

**ESCOLA
SUPERIOR
DE TECNOLOGIA
E GESTÃO**

P.PORTO

REDES DE COMPUTADORES I – Endereçamento IP

Sumário

1. Public vs. Private
2. IPv4 vs. IPv6
3. IPv4 subnetting
4. IPv6 concepts
5. Virtual IP (VIP)
6. Subinterfaces

Binário

- IPv4 32 bits
- IPv6 128 bits
- Base 10

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| 2^7 | 2^6 | 2^5 | 2^4 | 2^3 | 2^2 | 2^1 | 2^0 |

Binário

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| 1 | | | | | | | |

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| 1 | 0 | | | | | | |

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| 1 | 0 | 0 | | | | | |

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| 1 | 0 | 0 | 1 | | | | |

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| 1 | 0 | 0 | 1 | 0 | | | |

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| 1 | 0 | 0 | 1 | 0 | 1 | | |

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| 1 | 0 | 0 | 1 | 0 | 1 | 1 | |

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |

1x128

1x128+0x64

1x128+0x64+0x32

1x128+0x64+0x32+1x16

1x128+0x64+0x32+1x16+0x8

1x128+0x64+0x32+1x16+0x8+1x4

1x128+0x64+0x32+1x16+0x8+1x4+1x2

1x128+0x64+0x32+1x16+0x8+1x4+1x2+0x1

15
0

Binário

- Exercício

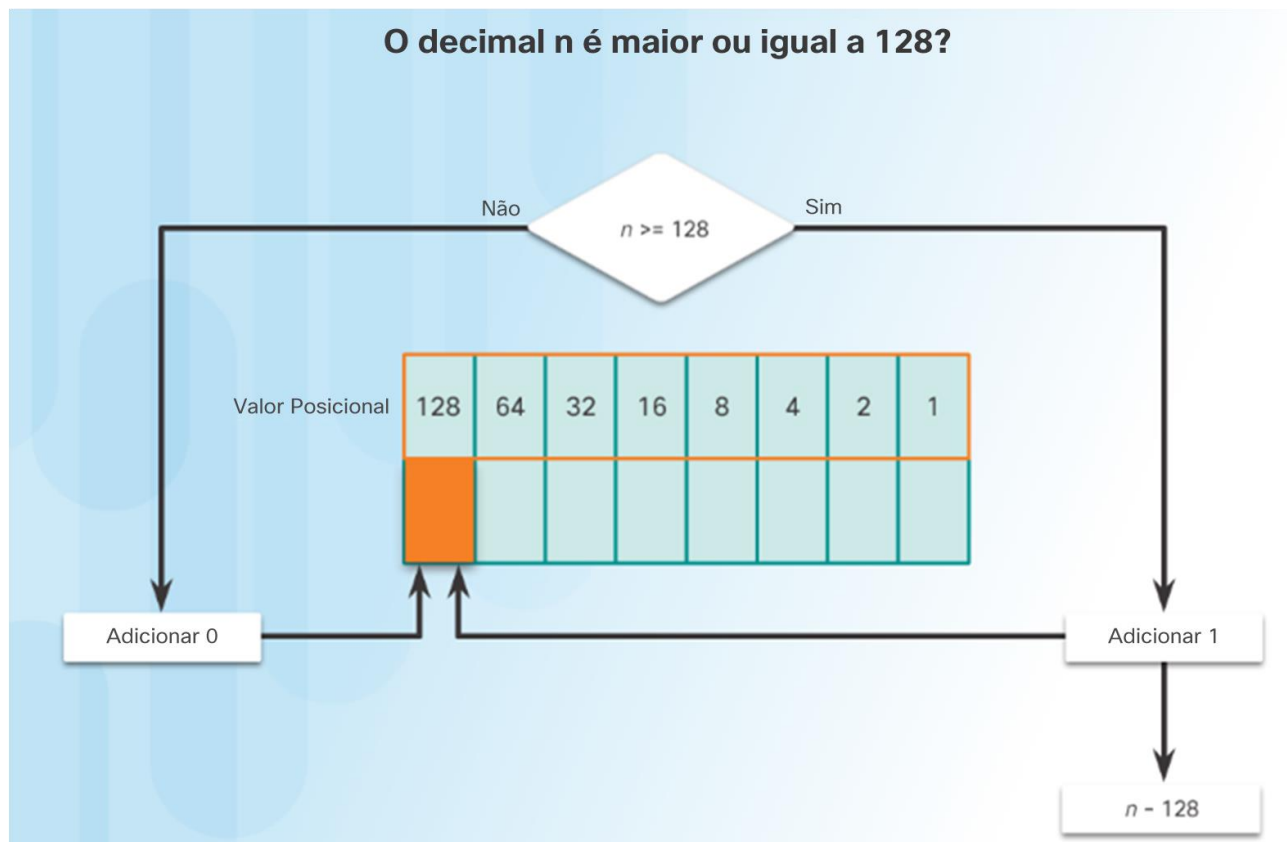
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| | | | | | | | |

Binário

- Exercício

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 |
| | | | | | | | |

Conversão de decimal para binário



Conversão de decimal para binário

Exemplo: 192.168.10.11

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

11000000 . _____ . _____ . _____

Exemplo: 192.168.10.11

| Valor Posicional | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|------------------|-----|----|----|----|---|---|---|---|
| | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |

11000000 . 10101000 . _____ . _____

Exemplo: 192.168.10.11

| Valor Posicional | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|------------------|-----|----|----|----|---|---|---|---|
| | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |

11000000 . 10101000 . 00001010 . _____

Exemplo: 192.168.10.11

| Valor Posicional | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|------------------|-----|----|----|----|---|---|---|---|
| | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |

11000000 . 10101000 . 00001010 . 00001011

Conversão de decimal para binário

- Exercício

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| | | | | | | | |
| 49 | | | | | | | |

Conversão de decimal para binário

- Exercício

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| | | | | | | | |
| 236 | | | | | | | |

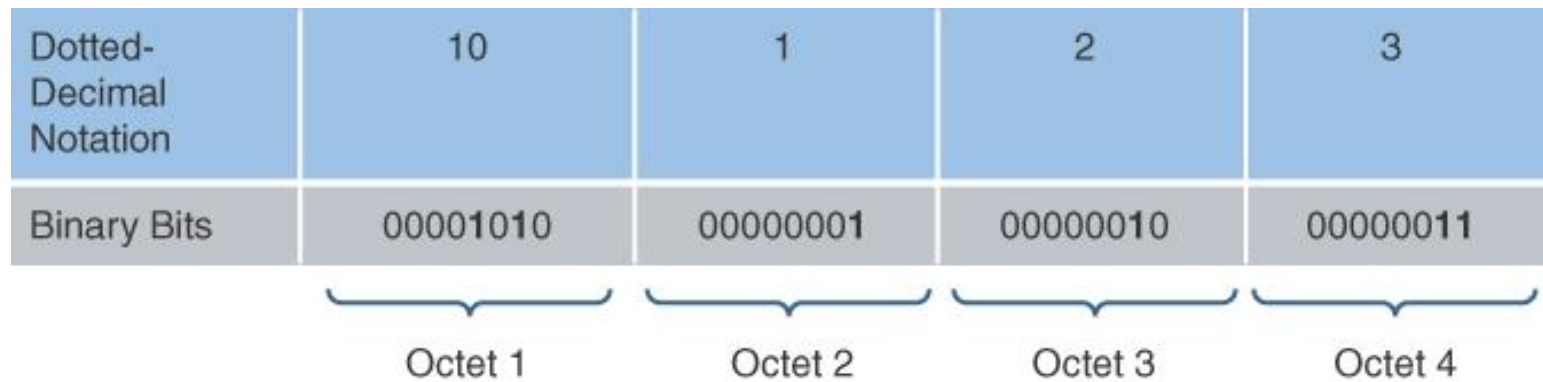
Conversão de decimal para binário

- Exercício

| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
|-----|----|----|----|---|---|---|---|
| | | | | | | | |
| 236 | | | | | | | |

IPv4 Address Structure

- IPv4 32 bits
- Subnet mask A 32-bit value (in IPv4) that indicates what portion of the IP address is the network ID versus what portion is the host ID.



IPv4 Address Structure

- network address
 - 255.0.0.0
 - /8

| Dotted-Decimal Notation | 10 | 1 | 2 | 3 |
|-------------------------|----------|----------|----------|----------|
| IP Address (in Binary) | 00001010 | 00000001 | 00000010 | 00000011 |
| Subnet Mask | 11111111 | 00000000 | 00000000 | 00000000 |

Network Bits Host Bits

Classes of Addresses

| Address Class | Value in First Octet | Classful Mask (Dotted Decimal) | Classful Mask (Prefix Notation) |
|---------------|----------------------|--------------------------------|---------------------------------|
| Class A | 1–126 | 255.0.0.0 | /8 |
| Class B | 128–191 | 255.255.0.0 | /16 |
| Class C | 192–223 | 255.255.255.0 | /24 |
| Class D | 224–239 | — | — |
| Class E | 240–255 | — | — |

Loopback Address

| Address Class | Value in First Octet | Classful Mask (Dotted Decimal) | Classful Mask (Prefix Notation) |
|---------------|----------------------|--------------------------------|---------------------------------|
| Class A | 1–126 | 255.0.0.0 | /8 |
| Class B | 128–191 | 255.255.0.0 | /16 |
| Class C | 192–223 | 255.255.255.0 | /24 |
| Class D | 224–239 | — | — |
| Class E | 240–255 | — | — |

127.0.0.1/32 ←

Internet Corporation for Assigned Names and Numbers (ICANN) globally manages publicly routable IP addresses.

Private IP Networks

| Address Class | Address Range | Default Subnet Mask |
|---------------|---------------------------------|---------------------|
| Class A | 10.0.0.0– 10.255.255.255 | 255.0.0.0 |
| Class B | 172.16.0.0– 172.31.255.255 | 255.255.0.0 |
| Class B | 169.254.0.0– 169.254.255.255 | 255.255.0.0 |
| Class C | 192.168.0.0– 192.168.255.255 | 255.255.255.0 |

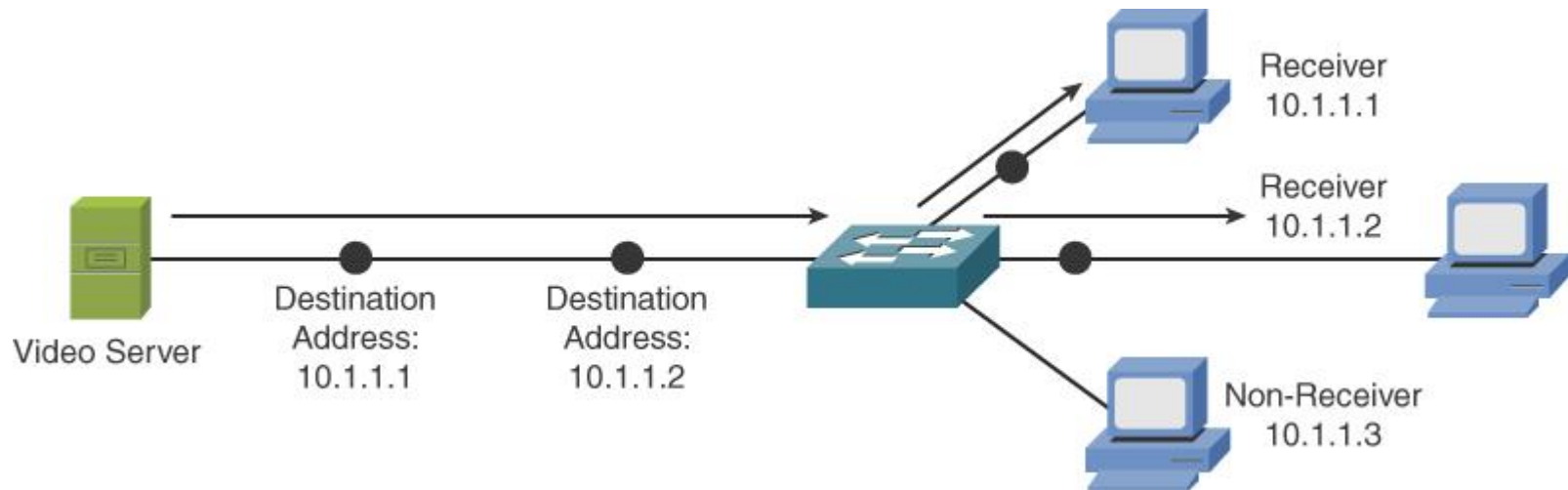
RFC (Private) 1918 Addresses

Private IP Networks APIPA

- Automatic Private IP Addressing (APIPA)
- 169.254.0.0–169.254.255.255 address range is not routable

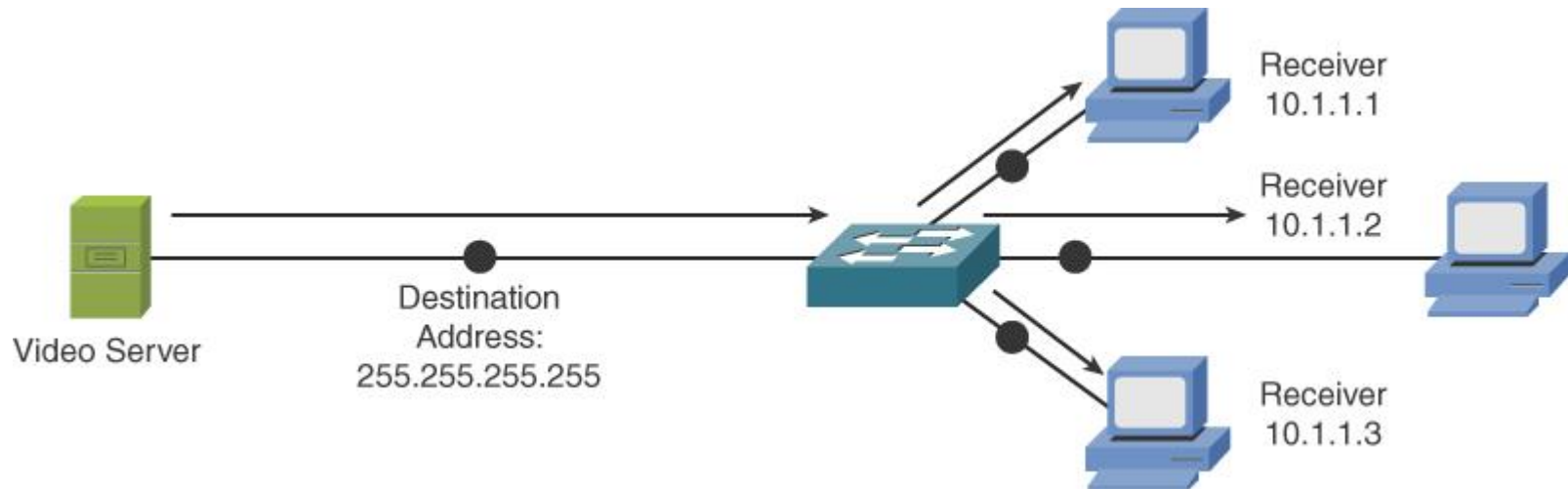
Types of Addresses

- Unicast A one-to-one communication flow.



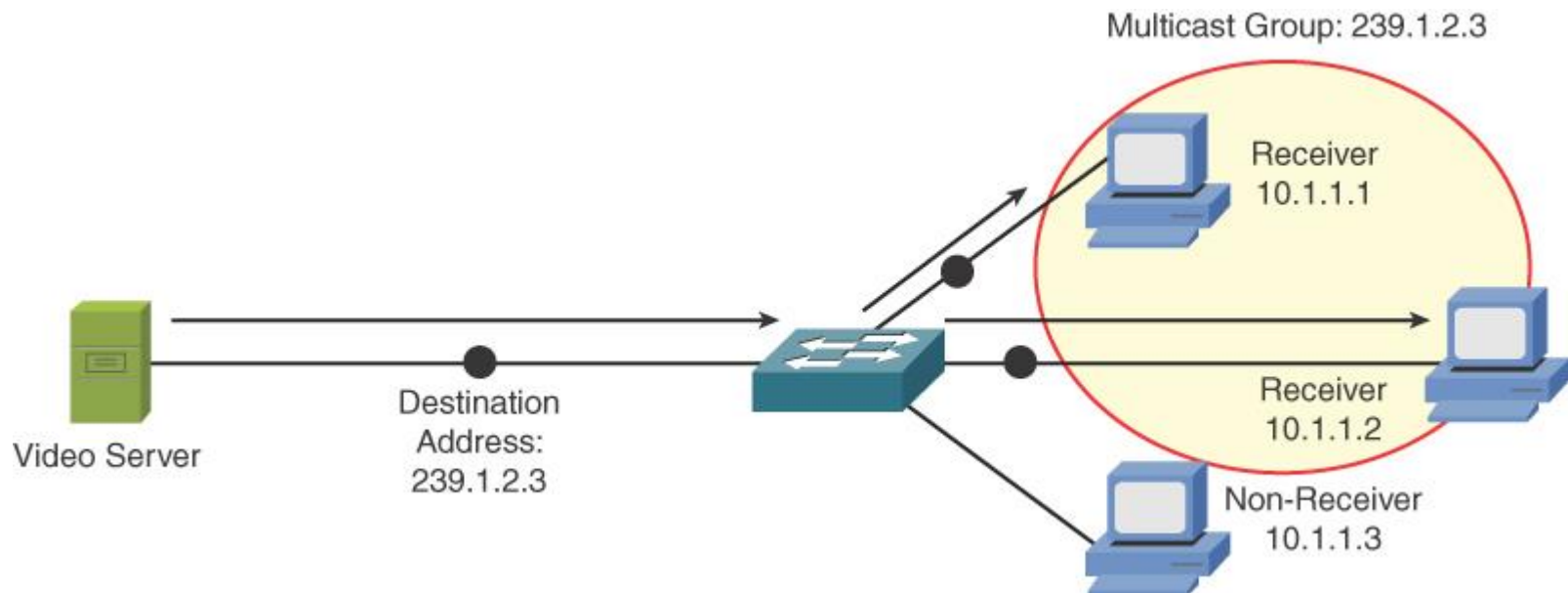
Types of Addresses

- Broadcast A a single source to all destinations on a network (*broadcast domain*)



Types of Addresses

- Multicast A one-to-many communication flow.

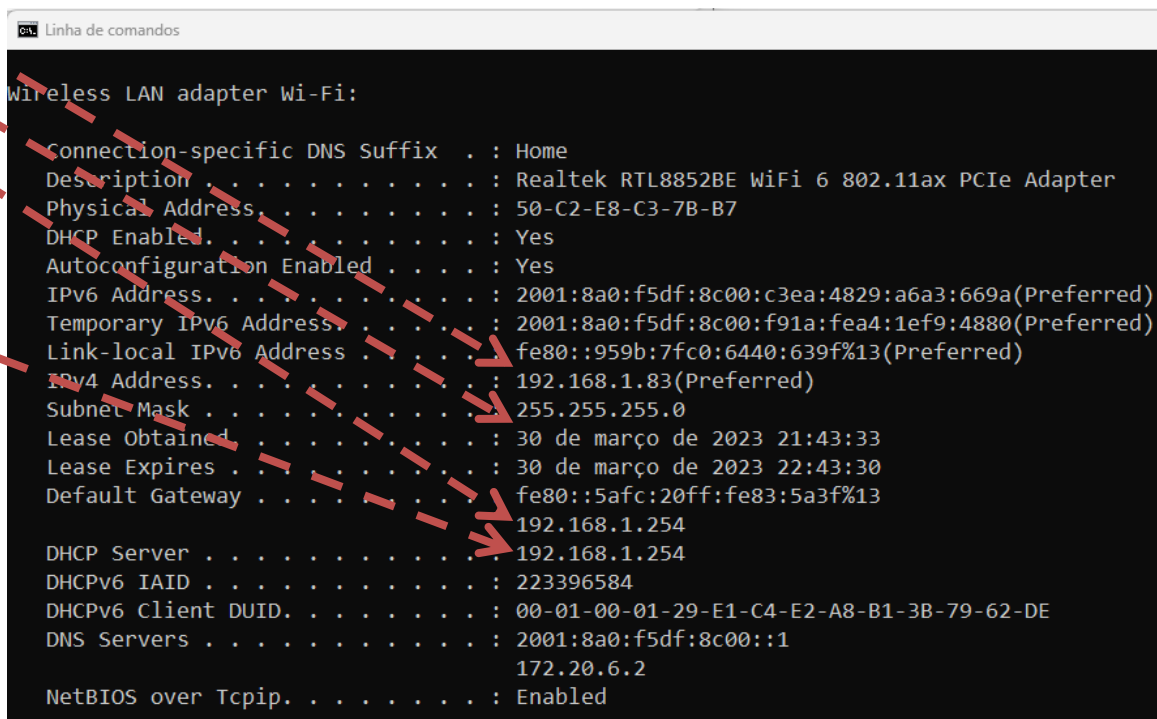


Assigning IPv4 Addresses

- A network address defines the entire network and all of the hosts inside it. This address cannot be assigned to a specific device.
- A host address defines one specific device inside of that network. This address can be assigned to a single device.
- A broadcast address represents all of the hosts within a specific network. All devices within the network are programmed to accept messages sent to this address.

Assigning IPv4 Addresses

- IP address
- Subnet mask
- Default gateway
- Server address

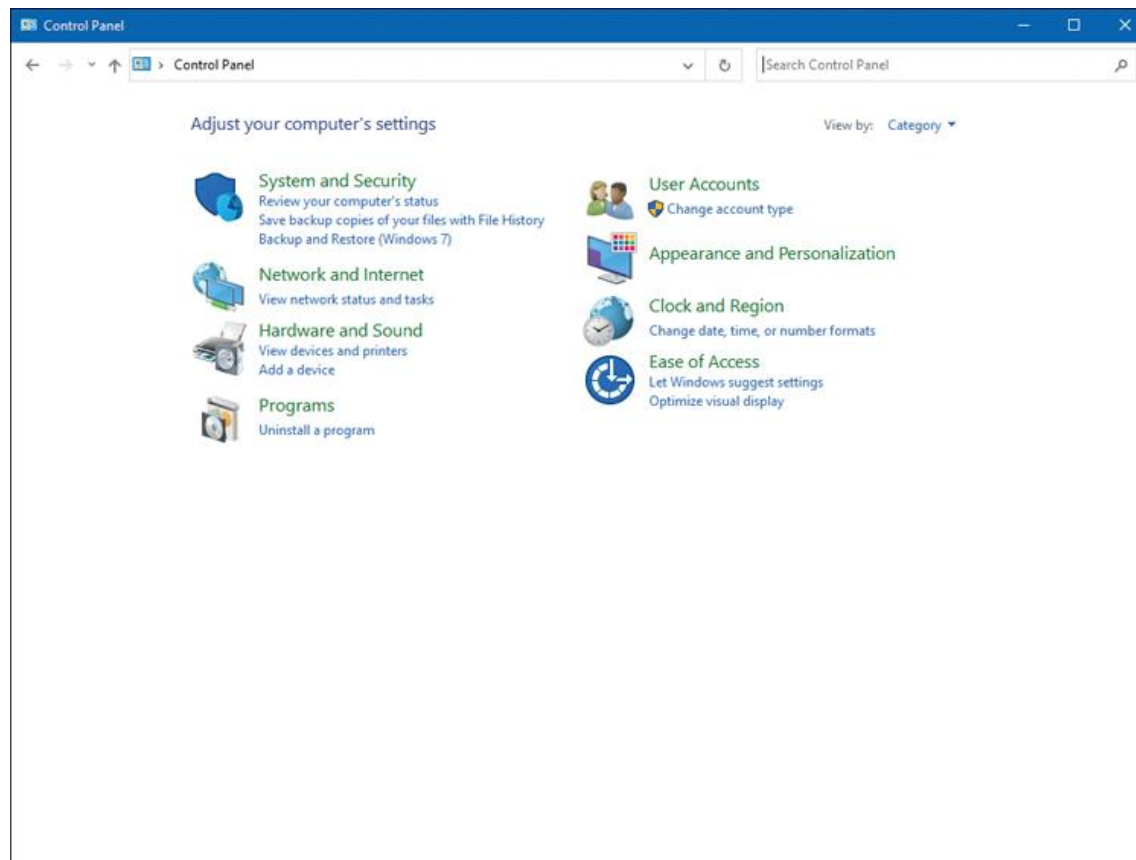


```
Windows PowerShell
C:\> ipconfig /all

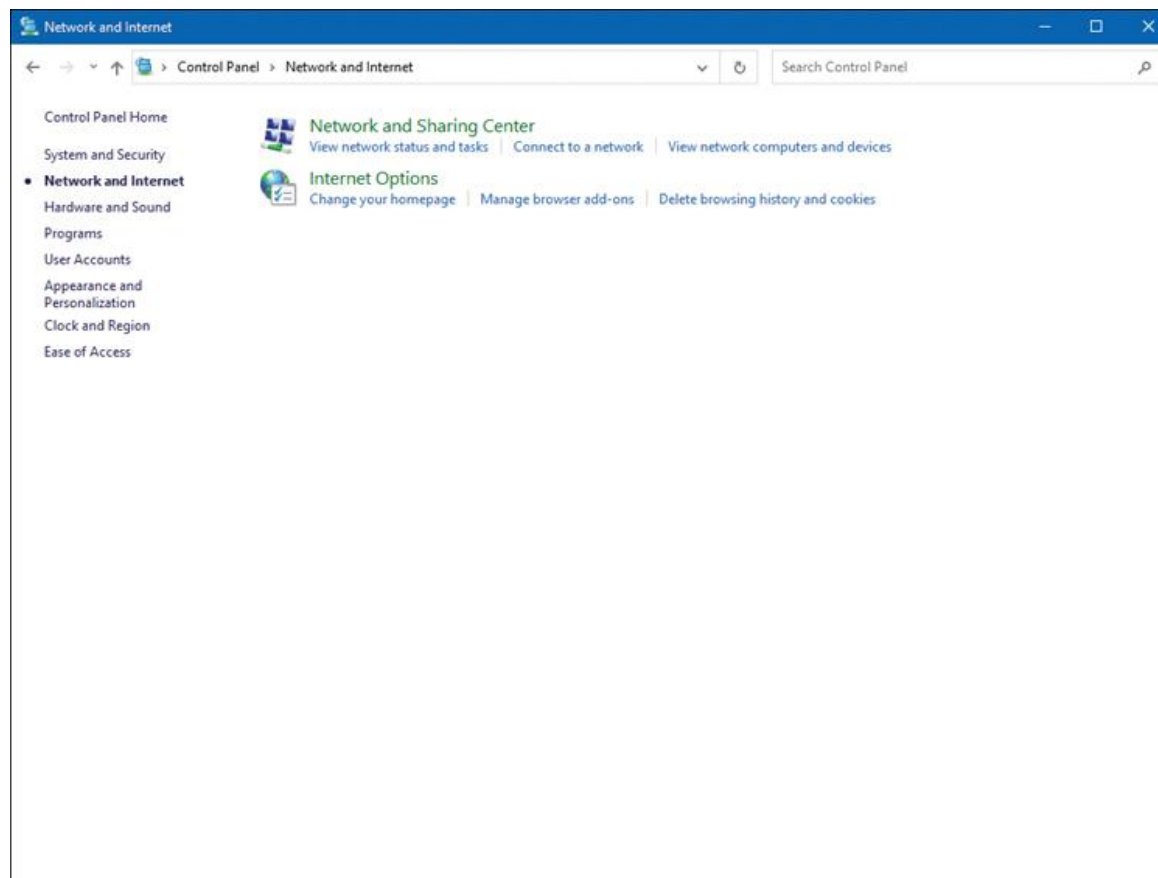
Wireless LAN adapter Wi-Fi:

    Connection-specific DNS Suffix  . : Home
    Description . . . . . : Realtek RTL8852BE WiFi 6 802.11ax PCIe Adapter
    Physical Address. . . . . : 50-C2-E8-C3-7B-B7
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    IPv6 Address. . . . . : 2001:8a0:f5df:8c00:c3ea:4829:a6a3:669a(Preferred)
    Temporary IPv6 Address. . . . . : 2001:8a0:f5df:8c00:f91a:fea4:1ef9:4880(Preferred)
    Link-local IPv6 Address . . . . . : fe80::959b:7fc0:6440:639f%13(Preferred)
    IPv4 Address. . . . . : 192.168.1.83(Preferred)
    Subnet Mask . . . . . : 255.255.255.0
    Lease Obtained. . . . . : 30 de março de 2023 21:43:33
    Lease Expires . . . . . : 30 de março de 2023 22:43:30
    Default Gateway . . . . . : fe80::5afc:20ff:fe83:5a3f%13
                                192.168.1.254
    DHCP Server . . . . . : 192.168.1.254
    DHCPv6 IAID . . . . . : 223396584
    DHCPv6 Client DUID. . . . . : 00-01-00-01-29-E1-C4-E2-A8-B1-3B-79-62-DE
    DNS Servers . . . . . : 2001:8a0:f5df:8c00::1
                                172.20.6.2
    NetBIOS over Tcpip. . . . . : Enabled
```

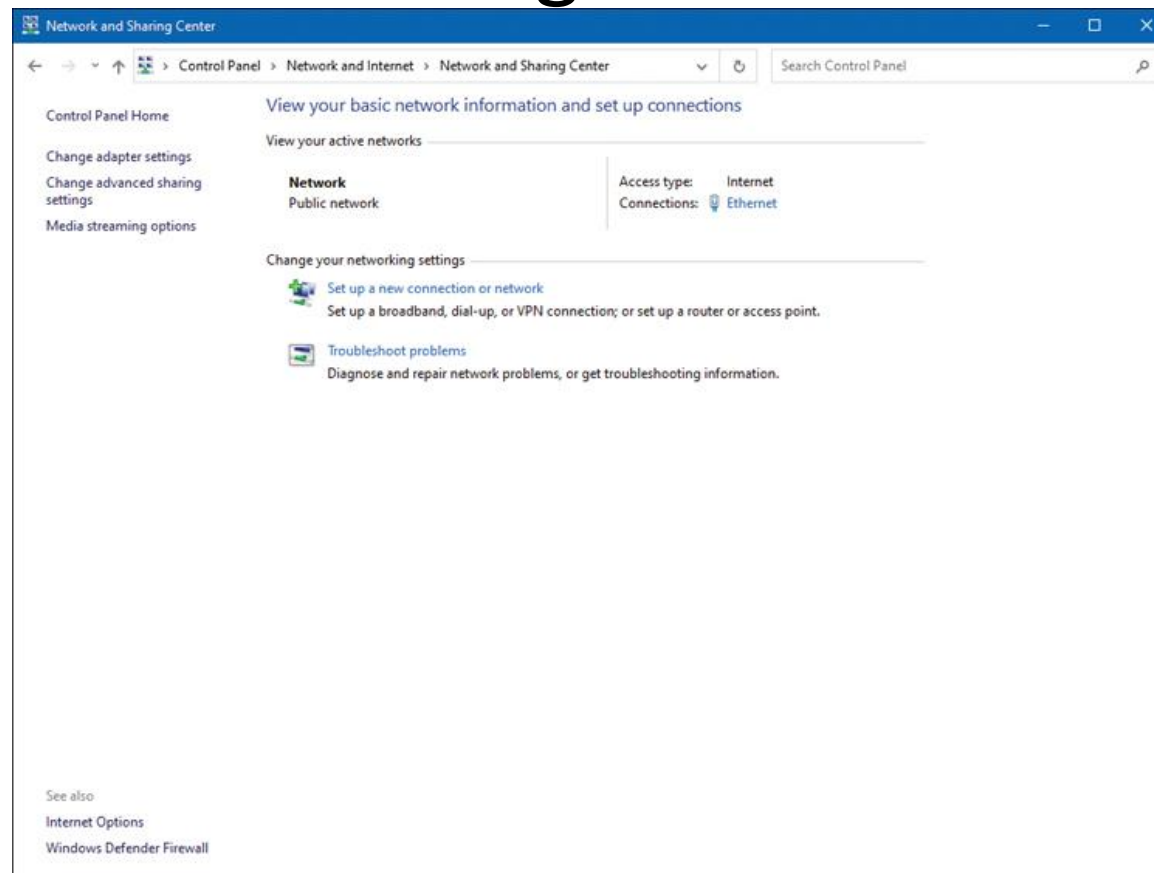
Assigning IPv4 Addresses Static Configuration



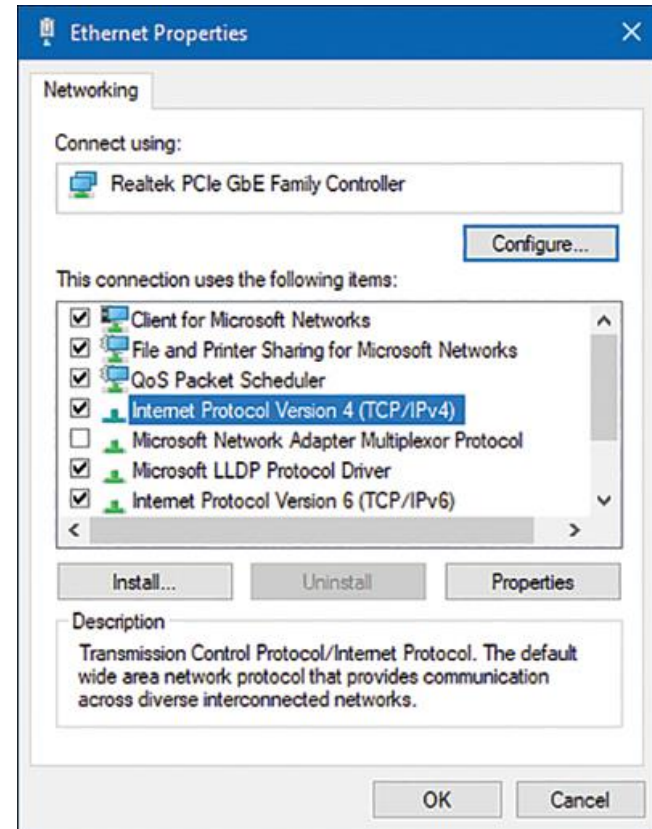
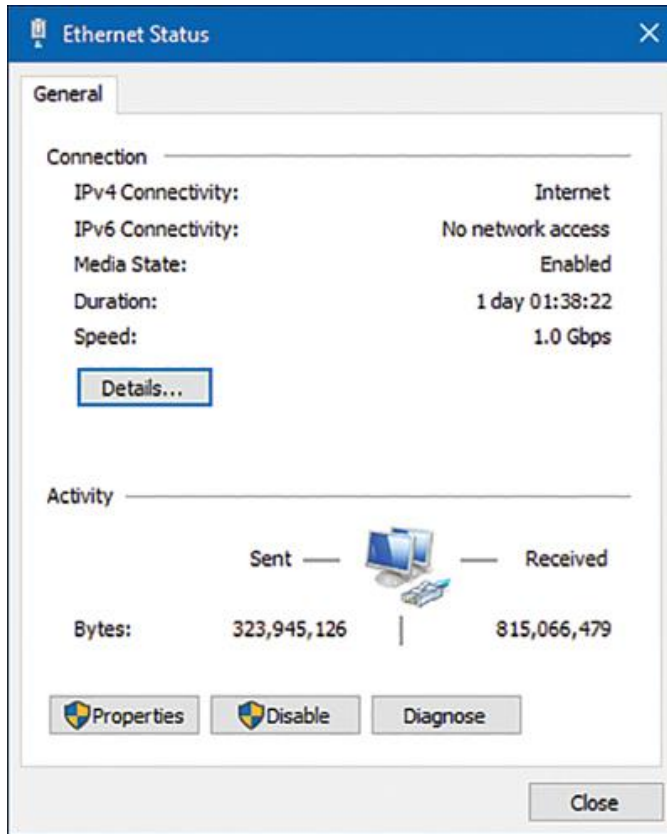
Assigning IPv4 Addresses Static Configuration



Assigning IPv4 Addresses Static Configuration



Assigning IPv4 Addresses Static Configuration



Assigning IPv4 Addresses Static Configuration



Internet Protocol Version 4 (TCP/IPv4) Properties

General Alternate Configuration

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

☒ Obtain an IP address automatically

☐ Use the following IP address:

IP address: . . .

Subnet mask: . . .

Default gateway: . . .

☒ Obtain DNS server address automatically

☐ Use the following DNS server addresses:

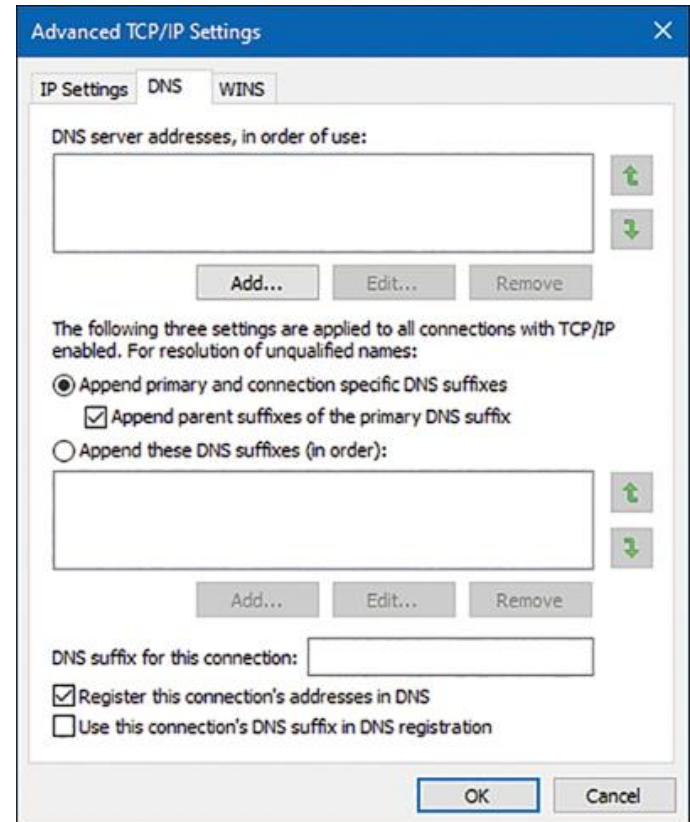
Preferred DNS server: . . .

Alternate DNS server: . . .

☐ Validate settings upon exit

Advanced...

OK Cancel



Advanced TCP/IP Settings

IP Settings DNS WINS

DNS server addresses, in order of use:

. . .

Add... Edit... Remove

The following three settings are applied to all connections with TCP/IP enabled. For resolution of unqualified names:

☒ Append primary and connection specific DNS suffixes

☒ Append parent suffixes of the primary DNS suffix

☐ Append these DNS suffixes (in order):

. . .

Add... Edit... Remove

DNS suffix for this connection: . . .

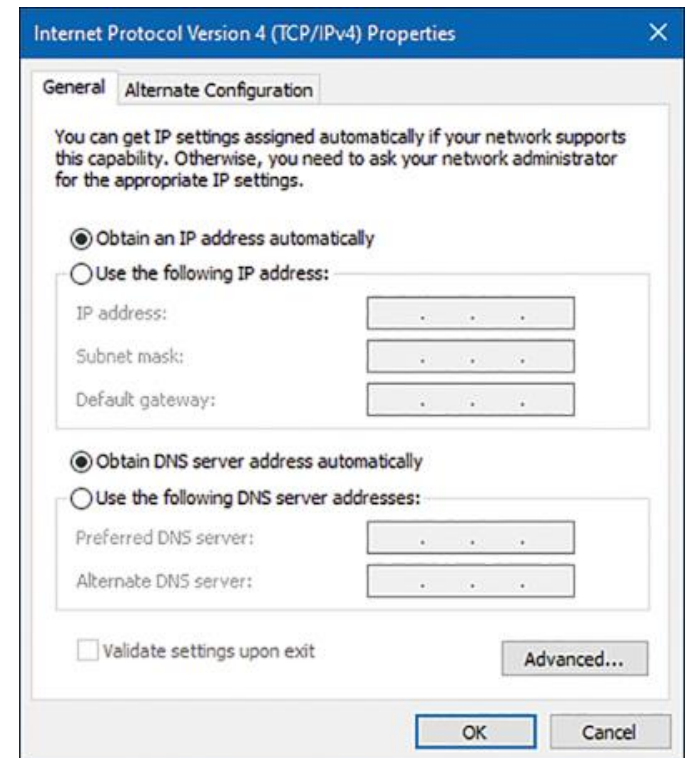
☒ Register this connection's addresses in DNS

☐ Use this connection's DNS suffix in DNS registration

OK Cancel

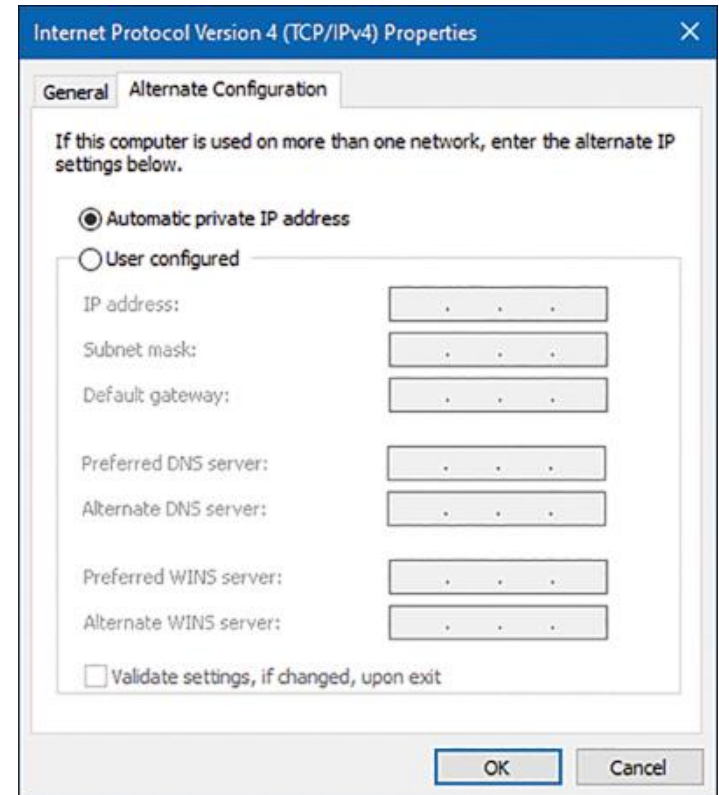
Assigning IPv4 Addresses Dynamic Configuration

Dynamic Host Configuration Protocol (DHCP) A protocol that dynamically assigns IP address information (for example, IP address, subnet mask, DNS server's IP address, and default gateway's IP address) to network devices.



Assigning IPv4 Addresses Automatic Private IP Addressing

Automatic Private IP Addressing (APIPA) A feature that allows a networked device to self-assign an IP address from the 169.254.0.0/16 network. Note that this address is usable only on the device's local subnet (meaning that the IP address is not routable).



Assigning IPv4 Addresses – Network Devices

Cisco CLI:

Router# sh  = Router# show

Entrar no modo EXEC privilegiado

Router >enable

Router#

Lists all commands available in the current command mode

Router#?

Lists all the possible choices that start with the letter c

Router#c?

Assigning IPv4 Addresses – Network Devices

Logs a user off:

Router# exit

Moves you back one level

Router(config-if)# exit

Moves you from privileged EXEC mode back to user mode

Router# disable

Displays information about the current Cisco IOS Software

Router# show

Displays configuration information

Router# show runningconfig

Assigning IPv4 Addresses – Network Devices

Saves the configuration to NVRAM

ISP# copy running-config startup-config

Moves to global configuration mode

Router># configure terminal

Moves to interface configuration mode

CORP(config)# interface serial 0/0/0

Assigns an IP address and netmask

CORP(config-if)# ip address 192.31.7.6 255.255.255.252

Enables the interface

CORP(config-if)# no shutdown

LABS



Bibliografia

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- ODOM, Wendell. *CCNA 200-301 Official Cert Guide, Volume 2*. Cisco Press, 2019.
- ODOM, W. *CCNA 200-301, Volume 1 Official Cert Guide*. 2019.