



UNIVERSIDADE
LUSÓFONA

Relatório Técnico Projeto de Redes de Computadores

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1. Introdução

Este relatório descreve a implementação de uma rede empresarial para a empresa **Omicron Lda.** utilizando o simulador Cisco Packet Tracer. O projeto envolveu a criação de uma infraestrutura de rede completa que conecta a sede em Coimbra com quatro filiais (Porto, Tavira, Viseu e Ericeira), implementando VLANs departamentais, serviços centralizados e conectividade WiFi.

A rede foi projetada para suportar diferentes departamentos (Servidores, RH, Financeiro, Logístico, Administração e TI) distribuídos pelas várias localizações, garantindo comunicação eficiente e acesso centralizado aos recursos da empresa

2. Topologia da Rede

2.1. Arquitetura geral

A rede implementada segue uma topologia **estrela hierárquica** com Coimbra como centro de todas as comunicações. Todas as filiais conectam-se diretamente à sede através de ligações WAN de 1 Gbps.

Localizações:

- **Coimbra (Sede)**: Centro da rede com serviços centralizados.
- **Porto**: Filial com departamentos Financeiro, Logístico e Administração.
- **Tavira**: Filial com departamentos Logístico e Administração.
- **Viseu**: Filial com departamentos Financeiro e Logístico.
- **Ericeira**: Filial com departamentos RH, Financeiro e TI.

2.2. Equipamentos Utilizados

Routers:

- 7x Cisco PT-Router (Coimbra, Porto, Tavira, Viseu, Ericeira, ISP, INTERNET).

Switches:

- 1x Cisco Catalyst 3650-24 (Switch Core em Coimbra).
- 7x Cisco 2960-24 (Switches de acesso).

Servidores:

- Servidor DHCP (10.19.7.2).
- Servidor Web (10.19.7.3).
- Servidor DNS(10.19.7.4).

Dispositivos Finais:

- 66 PCs distribuídos pelos departamentos.
- 1 Access Point WiFi (AP-PT-N).
- 1 Smartphone para teste WiFi.

3. Endereçamento e VLANs

3.1. Esquema de Endereçamento

Rede Principal: 10.0.0.0/8 (Classe A)

Interligações WAN: 172.16.19.0/24

Ligaçao ISP: 89.19.0.0/30

3.2. VLANs Implementadas

VLAN	Nome	Departamento	Localizações
119	Servidores	Servidores	Coimbra
219	RH	Recursos Humanos	Coimbra, Ericeira
319	Financeiro	Financeiro	Coimbra, Porto, Viseu, Ericeira
419	Logístico	Logístico	Porto, Tavira, Viseu
519	Administração	Administração	Coimbra, Porto, Tavira
619	TI	Tecnologias Informação	Coimbra, Ericeira

Seguindo o formato N19/19N para o grupo 19:

3.3. Sub-redes por Localização

Coimbra:

- 10.19.7.0/28 - Servidores (VLAN 119)
- 10.19.8.0/28 - RH (VLAN 219)
- 10.19.1.0/26 - Financeiro (VLAN 319)
- 10.19.5.0/27 - Administração (VLAN 519)
- 10.19.6.0/27 - TI (VLAN 619)

Porto:

- 10.19.9.0/28 - Financeiro (VLAN 319)

- 10.19.2.0/25 - Logístico (VLAN 419)
- 10.19.10.0/28 - Administração (VLAN 519)

Tavira:

- 10.19.3.0/24 - Logístico (VLAN 419)
- 10.19.11.0/28 - Administração (VLAN 519)

Viseu:

- 10.19.12.0/28 - Financeiro (VLAN 319)
- 10.19.4.0/25 - Logístico (VLAN 419)

Ericeira:

- 10.19.13.0/28 - RH (VLAN 219)
- 10.19.14.0/28 - Financeiro (VLAN 319)
- 10.19.15.0/28 - TI (VLAN 619)

4. Serviços Implementados

4.1. DHCP Centralizado

Implementámos um servidor DHCP centralizado em Coimbra (10.19.7.2) que atende todas as localizações através de **DHCP Relay** configurado nos routers das filiais. Esta abordagem centraliza a gestão de endereços IP e garante consistência na configuração.

4.2. DNS

O servidor DNS (10.19.7.2) resolve o nome `intranet.omicron.local` para o servidor web (10.19.7.3), permitindo acesso por nome em toda a rede. No entanto, embora tenha sido solicitado que fosse configurado um servidor DNS separado, acabou-se por utilizar o mesmo servidor do DHCP para essa função, o que, na verdade a utilização de um servidor DNS, é uma prática recomendada para uma implementação empresarial completa.

4.3. Servidor Web

O servidor web (10.19.7.3) hospeda a página da empresa com informações do projeto do Grupo 19.

4.4. WiFi

Implementámos uma rede WiFi em Coimbra usando um AP-PT-N conectado à VLAN 619 (TI).

5. Configurações Principais

5.1. Switch Core (Coimbra)

O Cisco 3650 atua como switch core com funcionalidades Layer 3, fazendo roteamento entre VLANs através de SVIs (Switch Virtual Interfaces). Esta configuração otimiza o desempenho local e reduz a carga no router principal.

5.2. Roteamento

Roteamento Estático: Configurado em todos os routers para garantir conectividade entre localizações.

NAT: Implementado no router ISP para permitir acesso à Internet de todas as localizações.

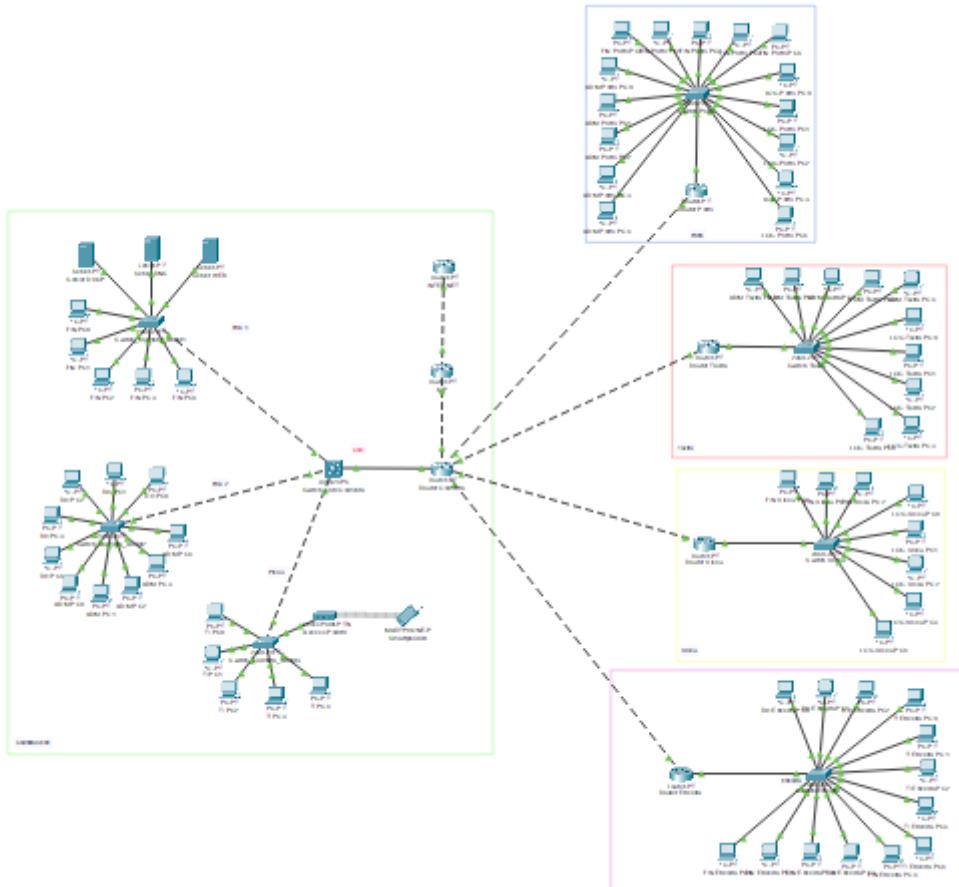
5.3. Interligações WAN

Todas as filiais conectam-se a Coimbra usando a rede 172.16.19.0/24 com sub-redes /30:

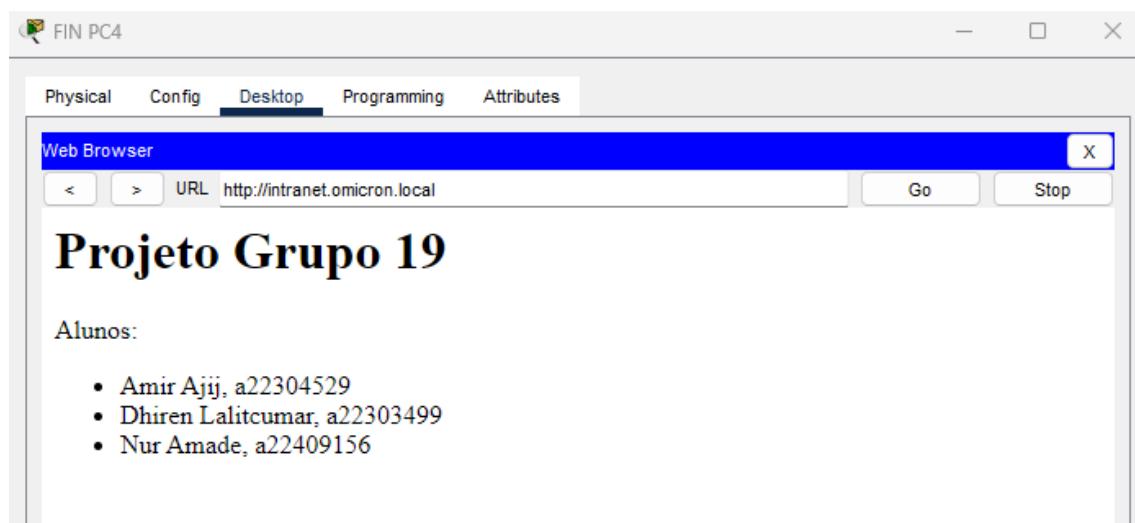
- Coimbra ↔ Porto: 172.16.19.0/30
- Coimbra ↔ Tavira: 172.16.19.4/30
- Coimbra ↔ Viseu: 172.16.19.8/30
- Coimbra ↔ Ericeira: 172.16.19.12/30

6. Screenshots da Implementação

6.1. Topologia Completa



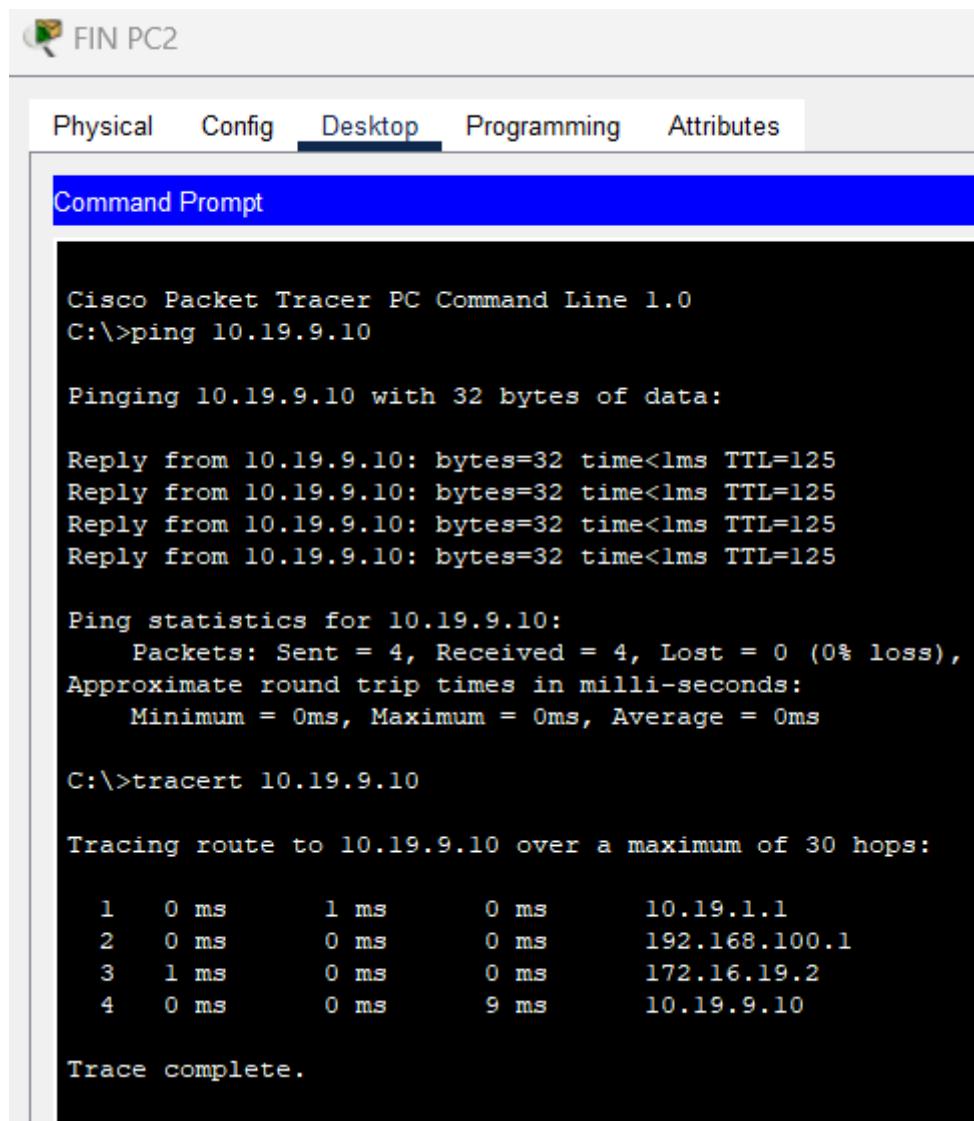
6.2 Servidor Web



7. Testes de Conectividade

7.1 Conectividade Intra-departamental (Mesmo Departamento e Diferentes Localizações)

Teste: PC Financeiro Coimbra → PC Financeiro Porto



The screenshot shows a Cisco Packet Tracer interface with a 'FIN PC2' title bar. Below it is a navigation bar with tabs: Physical, Config, Desktop (which is selected), Programming, and Attributes. The main area is a 'Command Prompt' window containing the following text:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 10.19.9.10

Pinging 10.19.9.10 with 32 bytes of data:

Reply from 10.19.9.10: bytes=32 time<1ms TTL=125

Ping statistics for 10.19.9.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>tracert 10.19.9.10

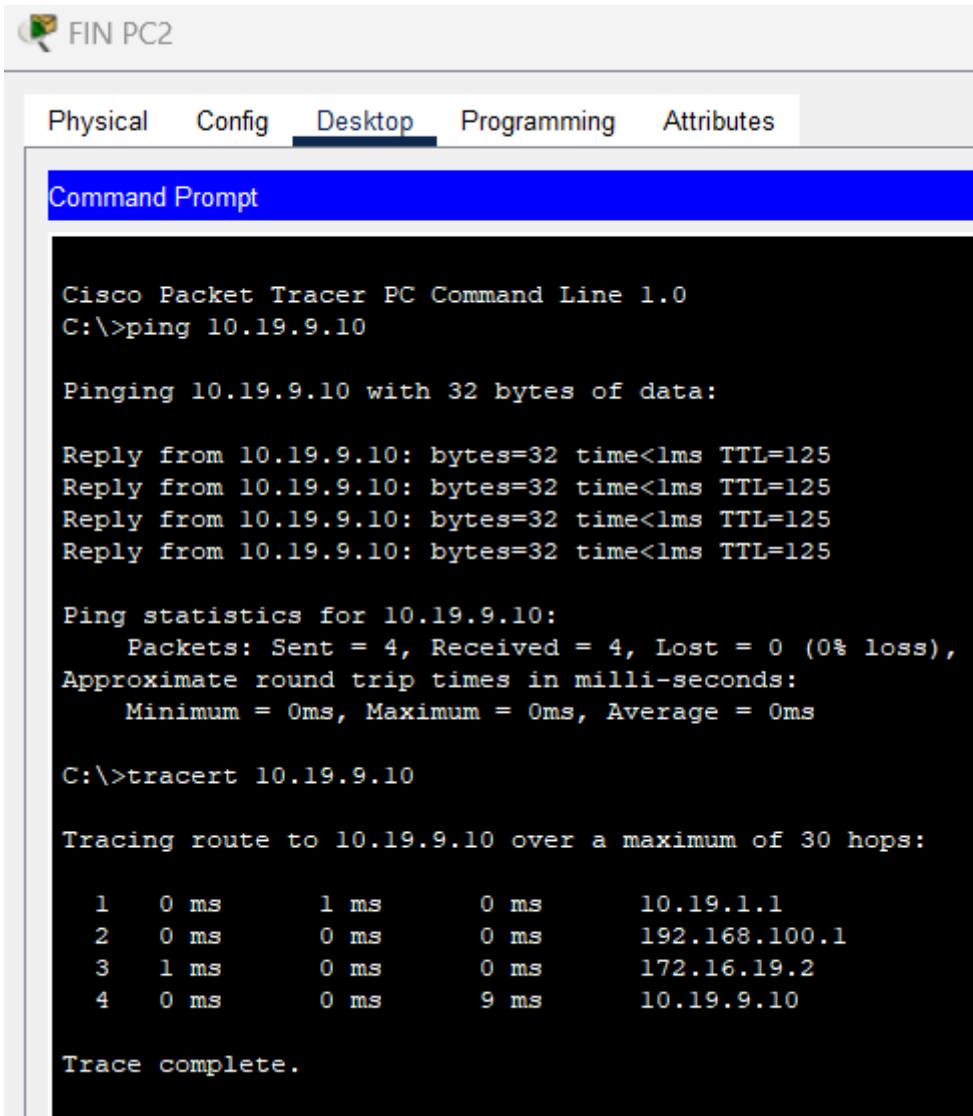
Tracing route to 10.19.9.10 over a maximum of 30 hops:

  1  0 ms       1 ms       0 ms       10.19.1.1
  2  0 ms       0 ms       0 ms      192.168.100.1
  3  1 ms       0 ms       0 ms      172.16.19.2
  4  0 ms       0 ms       9 ms      10.19.9.10

Trace complete.
```

7.2 Conectividade Intra-departamental (Mesmo Departamento e Diferentes Localizações)

Teste: PC Financeiro Coimbra → PC Financeiro Porto



FIN PC2

Physical Config Desktop Programming Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 10.19.9.10

Pinging 10.19.9.10 with 32 bytes of data:

Reply from 10.19.9.10: bytes=32 time<1ms TTL=125

Ping statistics for 10.19.9.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>tracert 10.19.9.10

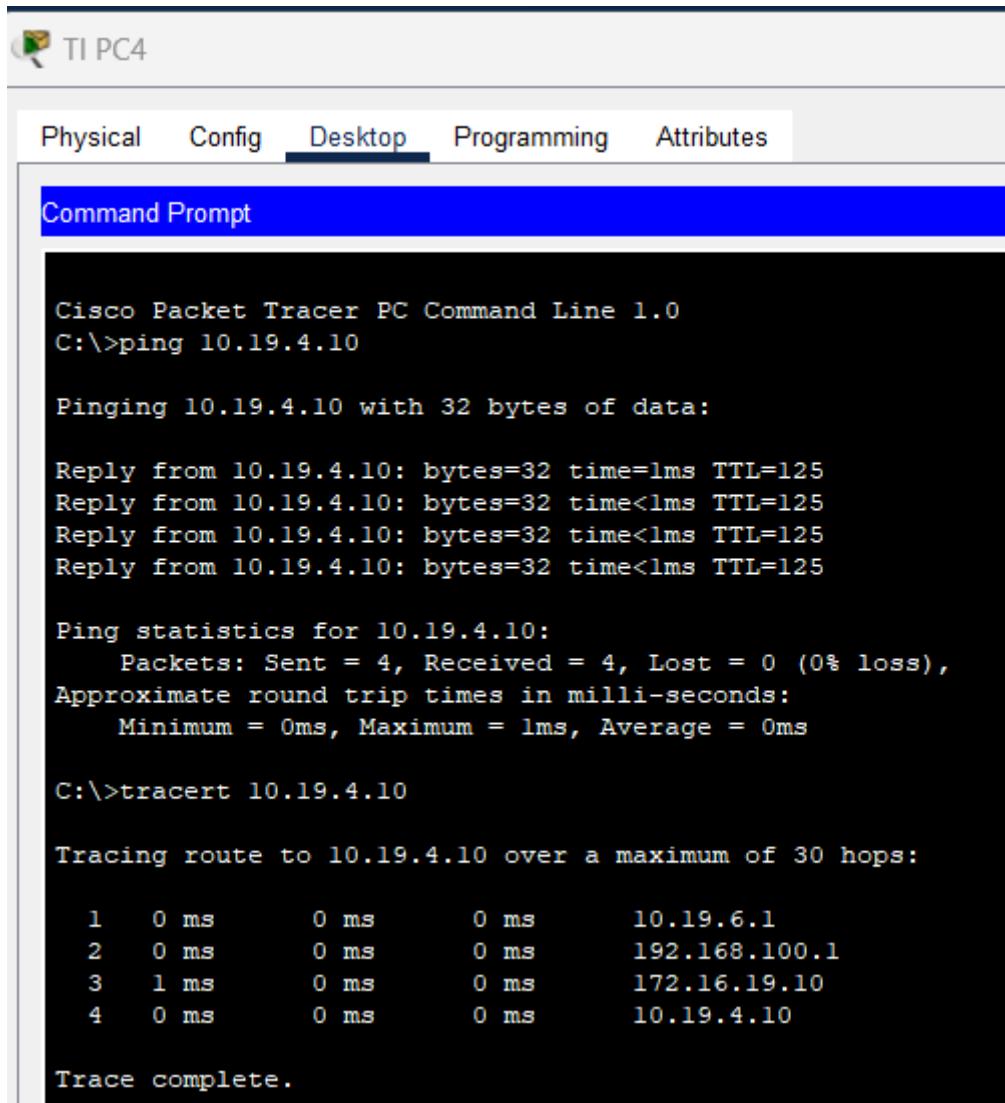
Tracing route to 10.19.9.10 over a maximum of 30 hops:

  1  0 ms      1 ms      0 ms      10.19.1.1
  2  0 ms      0 ms      0 ms      192.168.100.1
  3  1 ms      0 ms      0 ms      172.16.19.2
  4  0 ms      0 ms      9 ms      10.19.9.10

Trace complete.
```

7.3 Conectividade Inter-departamental (Diferentes Departamentos e Diferente localização)

Teste: PC TI Coimbra → PC LOG Viseu



The screenshot shows a Cisco Packet Tracer interface titled "TI PC4". The "Desktop" tab is selected in the top navigation bar. A blue header bar displays "Command Prompt". The main window contains the following command-line output:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 10.19.4.10

Pinging 10.19.4.10 with 32 bytes of data:

Reply from 10.19.4.10: bytes=32 time=lms TTL=125
Reply from 10.19.4.10: bytes=32 time<lms TTL=125
Reply from 10.19.4.10: bytes=32 time<lms TTL=125
Reply from 10.19.4.10: bytes=32 time<lms TTL=125

Ping statistics for 10.19.4.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = lms, Average = 0ms

C:\>tracert 10.19.4.10

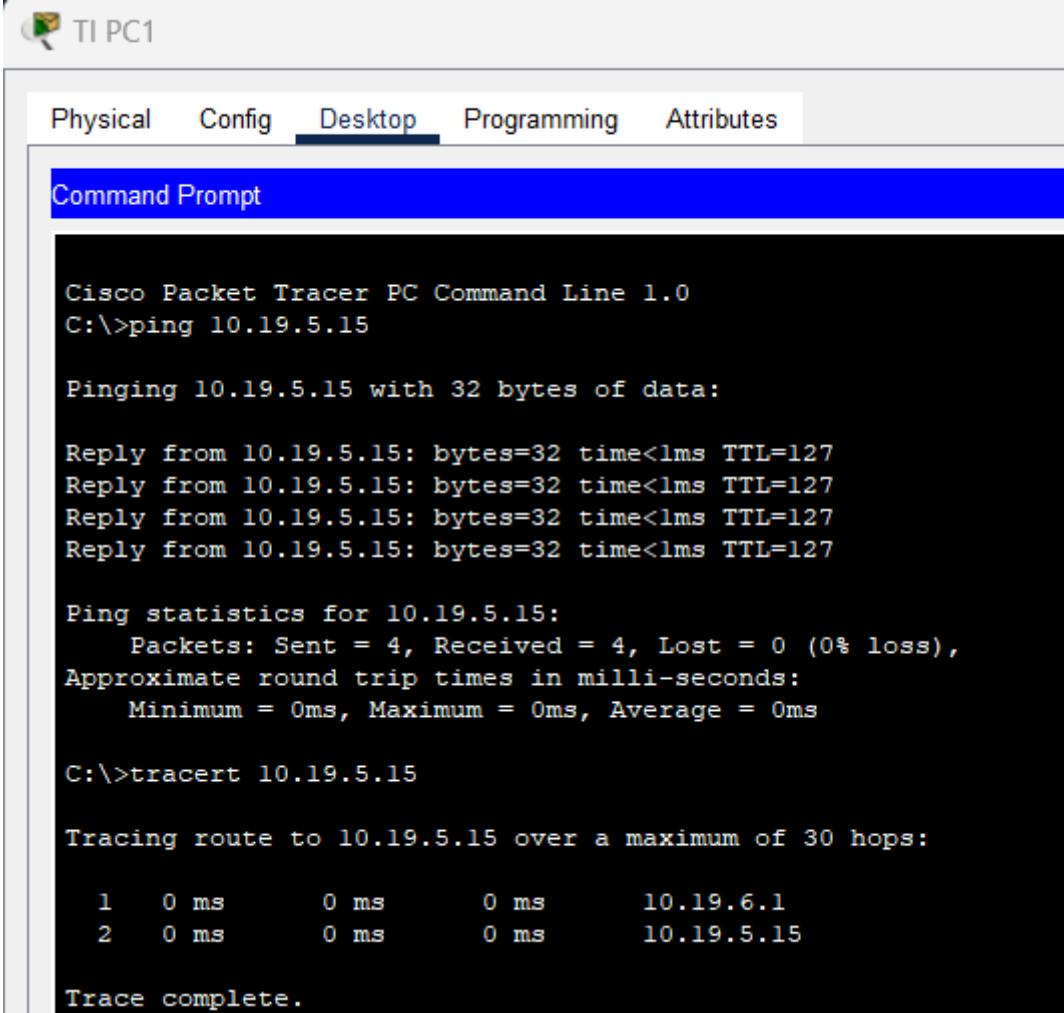
Tracing route to 10.19.4.10 over a maximum of 30 hops:

    1    0 ms      0 ms      0 ms      10.19.6.1
    2    0 ms      0 ms      0 ms      192.168.100.1
    3    1 ms      0 ms      0 ms      172.16.19.10
    4    0 ms      0 ms      0 ms      10.19.4.10

Trace complete.
```

7.4 Conectividade Inter-departamental (Diferentes Departamentos e Diferente localização)

Teste: PC TI Coimbra → PC ADM Coimbra



The screenshot shows a Cisco Packet Tracer interface titled "TI PC1". The "Desktop" tab is selected. A Command Prompt window is open, displaying the following output:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 10.19.5.15

Pinging 10.19.5.15 with 32 bytes of data:

Reply from 10.19.5.15: bytes=32 time<1ms TTL=127

Ping statistics for 10.19.5.15:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

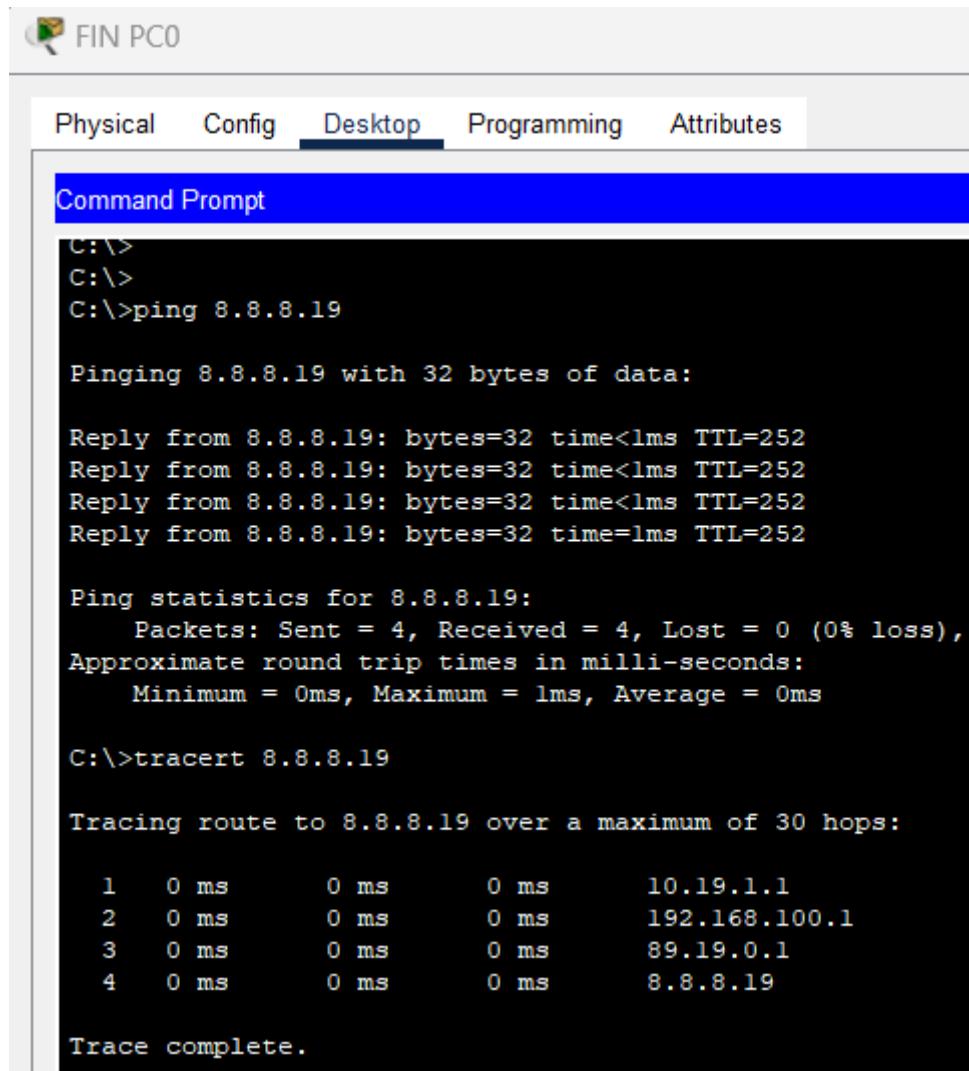
C:\>tracert 10.19.5.15

Tracing route to 10.19.5.15 over a maximum of 30 hops:
    1  0 ms      0 ms      0 ms      10.19.6.1
    2  0 ms      0 ms      0 ms      10.19.5.15

Trace complete.
```

7.5 Ping e Traceroute para Internet

Teste 1: PC FIN Coimbra → Router INTERNET (8.8.8.19)



FIN PC0

Physical Config Desktop Programming Attributes

```
Command Prompt
C:\>
C:\>
C:\>ping 8.8.8.19

Pinging 8.8.8.19 with 32 bytes of data:

Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time=1ms TTL=252

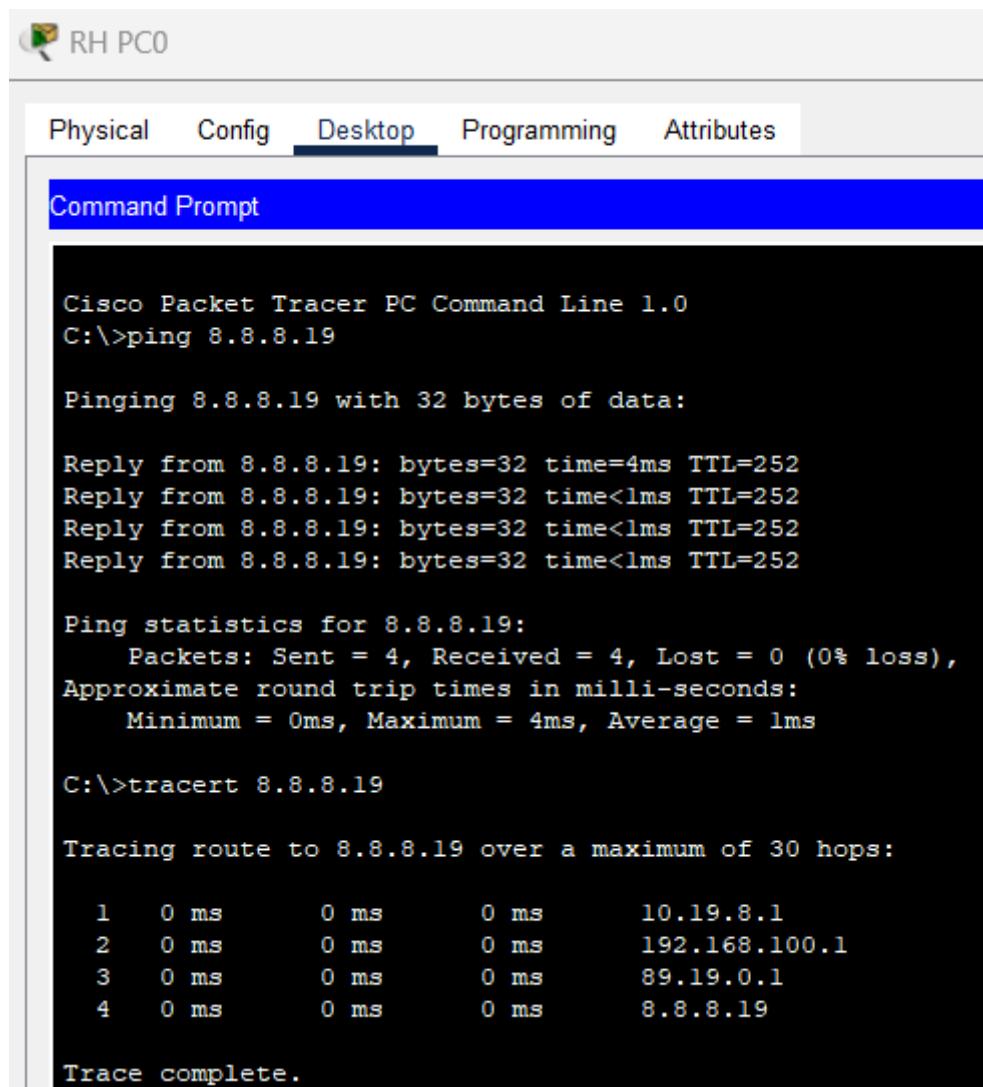
Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>tracert 8.8.8.19

Tracing route to 8.8.8.19 over a maximum of 30 hops:
  1  0 ms        0 ms        0 ms      10.19.1.1
  2  0 ms        0 ms        0 ms    192.168.100.1
  3  0 ms        0 ms        0 ms    89.19.0.1
  4  0 ms        0 ms        0 ms      8.8.8.19

Trace complete.
```

Teste 2: PC RH Coimbra → R outer INTERNET (8.8.8.19)



RH PC0

Physical Config Desktop Programming Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 8.8.8.19

Pinging 8.8.8.19 with 32 bytes of data:

Reply from 8.8.8.19: bytes=32 time=4ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252

Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 4ms, Average = 1ms

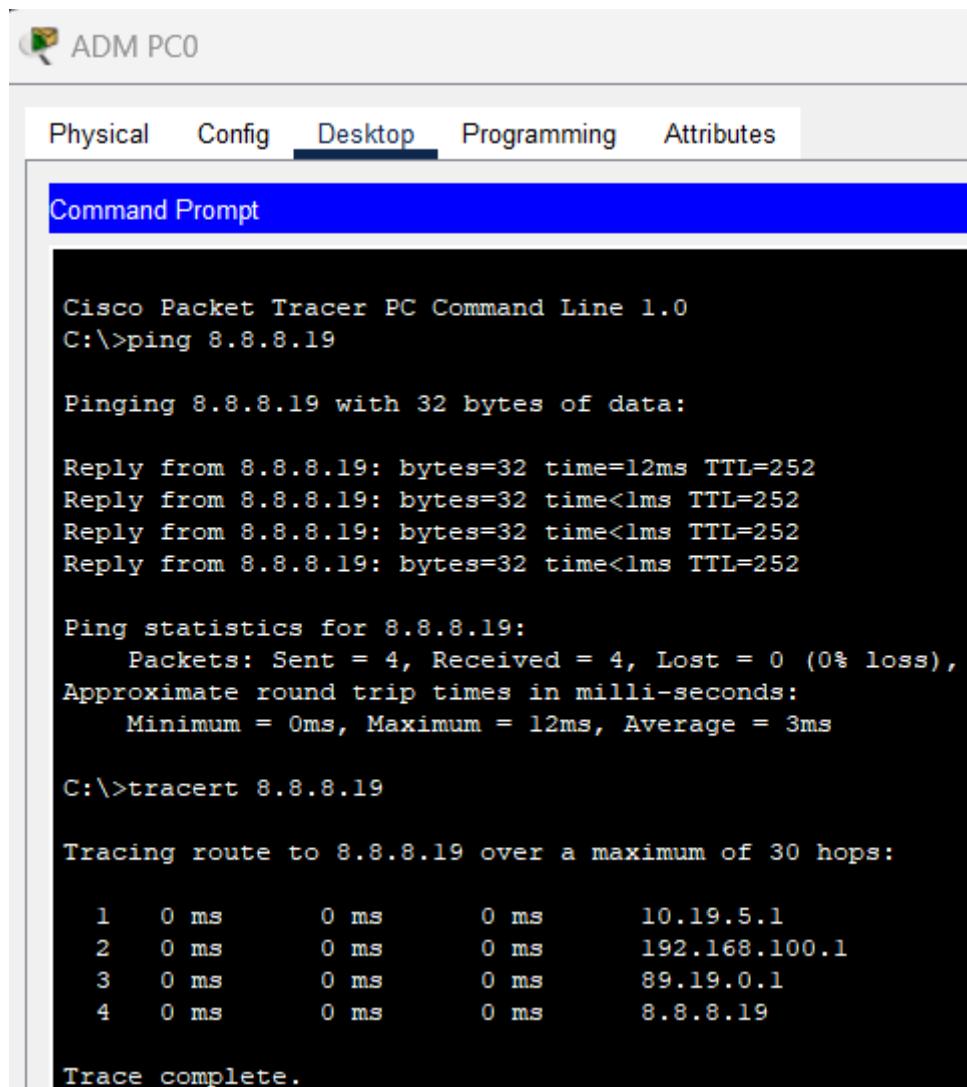
C:\>tracert 8.8.8.19

Tracing route to 8.8.8.19 over a maximum of 30 hops:

  1  0 ms      0 ms      0 ms      10.19.8.1
  2  0 ms      0 ms      0 ms      192.168.100.1
  3  0 ms      0 ms      0 ms      89.19.0.1
  4  0 ms      0 ms      0 ms      8.8.8.19

Trace complete.
```

Teste 3: PC ADM Coimbra → Router INTERNET (8.8.8.19)



The screenshot shows a software interface titled "ADM PC0" with a toolbar at the top containing tabs: Physical, Config, Desktop, Programming, and Attributes. The "Desktop" tab is currently selected. Below the toolbar is a blue header bar labeled "Command Prompt". The main area of the window is a black terminal window displaying command-line output. The output shows the results of a ping and tracert command.

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 8.8.8.19

Pinging 8.8.8.19 with 32 bytes of data:

Reply from 8.8.8.19: bytes=32 time=12ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252

Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 12ms, Average = 3ms

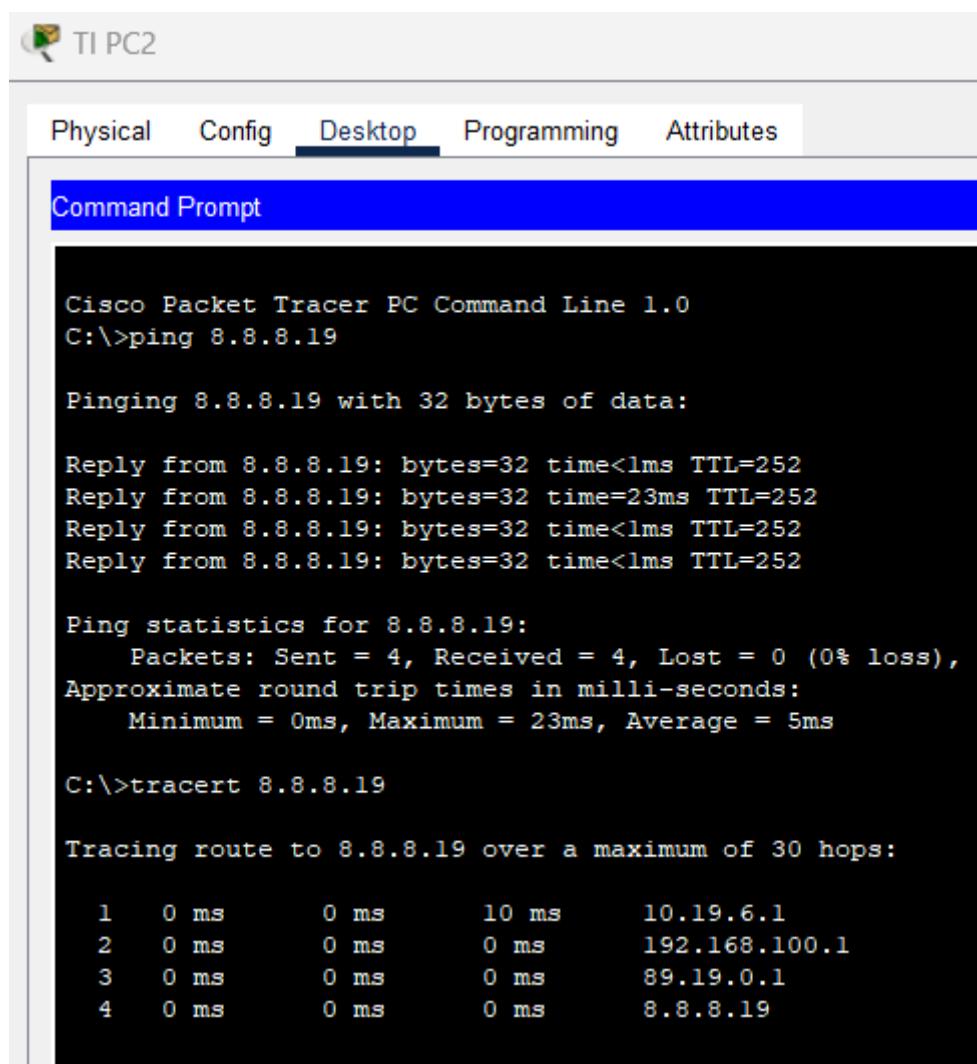
C:\>tracert 8.8.8.19

Tracing route to 8.8.8.19 over a maximum of 30 hops:

  1  0 ms      0 ms      0 ms      10.19.5.1
  2  0 ms      0 ms      0 ms      192.168.100.1
  3  0 ms      0 ms      0 ms      89.19.0.1
  4  0 ms      0 ms      0 ms      8.8.8.19

Trace complete.
```

Teste 4: PC TI Coimbra → Router INTERNET (8.8.8.19)



The screenshot shows a Cisco Packet Tracer window titled "TI PC2". The "Desktop" tab is selected. A blue bar at the top says "Command Prompt". The terminal window displays the following output:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 8.8.8.19

Pinging 8.8.8.19 with 32 bytes of data:

Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time=23ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252

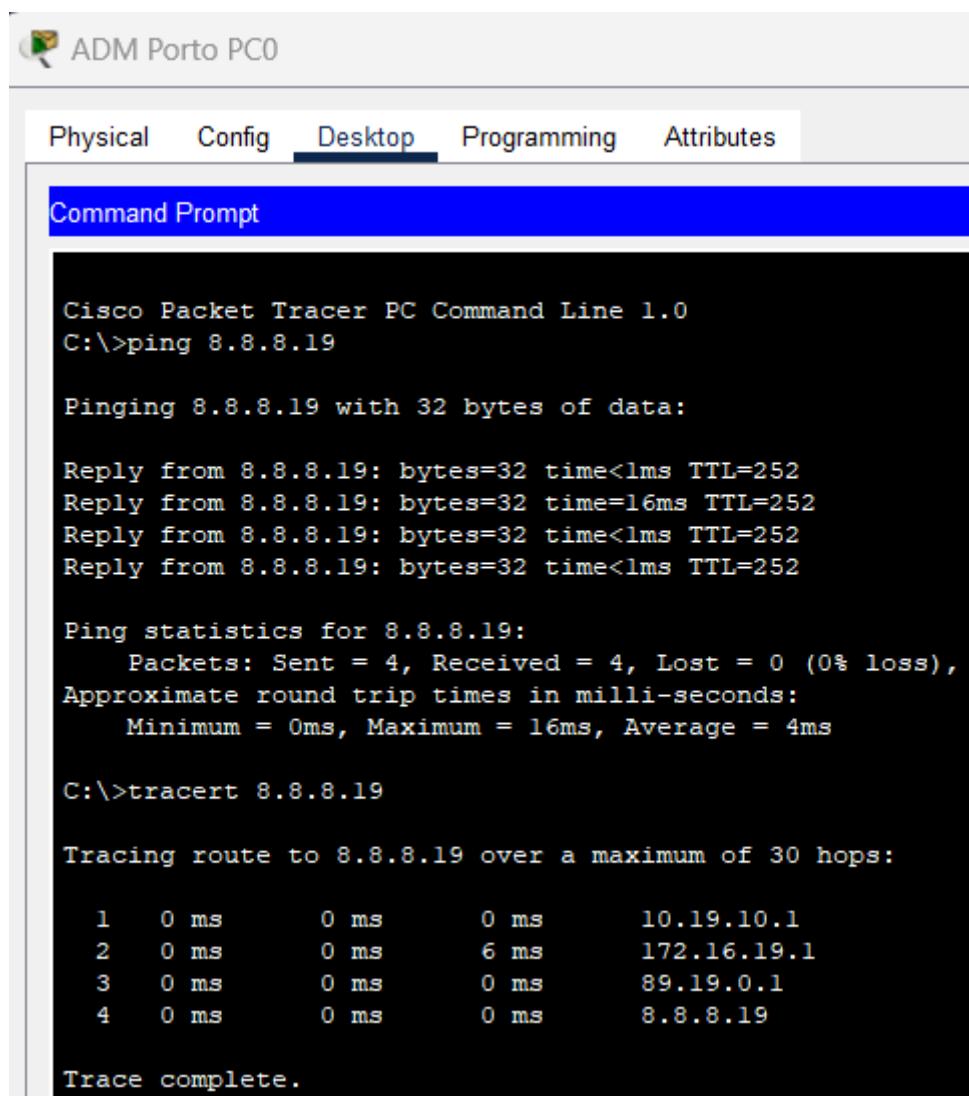
Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 23ms, Average = 5ms

C:\>tracert 8.8.8.19

Tracing route to 8.8.8.19 over a maximum of 30 hops:

  1  0 ms      0 ms      10 ms      10.19.6.1
  2  0 ms      0 ms      0 ms      192.168.100.1
  3  0 ms      0 ms      0 ms      89.19.0.1
  4  0 ms      0 ms      0 ms      8.8.8.19
```

Teste 5: PC ADM Porto → Router INTERNET (8.8.8.19)



The screenshot shows a Cisco Packet Tracer interface titled "ADM Porto PC0". The "Desktop" tab is selected. A blue bar at the top says "Command Prompt". The terminal window displays the following output:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 8.8.8.19

Pinging 8.8.8.19 with 32 bytes of data:

Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time=16ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252

Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 16ms, Average = 4ms

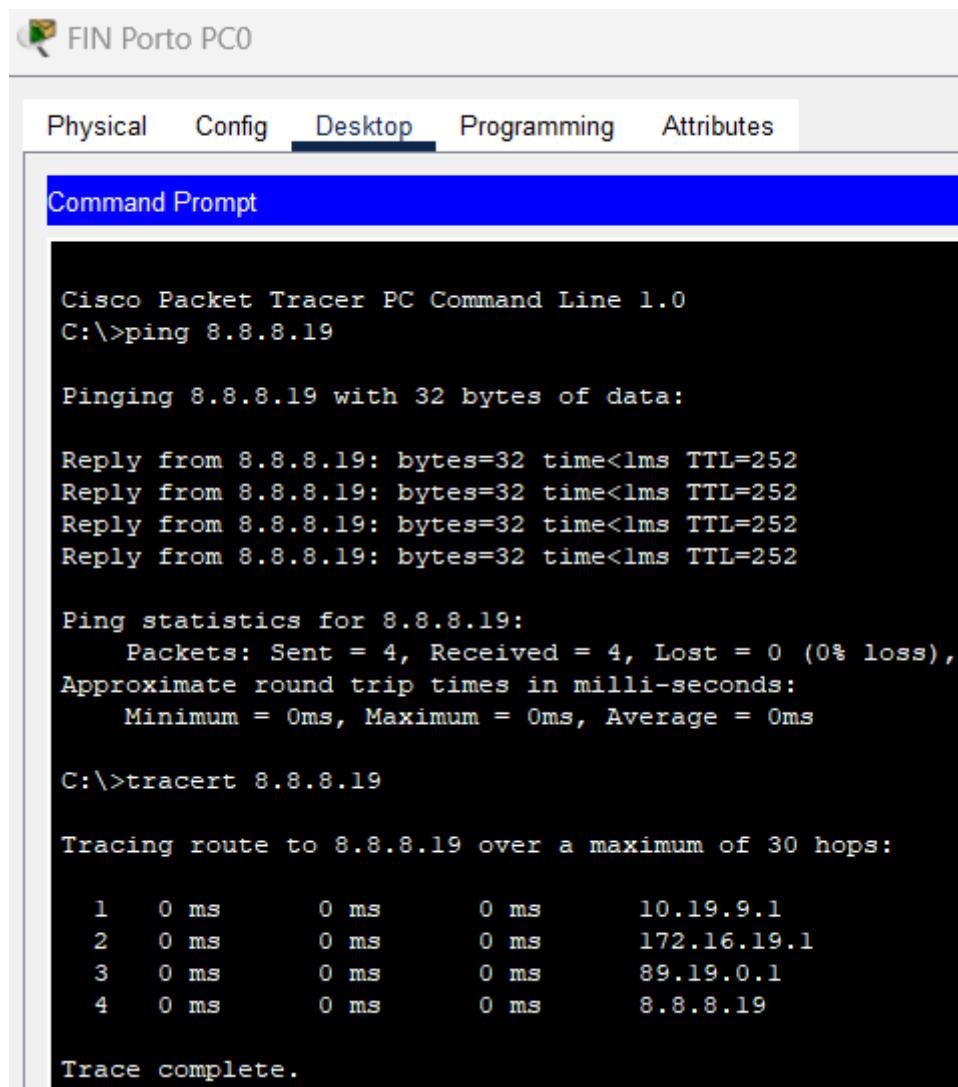
C:\>tracert 8.8.8.19

Tracing route to 8.8.8.19 over a maximum of 30 hops:

  1  0 ms      0 ms      0 ms      10.19.10.1
  2  0 ms      0 ms      6 ms      172.16.19.1
  3  0 ms      0 ms      0 ms      89.19.0.1
  4  0 ms      0 ms      0 ms      8.8.8.19

Trace complete.
```

Teste 6: PC FIN Porto → Router INTERNET (8.8.8.19)



The screenshot shows the Cisco Packet Tracer interface with the title bar "FIN Porto PC0". Below the title bar, there is a menu bar with tabs: Physical, Config, Desktop, Programming, and Attributes. The "Desktop" tab is currently selected. Underneath the menu bar, there is a blue header bar with the text "Command Prompt". The main area of the window is a black terminal window displaying the output of a ping and tracert command.

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 8.8.8.19

Pinging 8.8.8.19 with 32 bytes of data:

Reply from 8.8.8.19: bytes=32 time<1ms TTL=252

Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

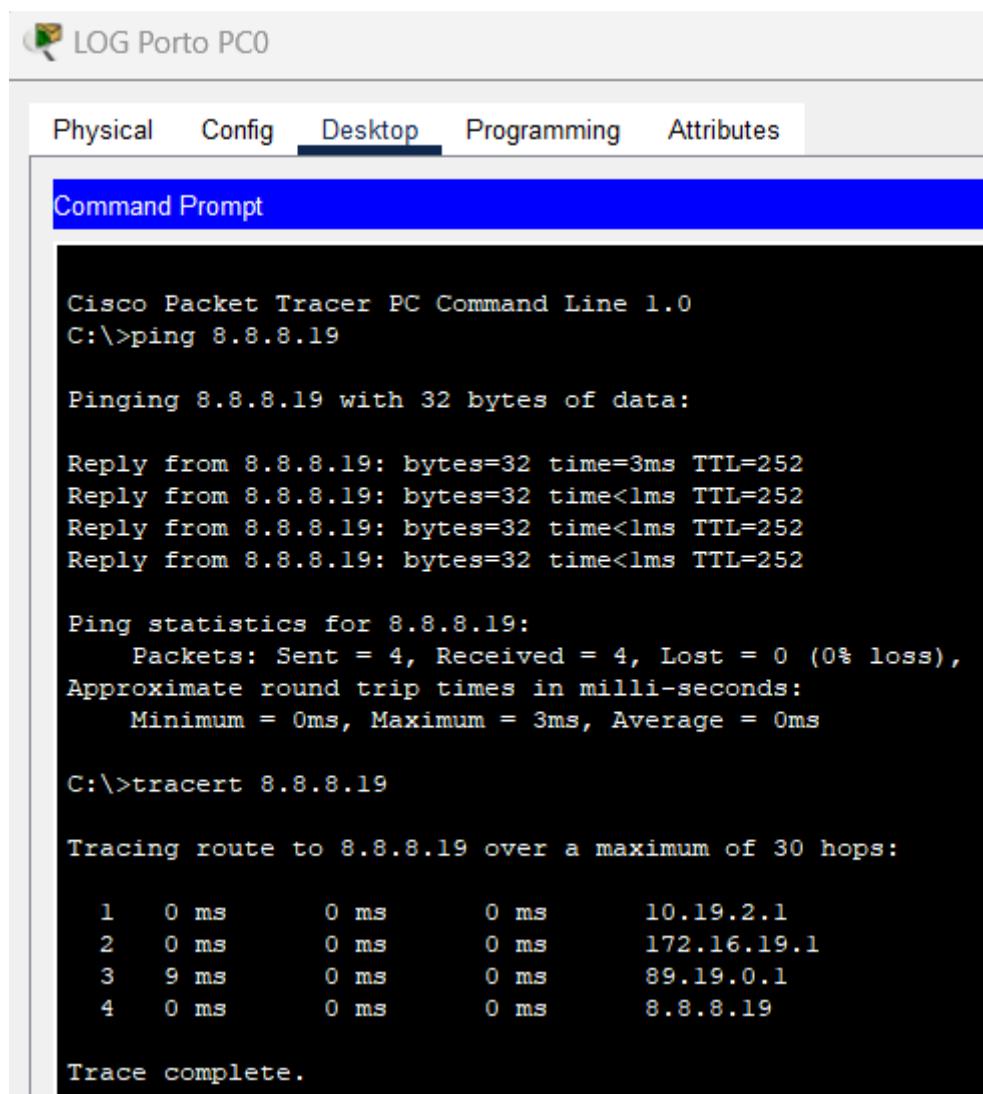
C:\>tracert 8.8.8.19

Tracing route to 8.8.8.19 over a maximum of 30 hops:

  1  0 ms      0 ms      0 ms      10.19.9.1
  2  0 ms      0 ms      0 ms      172.16.19.1
  3  0 ms      0 ms      0 ms      89.19.0.1
  4  0 ms      0 ms      0 ms      8.8.8.19

Trace complete.
```

Teste 7: PC LOG Porto → Router INTERNET (8.8.8.19)



The screenshot shows a Cisco Packet Tracer window titled "LOG Porto PC0". The "Desktop" tab is selected. A blue bar at the top says "Command Prompt". The terminal window displays the following output:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 8.8.8.19

Pinging 8.8.8.19 with 32 bytes of data:

Reply from 8.8.8.19: bytes=32 time=3ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252

Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 3ms, Average = 0ms

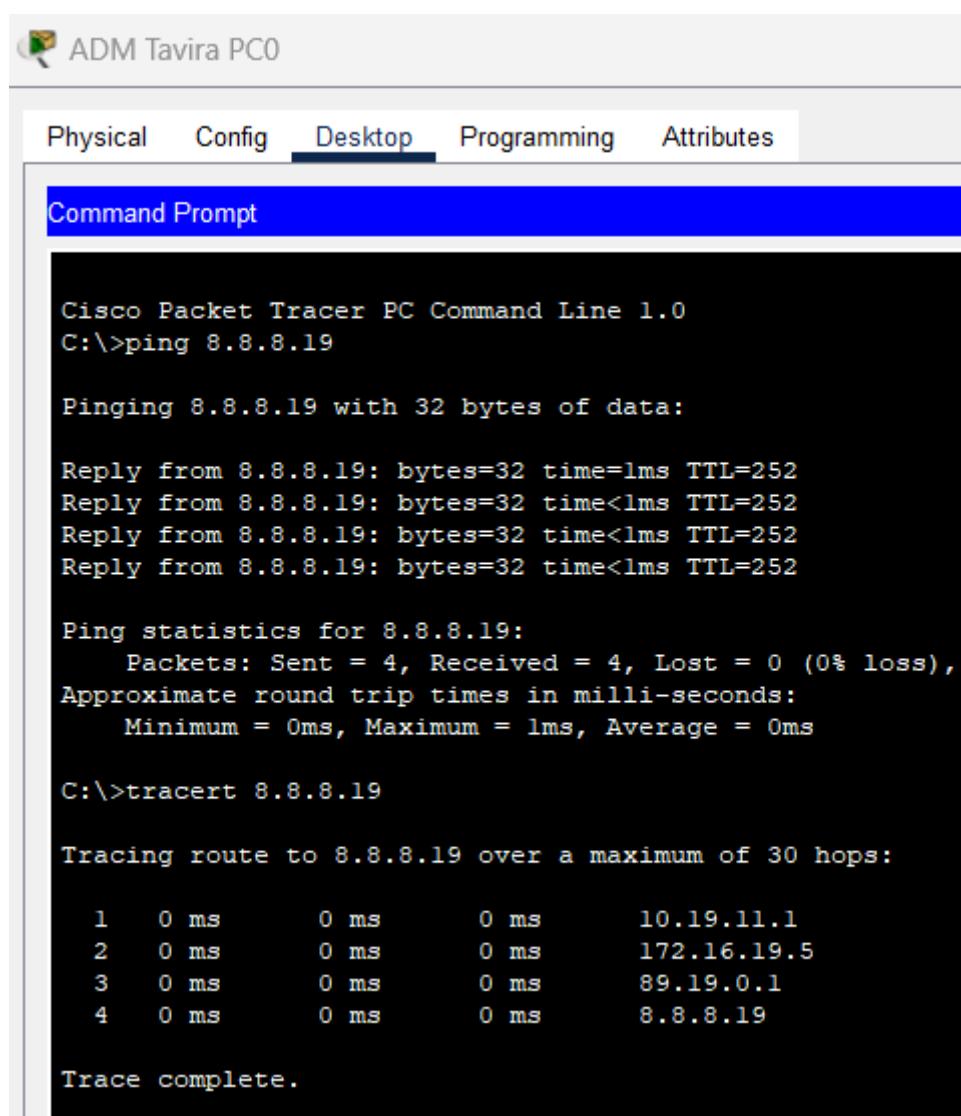
C:\>tracert 8.8.8.19

Tracing route to 8.8.8.19 over a maximum of 30 hops:

  1  0 ms      0 ms      0 ms      10.19.2.1
  2  0 ms      0 ms      0 ms      172.16.19.1
  3  9 ms      0 ms      0 ms      89.19.0.1
  4  0 ms      0 ms      0 ms      8.8.8.19

Trace complete.
```

Teste 8: PC ADM Tavira → Router INTERNET (8.8.8.19)



The screenshot shows a window titled "ADM Tavira PC0" with tabs for Physical, Config, Desktop (selected), Programming, and Attributes. The main area is a "Command Prompt" window displaying the following output:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 8.8.8.19

Pinging 8.8.8.19 with 32 bytes of data:

Reply from 8.8.8.19: bytes=32 time=lms TTL=252
Reply from 8.8.8.19: bytes=32 time<lms TTL=252
Reply from 8.8.8.19: bytes=32 time<lms TTL=252
Reply from 8.8.8.19: bytes=32 time<lms TTL=252

Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

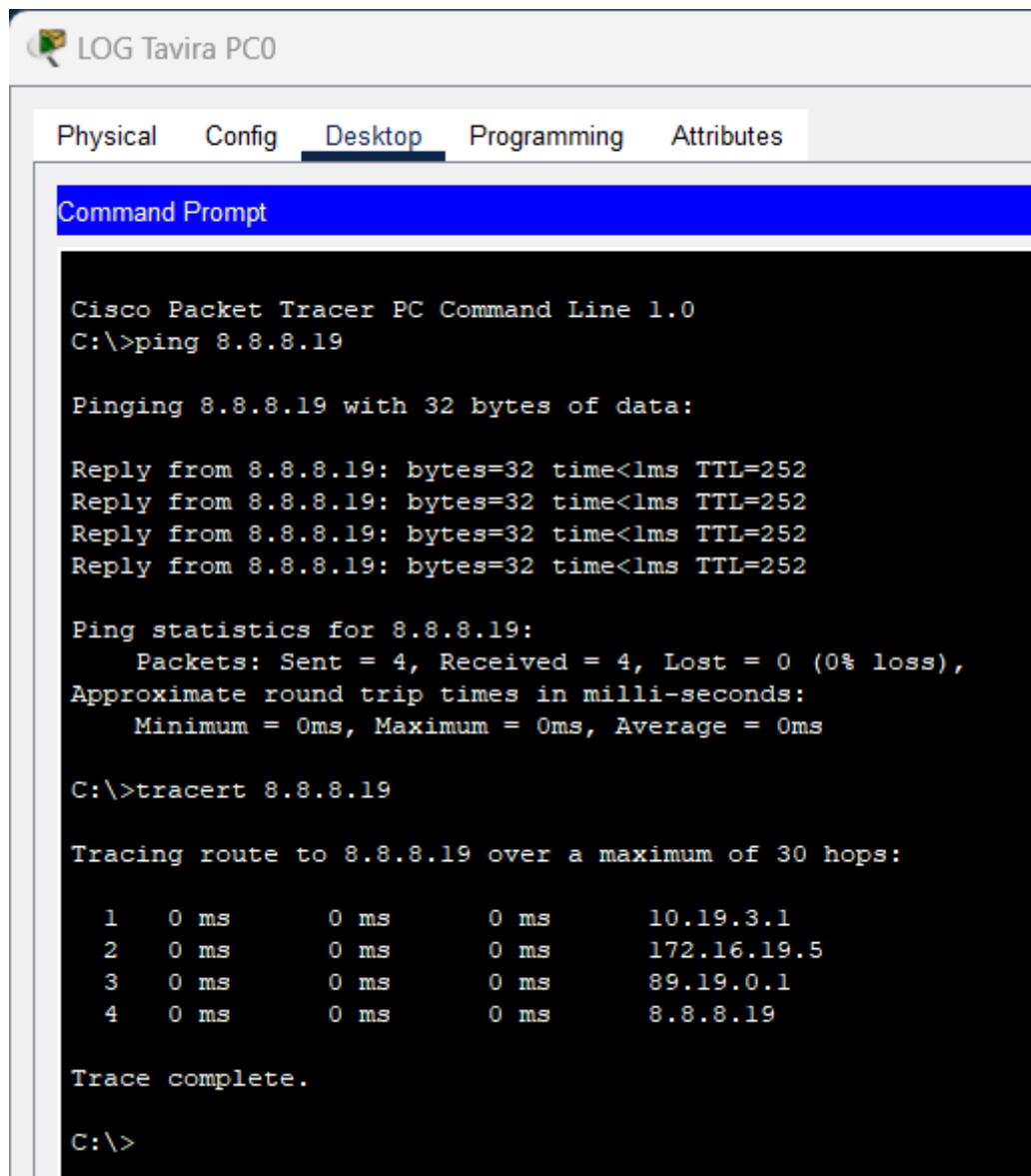
C:\>tracert 8.8.8.19

Tracing route to 8.8.8.19 over a maximum of 30 hops:

  1  0 ms        0 ms        0 ms      10.19.11.1
  2  0 ms        0 ms        0 ms      172.16.19.5
  3  0 ms        0 ms        0 ms      89.19.0.1
  4  0 ms        0 ms        0 ms      8.8.8.19

Trace complete.
```

Teste 9: PC LOG Tavira → Router INTERNET (8.8.8.19)



The screenshot shows a Cisco Packet Tracer PC Command Line interface. The title bar says "LOG Tavira PC0". The menu bar includes "Physical", "Config", "Desktop" (which is underlined), "Programming", and "Attributes". A blue header bar says "Command Prompt". The command line output is as follows:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 8.8.8.19

Pinging 8.8.8.19 with 32 bytes of data:

Reply from 8.8.8.19: bytes=32 time<lms TTL=252

Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

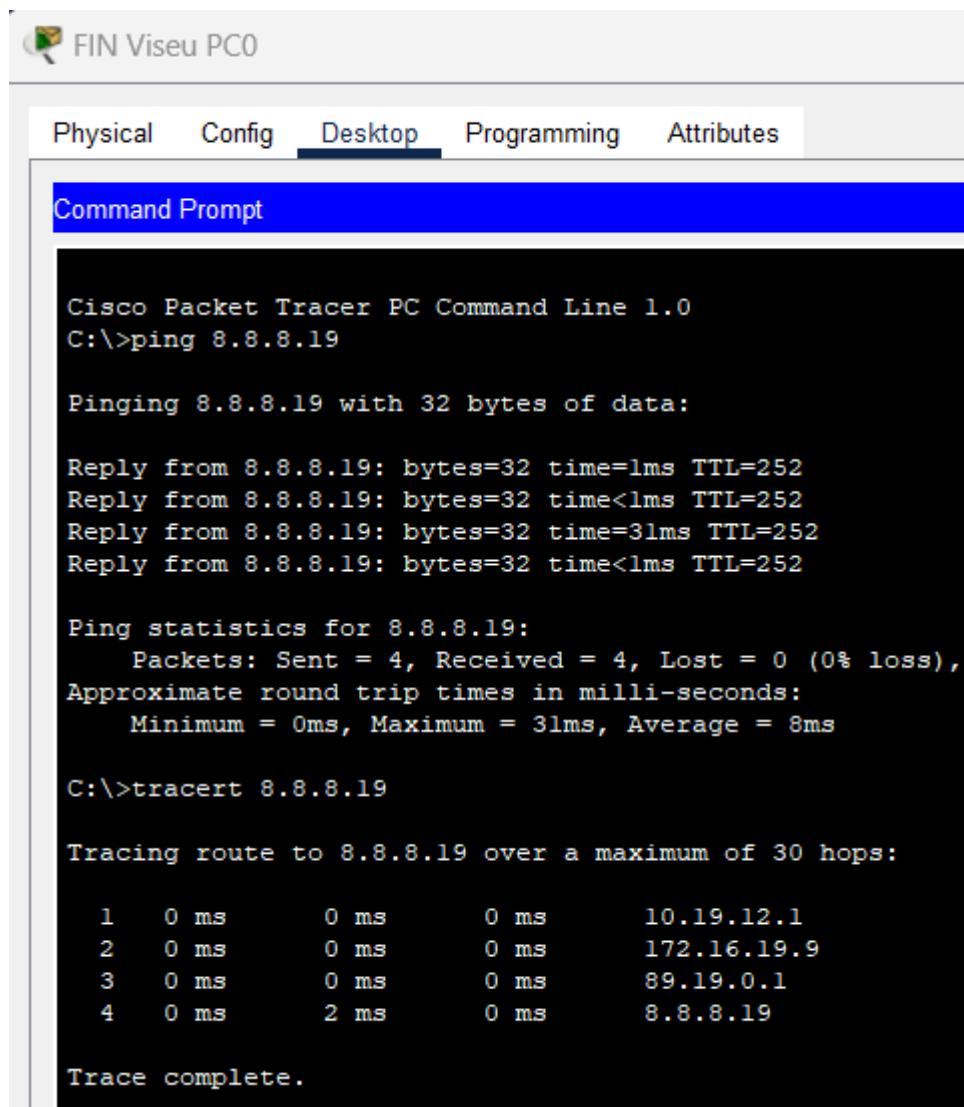
C:\>tracert 8.8.8.19

Tracing route to 8.8.8.19 over a maximum of 30 hops:
    1    0 ms      0 ms      0 ms      10.19.3.1
    2    0 ms      0 ms      0 ms      172.16.19.5
    3    0 ms      0 ms      0 ms      89.19.0.1
    4    0 ms      0 ms      0 ms      8.8.8.19

Trace complete.

C:\>
```

Teste 11: PC FIN Viseu → Router INTERNET (8.8.8.19)



The screenshot shows the Cisco Packet Tracer PC Command Line interface. The title bar says "FIN Viseu PC0". The menu bar includes "Physical", "Config", "Desktop" (which is underlined), "Programming", and "Attributes". A blue header bar says "Command Prompt". The main window displays the following command-line session:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 8.8.8.19

Pinging 8.8.8.19 with 32 bytes of data:

Reply from 8.8.8.19: bytes=32 time=1ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time=31ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252

Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 31ms, Average = 8ms

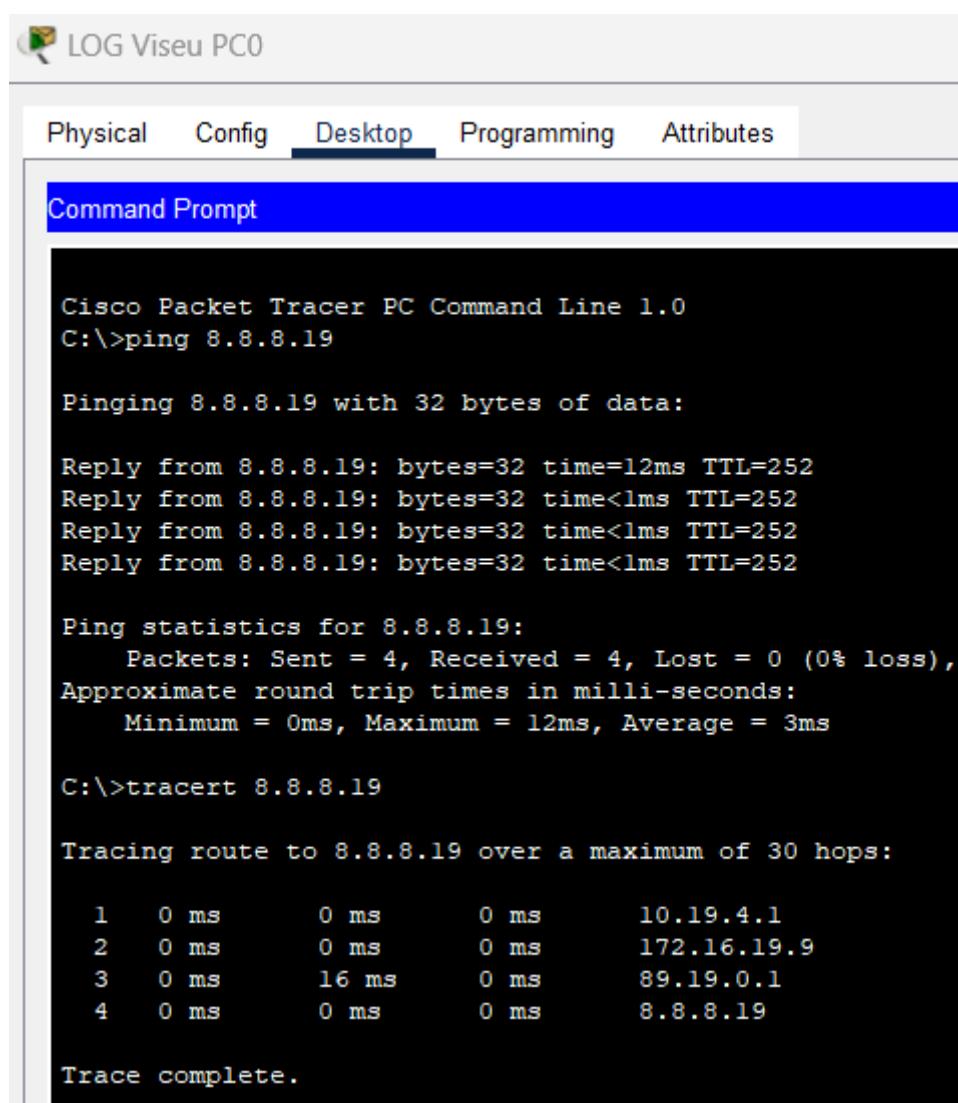
C:\>tracert 8.8.8.19

Tracing route to 8.8.8.19 over a maximum of 30 hops:

  1  0 ms        0 ms        0 ms      10.19.12.1
  2  0 ms        0 ms        0 ms      172.16.19.9
  3  0 ms        0 ms        0 ms      89.19.0.1
  4  0 ms        2 ms        0 ms      8.8.8.19

Trace complete.
```

Teste 12: PC LOG Viseu → Router INTERNET (8.8.8.19)



The screenshot shows a Cisco Packet Tracer Command Line interface window titled "LOG Viseu PC0". The window has tabs at the top: Physical, Config, Desktop (which is selected), Programming, and Attributes. The main area is a "Command Prompt" window with the following text:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 8.8.8.19

Pinging 8.8.8.19 with 32 bytes of data:

Reply from 8.8.8.19: bytes=32 time=12ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252
Reply from 8.8.8.19: bytes=32 time<1ms TTL=252

Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 12ms, Average = 3ms

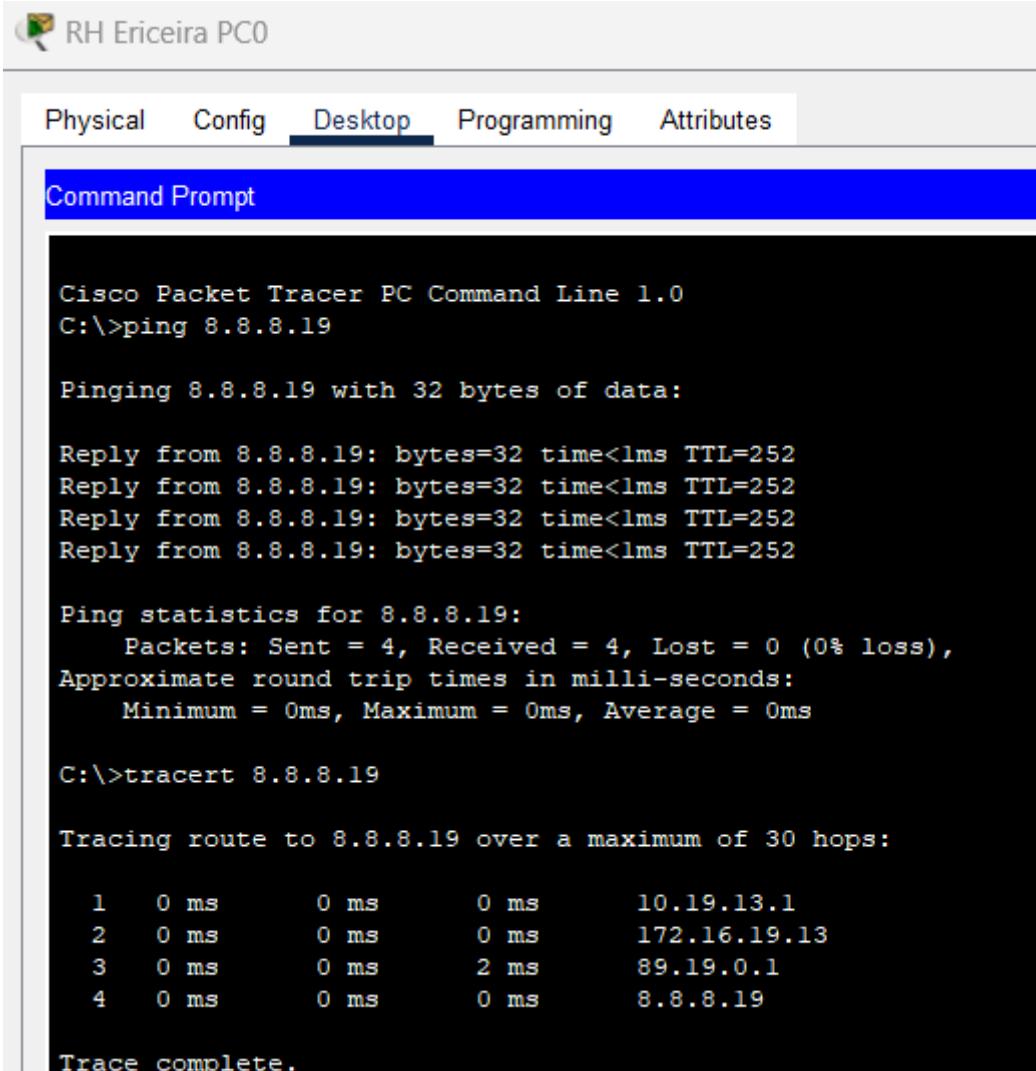
C:\>tracert 8.8.8.19

Tracing route to 8.8.8.19 over a maximum of 30 hops:

  1  0 ms        0 ms        0 ms      10.19.4.1
  2  0 ms        0 ms        0 ms      172.16.19.9
  3  0 ms       16 ms        0 ms      89.19.0.1
  4  0 ms        0 ms        0 ms      8.8.8.19

Trace complete.
```

Teste 13: PC RH Ericeira → Router INTERNET (8.8.8.19)



The screenshot shows the Cisco Packet Tracer interface with the title bar "RH Ericeira PC0". Below the title bar, there is a menu bar with tabs: Physical, Config, Desktop, Programming, and Attributes. The "Desktop" tab is currently selected, indicated by a blue underline. Below the menu bar, there is a blue header bar with the text "Command Prompt". The main area of the window is a black terminal window displaying command-line output.

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 8.8.8.19

Pinging 8.8.8.19 with 32 bytes of data:

Reply from 8.8.8.19: bytes=32 time<1ms TTL=252

Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

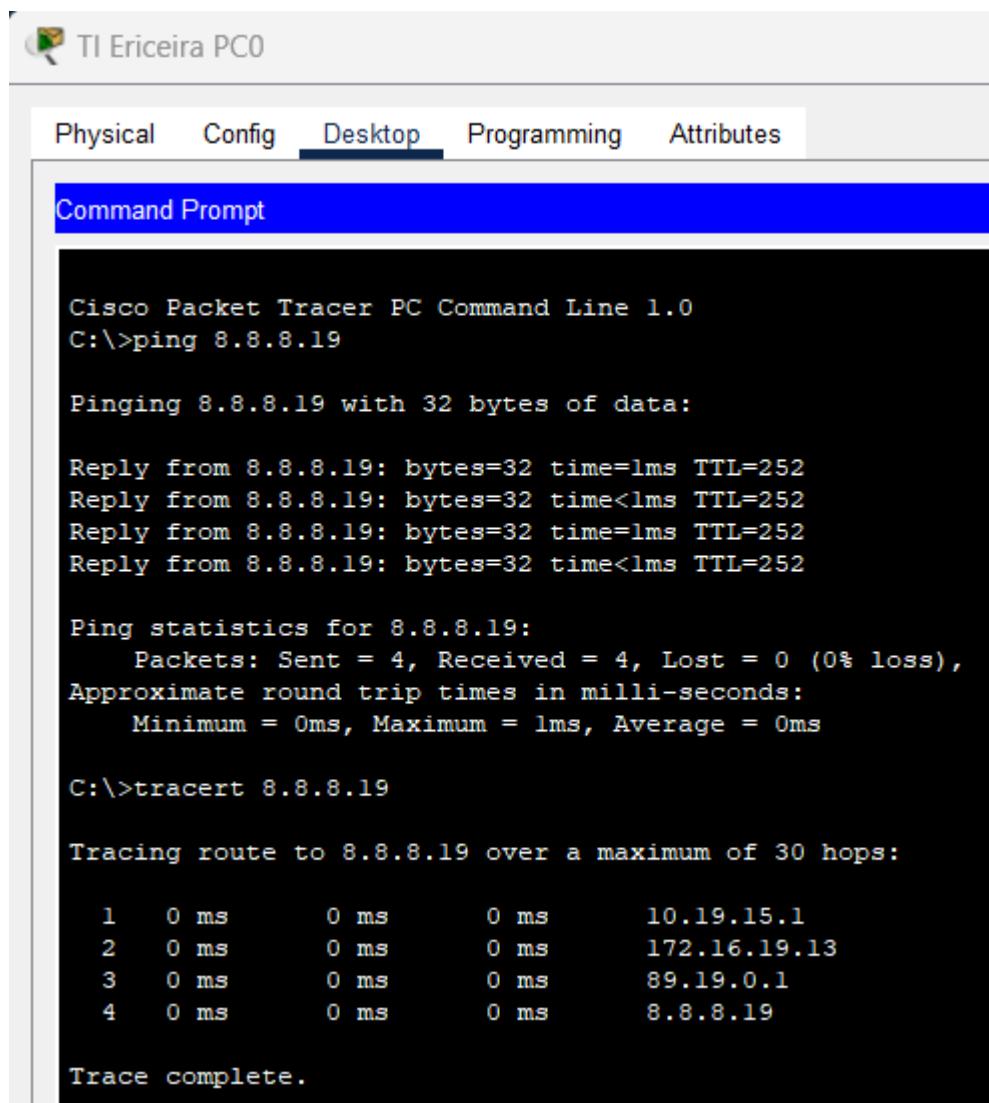
C:\>tracert 8.8.8.19

Tracing route to 8.8.8.19 over a maximum of 30 hops:

  1  0 ms      0 ms      0 ms      10.19.13.1
  2  0 ms      0 ms      0 ms      172.16.19.13
  3  0 ms      0 ms      2 ms      89.19.0.1
  4  0 ms      0 ms      0 ms      8.8.8.19

Trace complete.
```

Teste 14: PC TI Ericeira → Router INTERNET (8.8.8.19)



The screenshot shows the Cisco Packet Tracer PC Command Line interface. The title bar says "TI Ericeira PC0". The menu bar includes "Physical", "Config", "Desktop" (which is selected), "Programming", and "Attributes". A blue header bar says "Command Prompt". The command line output is as follows:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 8.8.8.19

Pinging 8.8.8.19 with 32 bytes of data:

Reply from 8.8.8.19: bytes=32 time=lms TTL=252
Reply from 8.8.8.19: bytes=32 time<lms TTL=252
Reply from 8.8.8.19: bytes=32 time=lms TTL=252
Reply from 8.8.8.19: bytes=32 time<lms TTL=252

Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = lms, Average = 0ms

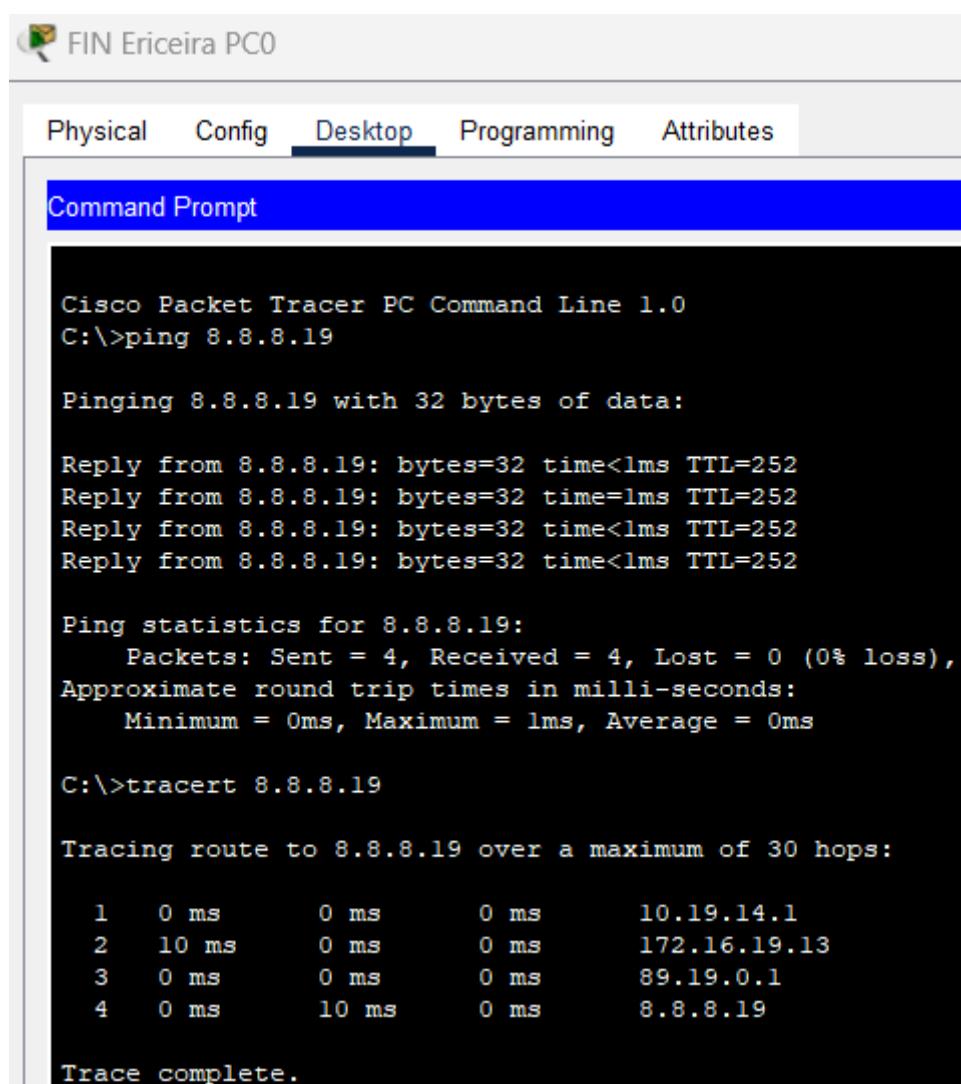
C:\>tracert 8.8.8.19

Tracing route to 8.8.8.19 over a maximum of 30 hops:

  1  0 ms        0 ms        0 ms      10.19.15.1
  2  0 ms        0 ms        0 ms      172.16.19.13
  3  0 ms        0 ms        0 ms      89.19.0.1
  4  0 ms        0 ms        0 ms      8.8.8.19

Trace complete.
```

Teste 15: PC FIN Ericeira → Router INTERNET (8.8.8.19)



FIN Ericeira PC0

Physical Config Desktop Programming Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 8.8.8.19

Pinging 8.8.8.19 with 32 bytes of data:

Reply from 8.8.8.19: bytes=32 time<lms TTL=252
Reply from 8.8.8.19: bytes=32 time=lms TTL=252
Reply from 8.8.8.19: bytes=32 time<lms TTL=252
Reply from 8.8.8.19: bytes=32 time<lms TTL=252

Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = lms, Average = 0ms

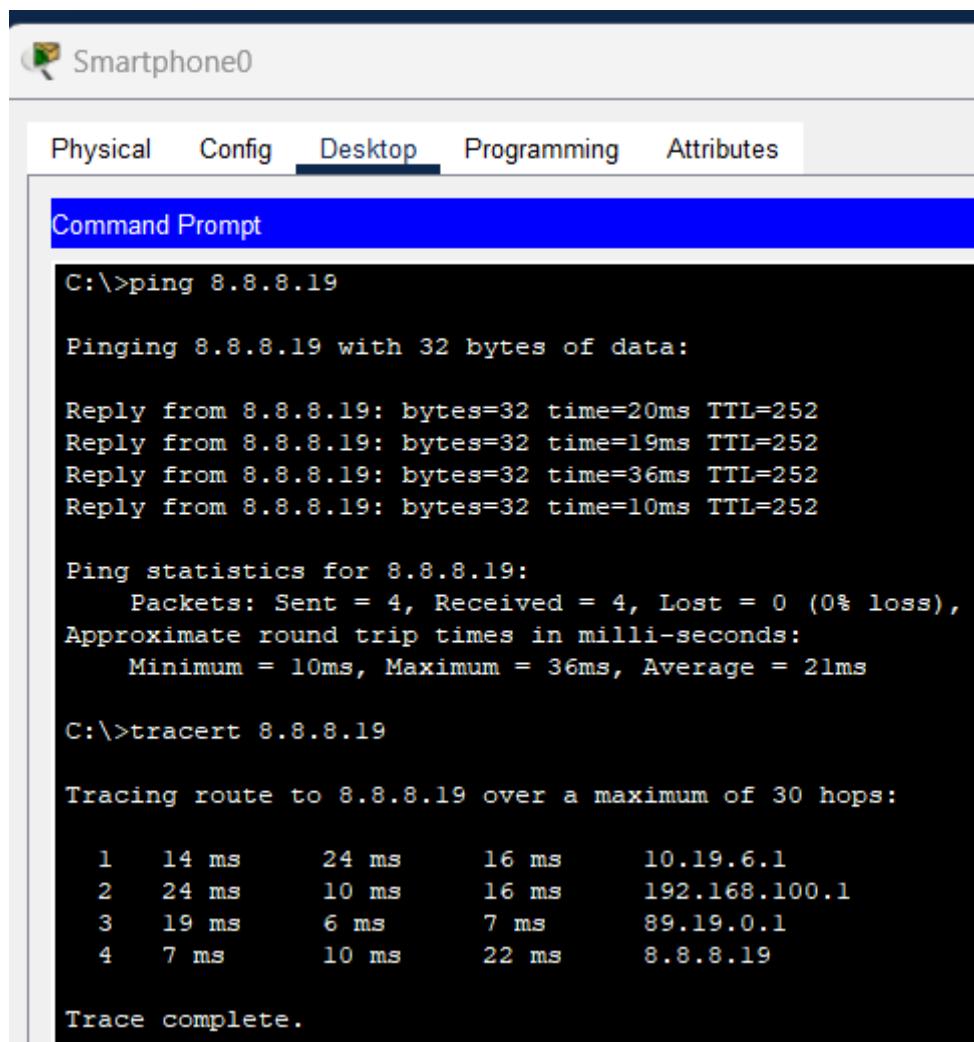
C:\>tracert 8.8.8.19

Tracing route to 8.8.8.19 over a maximum of 30 hops:

  1  0 ms      0 ms      0 ms      10.19.14.1
  2  10 ms     0 ms      0 ms     172.16.19.13
  3  0 ms      0 ms      0 ms     89.19.0.1
  4  0 ms     10 ms      0 ms      8.8.8.19

Trace complete.
```

Teste 16: Smartphone WIFI → Router INTERNET (8.8.8.19)



Smartphone0

Physical Config Desktop Programming Attributes

Command Prompt

```
C:\>ping 8.8.8.19
Pinging 8.8.8.19 with 32 bytes of data:
Reply from 8.8.8.19: bytes=32 time=20ms TTL=252
Reply from 8.8.8.19: bytes=32 time=19ms TTL=252
Reply from 8.8.8.19: bytes=32 time=36ms TTL=252
Reply from 8.8.8.19: bytes=32 time=10ms TTL=252

Ping statistics for 8.8.8.19:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 10ms, Maximum = 36ms, Average = 21ms

C:\>tracert 8.8.8.19
Tracing route to 8.8.8.19 over a maximum of 30 hops:

  1  14 ms      24 ms      16 ms      10.19.6.1
  2  24 ms      10 ms      16 ms      192.168.100.1
  3  19 ms       6 ms       7 ms      89.19.0.1
  4  7 ms       10 ms      22 ms      8.8.8.19

Trace complete.
```

Análise do Resultado dos Testes

Os testes de **ping** e **traceroute** demonstraram que a configuração da rede foi realizada com sucesso. Como evidenciado nas imagens, o **ping** obteve resposta de todos os destinos e o **traceroute** indicou o percurso correto dos pacotes, confirmando que a comunicação entre os dispositivos está funcional.

8. Desafios e Soluções

8.1 DHCP Centralizado

Desafio: Configurar DHCP centralizado para todas as filiais.

Solução: Implementação de DHCP Relay nos routers das filiais, direcionando pedidos para o servidor central em Coimbra.

8.2 Roteamento Inter-VLANs

Desafio: Permitir comunicação entre diferentes departamentos.

Solução: Configuração de SVIs no switch core 3650 para roteamento local eficiente.

8.3 Conectividade Internet

Desafio: Garantir acesso à Internet de todas as localizações.

Solução: Implementação de NAT no router ISP e configuração de rotas estáticas adequadas.

9. Conclusões

O projeto foi implementado com sucesso, cumprindo todos os requisitos especificados:

Conectividade completa entre todas as localizações

VLANs departamentais funcionais com IDs no formato correto (N19/19N)

Serviços centralizados (DHCP, DNS, Web) operacionais

Acesso à Internet de todas as localizações

Rede WiFi funcional com conectividade completa

Endereçamento hierárquico bem estruturado

A rede implementada demonstra uma arquitetura empresarial realista, com separação departamental, serviços centralizados e conectividade robusta. A utilização do switch core 3650 em Coimbra optimiza o desempenho local, enquanto o DHCP centralizado facilita a gestão da rede.

O projeto proporcionou uma compreensão prática de conceitos fundamentais de redes, incluindo VLANs, roteamento, NAT, DHCP e implementação de serviços de rede em ambiente empresarial.

10. Participações no Trabalho

Amir Ajij – a22304529 – 50%

Dhiren Lalitcumar – 22303499 – 25%

Nur Amade – 22409156 – 25%