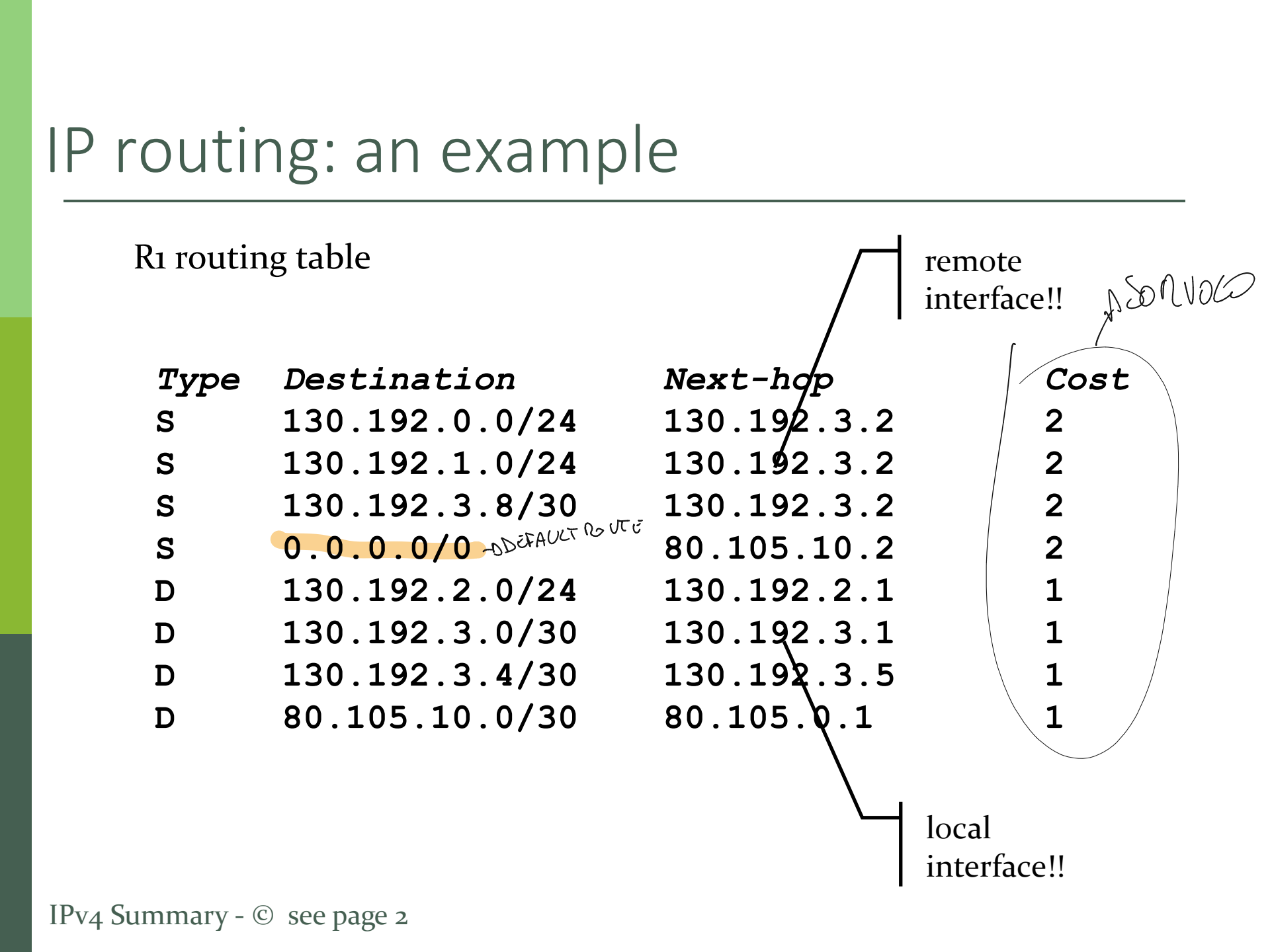
IP routing: an example



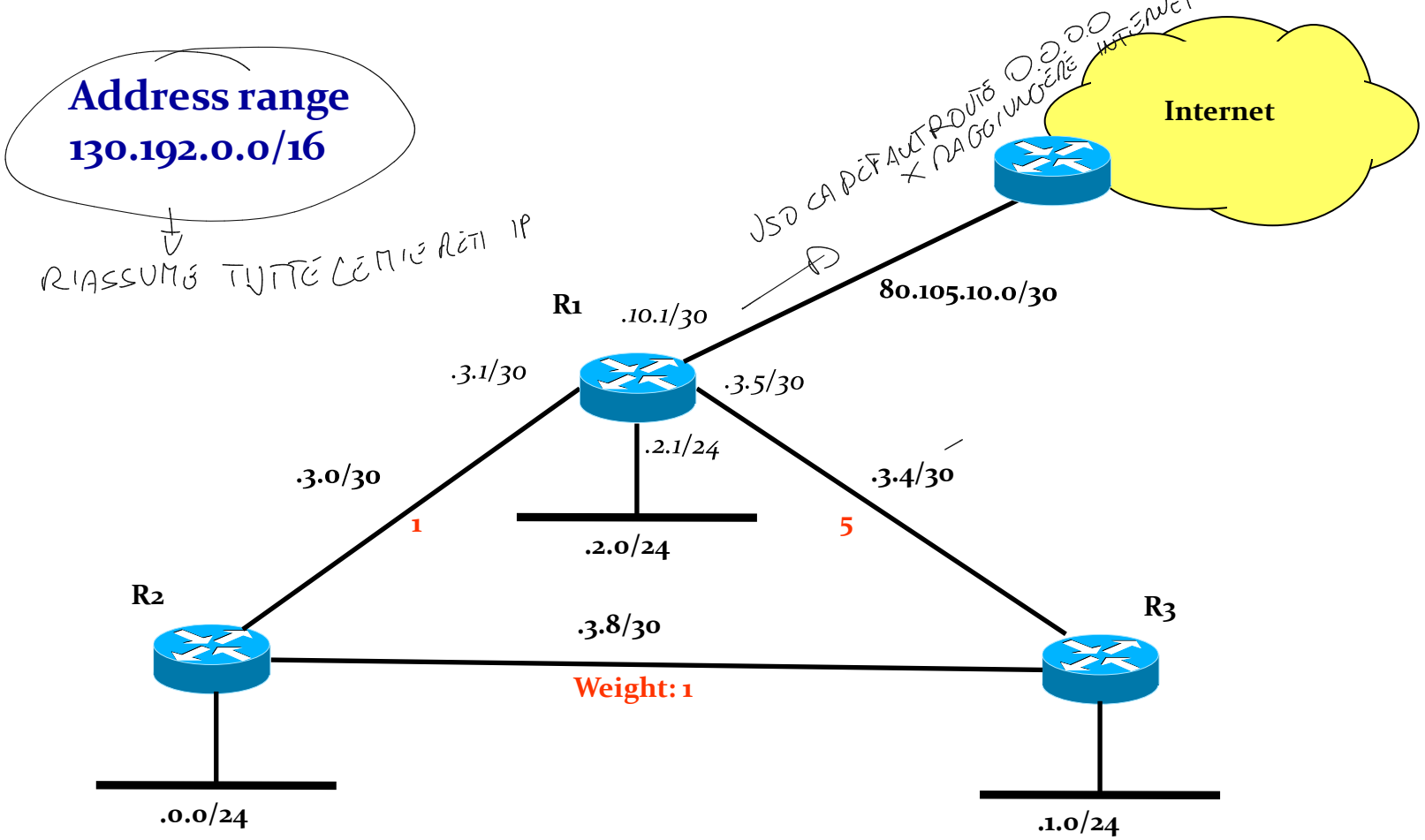
IP routing: an example

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



IP routing: an example of aggregazione



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

remote interface!!

local interface!!