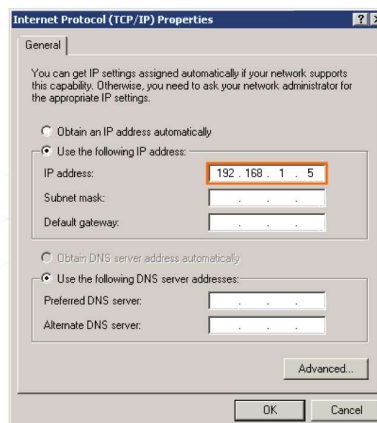


# NETWORKING – LEZIONE 2

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## Struttura indirizzo IP



I see you have assigned me an IP address 11000000.1010 1000.00000001. 0000101 Now other hosts can find me!



IP version 4 (IPv4) is the current form of addressing used on the Internet.

## Struttura indirizzo IP

4 byte di indirizzo e 4 di Maschera di rete

- Indirizzo: 192.168.0.12
- Maschera: 255.255.255.0

## Struttura indirizzo IP

- IP address: **192.168.12.28**
- Subnet Mask: **255.255.255.0**

Subnet Mask:  
**11111111.11111111.11111111.00000000**

CIDR Notation:

- 192.168.12.28/24

## Esempi

```

192.168.12.30          host
255.255.255.0
.....
192.168.30.0          network
255.255.255.0
.....
192.168.30.255       broadcast
255.255.255.0
.....
10.0.0.12            host
255.0.0.0
.....
10.0.0.0             network
255.0.0.0
.....
10.255.255.255      broadcast
255.0.0.0
    
```

## Classful IPv4 Addresses

IP Address Classes

| Address Class | 1st octet range (decimal) | 1st octet bits (green bits do not change) | Network(N) and Host(H) parts of address | Default subnet mask (decimal and binary) | Number of possible networks and hosts per network               |
|---------------|---------------------------|---|---|--|---|
| A             | 1-127**                   | 00000000-01111111                         | N.H.H.H                                 | 255.0.0.0                                | 128 nets ( $2^7$ )<br>16,777,214 hosts per net ( $2^{24-2}$ )   |
| B             | 128-191                   | 10000000-10111111                         | N.N.H.H                                 | 255.255.0.0                              | 16,384 nets ( $2^{14}$ )<br>65,534 hosts per net ( $2^{16-2}$ ) |
| C             | 192-223                   | 11000000-11011111                         | N.N.N.H                                 | 255.255.255.0                            | 2,097,150 nets ( $2^{21}$ )<br>254 hosts per net ( $2^{8-2}$ )  |
| D             | 224-239                   | 11100000-11101111                         | NA (multicast)                          |  |   |
| E             | 240-255                   | 11110000-11111111                         | NA (experimental)                       |  |   |

\*\* All zeros (0) and all ones (1) are invalid hosts addresses.

# Reti private e pubbliche

## IP Privati

- ❑ 10.0.0.0 – 10.255.255.255 mask 255.0.0.0
- ❑ 172.16.0.0 – 172.31.255.255 mask 255.240.0.0
- ❑ 192.168.0.0 – 192.168.255.255 mask 255.255.0.0

# Aritmetica binaria

## Binary To Decimal Conversion

| Exponent                   | $2^7$ | $2^6$ | $2^5$ | $2^4$ | $2^3$ | $2^2$ | $2^1$ | $2^0$ |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Position                   | 128   | 64    | 32    | 16    | 8     | 4     | 2     | 1     |
| Bits                       | 1     | 1     | 1     | 1     | 0     | 1     | 0     | 1     |
| 1 BYTE / 1 Octet           |       |       |       |       |       |       |       |       |
| Add these numbers together | 128   | + 64  | + 32  | + 16  | + 0   | + 4   | + 0   | + 1   |
| Decimal                    | 245   |       |       |       |       |       |       |       |

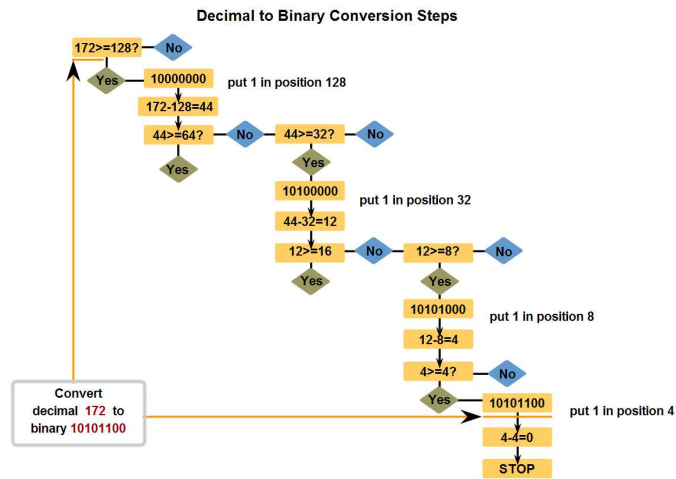
A 1 in this position means 64 is added to the total.

A 0 in any position means that 0 is added to the total.

11110101 in Binary = Decimal Number 245

# Aritmetica binaria

## Conversione da decimale a binario



# Aritmetica binaria (cont)

## Facciamo pratica

### Decimal to Binary Conversion Activity

Given a decimal value, enter the correct binary values for each position.

| Decimal Value | 209                  |                      |                      |                      |                      |                      |                      |                      |
|---------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Exponent      | 2 <sup>7</sup> th    | 2 <sup>6</sup> th    | 2 <sup>5</sup> th    | 2 <sup>4</sup> th    | 2 <sup>3</sup> rd    | 2 <sup>2</sup> nd    | 2 <sup>1</sup> st    | 2 <sup>0</sup>       |
| Position      | 128                  | 64                   | 32                   | 16                   | 8                    | 4                    | 2                    | 1                    |
| Bit           | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

Enter numbers for these 8 positions.

## Definire Indirizzi IPv4

### □ Diversi tipi di indirizzo IP

|                   | Address Types |          |          |          |
|-------------------|---------------|----------|----------|----------|
|                   | Network       |          |          | Host     |
| Network Address   | 10            | 0        | 0        | 0        |
|                   | 00001010      | 00000000 | 00000000 | 00000000 |
| Broadcast Address | 10            | 0        | 0        | 255      |
|                   | 00001010      | 00000000 | 00000000 | 11111111 |
| Host Address      | 10            | 0        | 0        | 1        |
|                   | 00001010      | 00000000 | 00000000 | 00000001 |

## Esempi

- 192.168.12.30      255.255.255.0      host
- 192.168.30.0      255.255.255.0      network
- 192.168.30.255      255.255.255.0      broadcast

## Classificare e Definire Indirizzi IPv4

Determinare the network, broadcast and host address per un dato indirizzo e mask

- 12.0.30.15 / 8
- 194.30.27.32/24
- 180.12.23.75/16

## Reti private e pubbliche

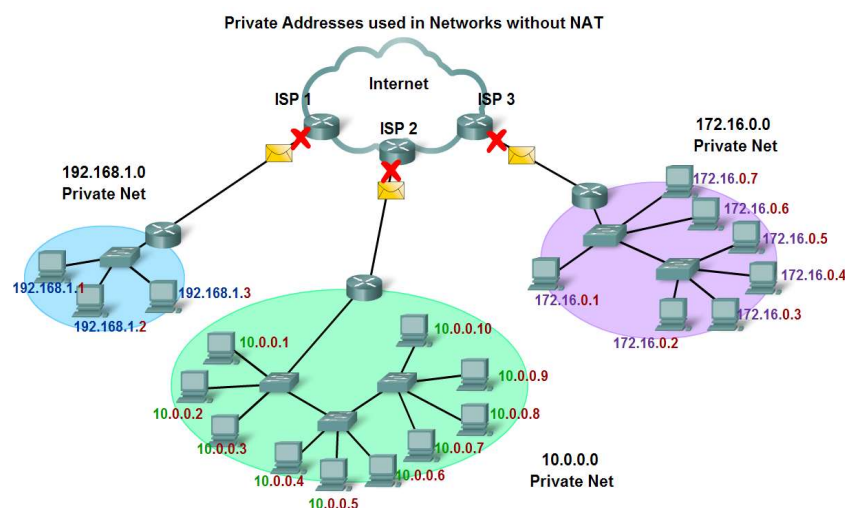
### IP Privati

- 10.0.0.0 – 10.255.255.255 mask 255.0.0.0
- 172.16.0.0 – 172.31.255.255 mask 255.240.0.0
- 192.168.0.0 – 192.168.255.255 mask 255.255.0.0

## IPv4 Link local address

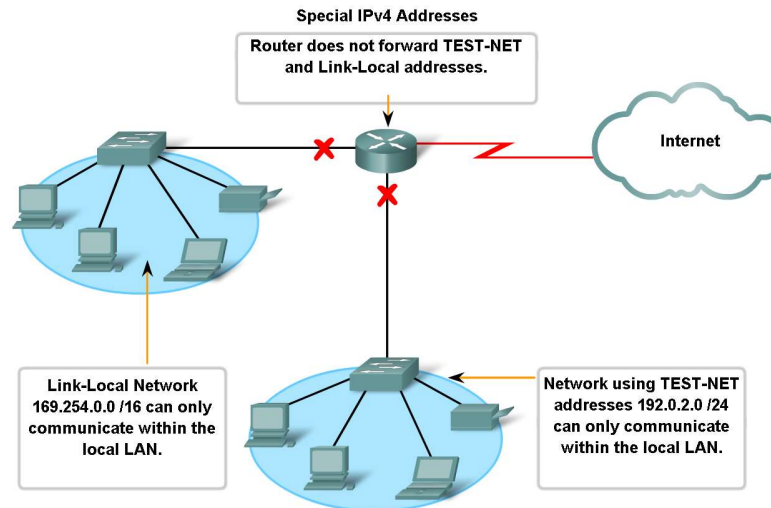
- Indirizzi configurati automaticamente, non routable
- RFC 3927 riserva la gamma 169.254.0.0/16
- 169.254.0.0/24 e 169.254.255.0/24 riservate per scopi futuri

## Reti private



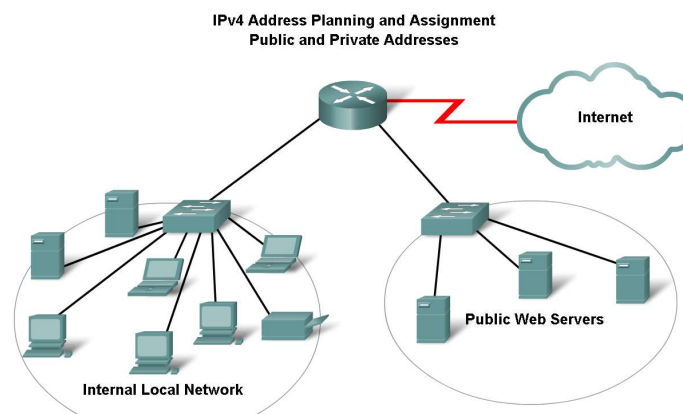


## Reti non instradabili



## Assegnazione degli indirizzi

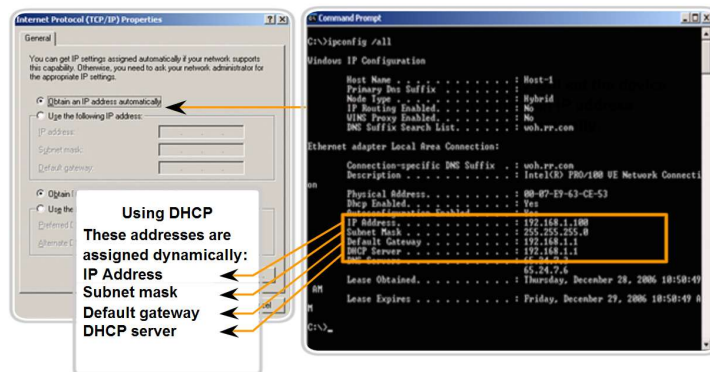
- Differenza tra IP pubblici e private: quando usare gli uni o gli altri?



# Assegnazione degli Indirizzi

□ Statica o dinamica (DHCP)

Assigning Dynamic Addresses



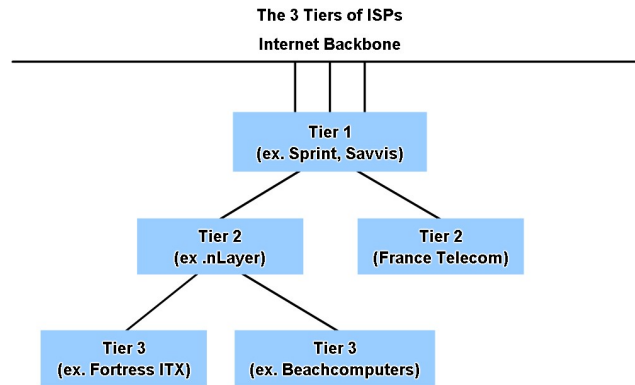
# Assegnazione degli IP pubblici

Entities that Oversee IP Address Allocation

| Global                       | IANA          |                     |                                    |                      |  |
|------------------------------|---------------|---------------------|------------------------------------|----------------------|--|
| Regional Internet Registries | AfriNIC       | APNIC               | LACNIC                             | ARIN                 | RIPE NCC                                 |
|                              | Africa Region | Asia/Pacific Region | Latin America And Caribbean Region | North America Region | Europe, Middle East, Central Asia Region |

# Assegnazione degli IP pubblici

## □ Diversi livelli di Provider



## Torniamo a Indirizzo e Maschera di rete

### Network and Host Portions of an IP Address

|                                 |          |   |          |   |          |   |          |
|---------------------------------|----------|---|----------|---|----------|---|----------|
| IP Address                      | 172      | . | 16       | . | 4        | . | 1        |
|                                 | 10101100 |   | 00010000 |   | 00000100 |   | 00000001 |
| Subnet Mask                     | 255      | . | 255      | . | 255      | . | 0        |
|                                 | 11111111 |   | 11111111 |   | 11111111 |   | 00000000 |
| Prefix /24 (24 high order bits) |          |   |          |   |          |   |          |

## Ruolo della Maschera di rete

Applying the Subnet Mask  
A device with address 192.0.0.1 belongs to network 192.0.0.0

|                 | High order bits<br>Prefix /16 |          | Low order bits |          |
|-----------------|-------------------------------|----------|----------------|----------|
|                 | 192                           | 0        | 0              | 1        |
| Host Address    | 11000000                      | 00000000 | 00000000       | 00000001 |
| Subnet Mask     | 255                           | 255      | 0              | 0        |
|                 | 11111111                      | 11111111 | 00000000       | 00000000 |
| Network Address | 11000000                      | 00000000 | 00000000       | 00000000 |
| Network         | 192                           | 0        | 0              | 0        |

## Calcolare l'indirizzo di rete

- Indirizzo di rete =  
Ip address AND Subnet Mask

## Regola base dell'indirizzamento IP

- Host che invia il pacchetto calcola indirizzo di rete proprio e del destinatario
- Mittente e destinatario stanno sulla stessa rete?
- SI:
  - Invio direttamente il pacchetto al destinatario
- NO:
  - Se è configurato un gateway:
    - Consegno il pacchetto al gateway
  - NO:
    - Scarto il pacchetto

esempi

Tutto chiaro?????

Domande????

02/05/2020

N.B.S. - Ing. M. Giustiniani