

Trabalho Prático

Encaminhamento de Dados



Aluno: Fábio Oliveira

Nº: 2022145902

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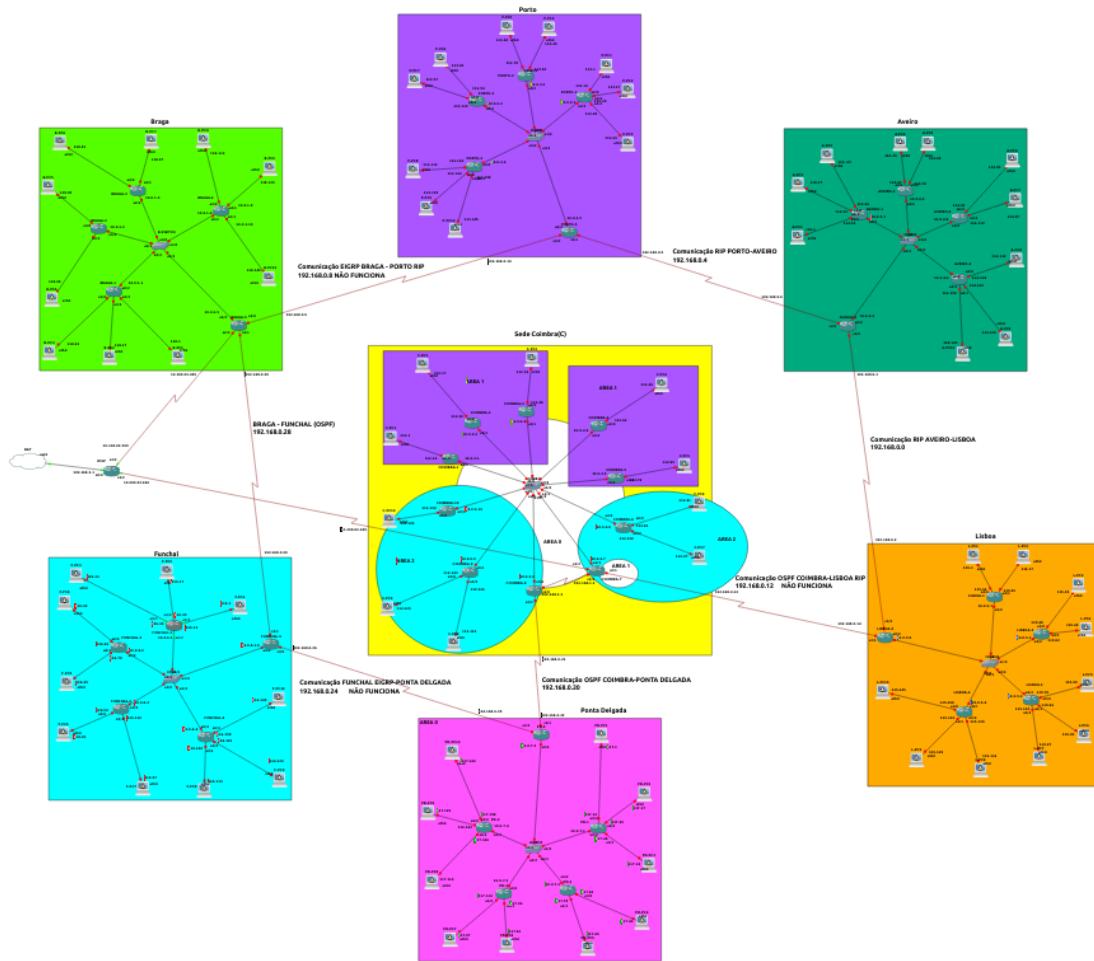
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Introdução

Este trabalho tem como objetivo o planeamento, simulação e configuração de uma rede de dados local e alargada para uma empresa fictícia. A rede é composta por uma sede e seis filiais distribuídas geograficamente. O projeto visa aprimorar a competência no planeamento, desenho e implementação de redes locais e alargadas, além da configuração de routers utilizando o sistema operativo Cisco IOS.

Topologia



A topologia da rede é composta pela sede em Coimbra e seis filiais em Aveiro, Braga, Funchal, Lisboa, Porto e Ponta Delgada. A sede possui 10 routers e cada filial possui 5 routers. Todas as filiais estão interconectadas e conectadas à sede via links de 100 Mbps.

Endereçamento

Endereçamento Privado

Para o endereçamento privado, foi utilizada a faixa 10.0.0.0/29 para as ligações internas entre routers e 192.168.0.0/30 para as conexões entre filiais. O endereçamento privado foi configurado de maneira a evitar desperdício do espaço de endereçamento público atribuído.

Tabela 1 - Endereços Privados

ID	Máscara	Rede	Primeiro Endereço	Último Endereço	Endereço Difusão
C-7 ao C-8	255.255.255.252	192.168.1.0	192.168.1.1	192.168.1.2	192.168.1.3
A-5 ao L-5	255.255.255.252	192.168.0.0	192.168.0.1	192.168.0.2	192.168.0.3
P-5 ao A-5	255.255.255.252	192.168.0.4	192.168.0.5	192.168.0.6	192.168.0.7
B-5 ao P-5	255.255.255.252	192.168.0.8	192.168.0.9	192.168.0.10	192.168.0.11
C-5 ao L-5	255.255.255.252	192.168.0.12	192.168.0.13	192.168.0.14	192.168.0.15
Nada	255.255.255.252	192.168.0.16	192.168.0.17	192.168.0.18	192.168.0.19
C-8 ao PD-5	255.255.255.252	192.168.0.20	192.168.0.21	192.168.0.22	192.168.0.23
PD-5 ao F5	255.255.255.252	192.168.0.24	192.168.0.25	192.168.0.26	192.168.0.27
F-5 ao B-5	255.255.255.252	192.168.0.28	192.168.0.29	192.168.0.30	192.168.0.31
C-7 ao RISP	255.255.255.252	10.200.02.244	10.200.02.245	10.200.02.246	10.200.02.247
B-5 ao RISP	255.255.255.252	10.100.02.248	10.100.02.249	10.100.02.250	10.100.02.251

Endereçamento Público

Endereço Público: 194.65.112.0/21

O endereço 194.65.112.0/21 cobre o intervalo de endereços IP de 194.65.112.0 a 194.65.119.255. Isso fornece um total de 2048 endereços.

Subdivisão Inicial: /21 para /24

Quando subdividimos o bloco /21 em blocos menores de /24, cada bloco /24 contém 256 endereços IP. A subdivisão resultará em 8 sub-redes /24.

Subdivisão Adicional: /24 para /28

Para fins de detalhamento e segmentação da rede, as sub-redes /24 podem ser subdivididas ainda mais em blocos /28. Cada bloco /28 contém 16 endereços IP como pode ser visto nas seguintes tabelas:

Tabela 2 - Endereços Braga IPv4

ID	Máscara	Rede	Primeiro Endereço	Último Endereço	Endereço Difusão
B Routers	255.255.255.248	10.0.1.0	10.0.1.1	10.0.1.5	10.0.1.7
B PC 1	255.255.255.240	194.65.118.0	194.65.118.1	194.65.118.14	194.65.118.15
B PC 2	255.255.255.240	194.65.118.16	194.65.118.17	194.65.118.30	194.65.118.31
B PC 3	255.255.255.240	194.65.118.32	194.65.118.33	194.65.118.46	194.65.118.47
B PC 4	255.255.255.240	194.65.118.48	194.65.118.49	194.65.118.62	194.65.118.63
B PC 5	255.255.255.240	194.65.118.64	194.65.118.65	194.65.118.78	194.65.118.79
B PC 6	255.255.255.240	194.65.118.80	194.65.118.81	194.65.118.94	194.65.118.95
B PC 7	255.255.255.240	194.65.118.96	194.65.118.97	194.65.118.110	194.65.118.111
B PC 8	255.255.255.240	194.65.118.112	194.65.118.113	194.65.118.126	194.65.118.127
B PC 9	255.255.255.240	194.65.118.128	194.65.118.129	194.65.118.142	194.65.118.143
B PC 10	255.255.255.240	194.65.118.144	194.65.118.145	194.65.118.158	194.65.118.159

Tabela 3 - Endereços - Braga IPv6

ID	Máscara	Rede	Primeiro Endereço	Último Endereço	Endereço Difusão
B Routers	/64	2001:db8:1::	2001:db8:1::1	2001:db8:1::5	2001:db8:1::ffff:ffff:ffff:ffff
B PC 1	/64	2001:db8:1:1::	2001:db8:1:1::1	2001:db8:1:1::ffff	2001:db8:1:1::ffff:ffff:ffff:ffff
B PC 2	/64	2001:db8:1:2::	2001:db8:1:2::1	2001:db8:1:2::ffff	2001:db8:1:2::ffff:ffff:ffff:ffff
B PC 3	/64	2001:db8:1:3::	2001:db8:1:3::1	2001:db8:1:3::ffff	2001:db8:1:3::ffff:ffff:ffff:ffff
B PC 4	/64	2001:db8:1:4::	2001:db8:1:4::1	2001:db8:1:4::ffff	2001:db8:1:4::ffff:ffff:ffff:ffff
B PC 5	/64	2001:db8:1:5::	2001:db8:1:5::1	2001:db8:1:5::ffff	2001:db8:1:5::ffff:ffff:ffff:ffff
B PC 6	/64	2001:db8:1:6::	2001:db8:1:6::1	2001:db8:1:6::ffff	2001:db8:1:6::ffff:ffff:ffff:ffff
B PC 7	/64	2001:db8:1:7::	2001:db8:1:7::1	2001:db8:1:7::ffff	2001:db8:1:7::ffff:ffff:ffff:ffff
B PC 8	/64	2001:db8:1:8::	2001:db8:1:8::1	2001:db8:1:8::ffff	2001:db8:1:8::ffff:ffff:ffff:ffff
B PC 9	/64	2001:db8:1:9::	2001:db8:1:9::1	2001:db8:1:9::ffff	2001:db8:1:9::ffff:ffff:ffff:ffff
B PC 10	/64	2001:db8:1:a::	2001:db8:1:a::1	2001:db8:1:a::ffff	2001:db8:1:a::ffff:ffff:ffff:ffff

Tabela 4 - Endereços Coimbra

ID	Máscara	Rede	Primeiro Endereço	Último Endereço	Endereço Difusão
C Routers	255.255.255.240	10.0.2.0	10.0.2.1	10.0.2.10	10.0.2.15
C PC 1	255.255.255.240	194.65.112.0	194.65.112.1	194.65.112.14	194.65.112.15
C PC 2	255.255.255.240	194.65.112.16	194.65.112.17	194.65.112.30	194.65.112.31
C PC 3	255.255.255.240	194.65.112.32	194.65.112.33	194.65.112.46	194.65.112.47
C PC 4	255.255.255.240	194.65.112.48	194.65.112.49	194.65.112.62	194.65.112.63
C PC 5	255.255.255.240	194.65.112.64	194.65.112.65	194.65.112.78	194.65.112.79
C PC 6	255.255.255.240	194.65.112.80	194.65.112.81	194.65.112.94	194.65.112.95
C PC 7	255.255.255.240	194.65.112.96	194.65.112.97	194.65.112.110	194.65.112.111
C PC 8	255.255.255.240	194.65.112.112	194.65.112.113	194.65.112.126	194.65.112.127
C PC 9	255.255.255.240	194.65.112.128	194.65.112.129	194.65.112.142	194.65.112.143
C PC 10	255.255.255.240	194.65.112.144	194.65.112.145	194.65.112.158	194.65.112.159

Tabela 5 - Endereços Porto

ID	Máscara	Rede	Primeiro Endereço	Último Endereço	Endereço Difusão
P Routers	255.255.255.248	10.0.3.0	10.0.3.1	10.0.3.5	10.0.3.7
P PC 1	255.255.255.240	194.65.113.0	194.65.113.1	194.65.113.14	194.65.113.15
P PC 2	255.255.255.240	194.65.113.16	194.65.113.17	194.65.113.30	194.65.113.31
P PC 3	255.255.255.240	194.65.113.32	194.65.113.33	194.65.113.46	194.65.113.47
P PC 4	255.255.255.240	194.65.113.48	194.65.113.49	194.65.113.62	194.65.113.63
P PC 5	255.255.255.240	194.65.113.64	194.65.113.65	194.65.113.78	194.65.113.79
P PC 6	255.255.255.240	194.65.113.80	194.65.113.81	194.65.113.94	194.65.113.95
P PC 7	255.255.255.240	194.65.113.96	194.65.113.97	194.65.113.110	194.65.113.111
P PC 8	255.255.255.240	194.65.113.112	194.65.113.113	194.65.113.126	194.65.113.127
P PC 9	255.255.255.240	194.65.113.128	194.65.113.129	194.65.113.142	194.65.113.143
P PC 10	255.255.255.240	194.65.113.144	194.65.113.145	194.65.113.158	194.65.113.159

Tabela 6 - Endereços Aveiro

ID	Máscara	Rede	Primeiro Endereço	Último Endereço	Endereço Difusão
A Routers	255.255.255.248	10.0.4.0	10.0.4.1	10.0.4.5	10.0.4.7
A PC 1	255.255.255.240	194.65.114.0	194.65.114.1	194.65.114.14	194.65.114.15
A PC 2	255.255.255.240	194.65.114.16	194.65.114.17	194.65.114.30	194.65.114.31
A PC 3	255.255.255.240	194.65.114.32	194.65.114.33	194.65.114.46	194.65.114.47
A PC 4	255.255.255.240	194.65.114.48	194.65.114.49	194.65.114.62	194.65.114.63
A PC 5	255.255.255.240	194.65.114.64	194.65.114.65	194.65.114.78	194.65.114.79
A PC 6	255.255.255.240	194.65.114.80	194.65.114.81	194.65.114.94	194.65.114.95
A PC 7	255.255.255.240	194.65.114.96	194.65.114.97	194.65.114.110	194.65.114.111
A PC 8	255.255.255.240	194.65.114.112	194.65.114.113	194.65.114.126	194.65.114.127
A PC 9	255.255.255.240	194.65.114.128	194.65.114.129	194.65.114.142	194.65.114.143
A PC 10	255.255.255.240	194.65.114.144	194.65.114.145	194.65.114.158	194.65.114.159

Tabela 7 - Endereços Lisboa

ID	Máscara	Rede	Primeiro Endereço	Último Endereço	Endereço Difusão
L Routers	255.255.255.248	10.0.5.0	10.0.5.1	10.0.5.5	10.0.5.7
L PC 1	255.255.255.240	194.65.115.0	194.65.115.1	194.65.115.14	194.65.115.15
L PC 2	255.255.255.240	194.65.115.16	194.65.115.17	194.65.115.30	194.65.115.31
L PC 3	255.255.255.240	194.65.115.32	194.65.115.33	194.65.115.46	194.65.115.47
L PC 4	255.255.255.240	194.65.115.48	194.65.115.49	194.65.115.62	194.65.115.63
L PC 5	255.255.255.240	194.65.115.64	194.65.115.65	194.65.115.78	194.65.115.79
L PC 6	255.255.255.240	194.65.115.80	194.65.115.81	194.65.115.94	194.65.115.95
L PC 7	255.255.255.240	194.65.115.96	194.65.115.97	194.65.115.110	194.65.115.111
L PC 8	255.255.255.240	194.65.115.112	194.65.115.113	194.65.115.126	194.65.115.127
L PC 9	255.255.255.240	194.65.115.128	194.65.115.129	194.65.115.142	194.65.115.143
L PC 10	255.255.255.240	194.65.115.144	194.65.115.145	194.65.115.158	194.65.115.159

Tabela 8 - Endereços Funchal

ID	Máscara	Rede	Primeiro Endereço	Último Endereço	Endereço Difusão
F Routers	255.255.255.248	10.0.6.0	10.0.6.1	10.0.6.5	10.0.6.7
F PC 1	255.255.255.240	194.65.116.0	194.65.116.1	194.65.116.14	194.65.116.15
F PC 2	255.255.255.240	194.65.116.16	194.65.116.17	194.65.116.30	194.65.116.31
F PC 3	255.255.255.240	194.65.116.32	194.65.116.33	194.65.116.46	194.65.116.47
F PC 4	255.255.255.240	194.65.116.48	194.65.116.49	194.65.116.62	194.65.116.63
F PC 5	255.255.255.240	194.65.116.64	194.65.116.65	194.65.116.78	194.65.116.79
F PC 6	255.255.255.240	194.65.116.80	194.65.116.81	194.65.116.94	194.65.116.95
F PC 7	255.255.255.240	194.65.116.96	194.65.116.97	194.65.116.110	194.65.116.111
F PC 8	255.255.255.240	194.65.116.112	194.65.116.113	194.65.116.126	194.65.116.127
F PC 9	255.255.255.240	194.65.116.128	194.65.116.129	194.65.116.142	194.65.116.143
F PC 10	255.255.255.240	194.65.116.144	194.65.116.145	194.65.116.158	194.65.116.159

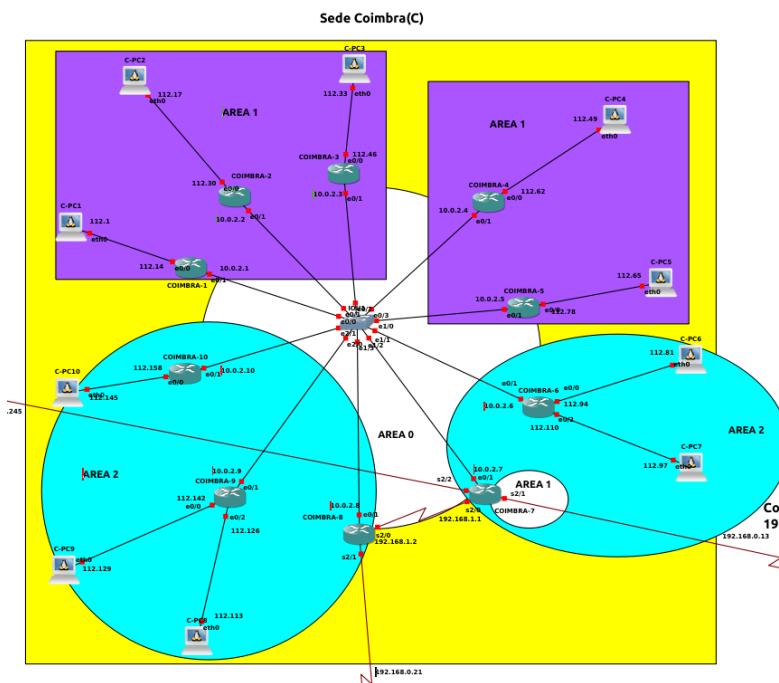
Tabela 9 - Endereços Ponta Delgada

ID	Máscara	Rede	Primeiro Endereço	Último Endereço	Endereço Difusão
PD Routers	255.255.255.248	10.0.7.0	10.0.7.1	10.0.7.5	10.0.7.7
PD PC 1	255.255.255.240	194.65.117.0	194.65.117.1	194.65.117.14	194.65.117.15
PD PC 2	255.255.255.240	194.65.117.16	194.65.117.17	194.65.117.30	194.65.117.31
PD PC 3	255.255.255.240	194.65.117.32	194.65.117.33	194.65.117.46	194.65.117.47
PD PC 4	255.255.255.240	194.65.117.48	194.65.117.49	194.65.117.62	194.65.117.63
PD PC 5	255.255.255.240	194.65.117.64	194.65.117.65	194.65.117.78	194.65.117.79
PD PC 6	255.255.255.240	194.65.117.80	194.65.117.81	194.65.117.94	194.65.117.95
PD PC 7	255.255.255.240	194.65.117.96	194.65.117.97	194.65.117.110	194.65.117.111
PD PC 8	255.255.255.240	194.65.117.112	194.65.117.113	194.65.117.126	194.65.117.127
PD PC 9	255.255.255.240	194.65.117.128	194.65.117.129	194.65.117.142	194.65.117.143
PD PC 10	255.255.255.240	194.65.117.144	194.65.117.145	194.65.117.158	194.65.117.159

Filiais

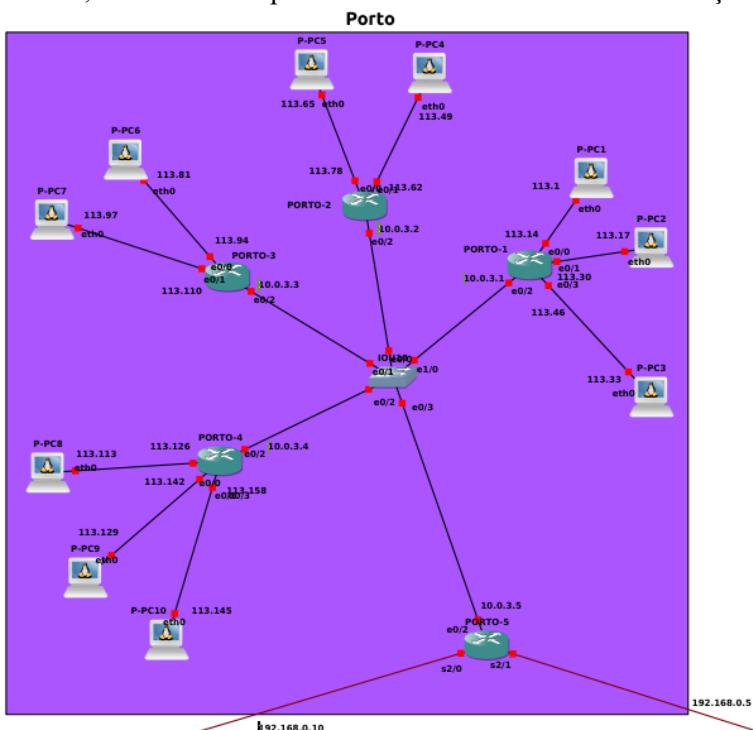
Coimbra

Em Coimbra, foi utilizado o protocolo OSPF com configuração de áreas. A sede possui 10 routers, e foram configurados links virtuais para o router 7 e 8 que não estavam diretamente conectadas à área 0. Também contem autenticação.



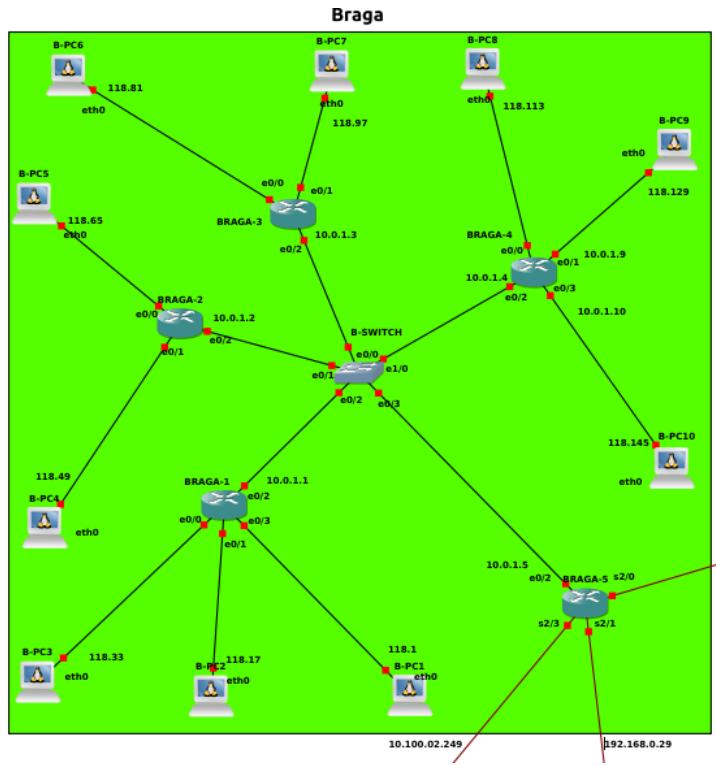
Porto

No Porto, foi utilizado o protocolo RIP versão 2 com autenticação e com auto-summary.



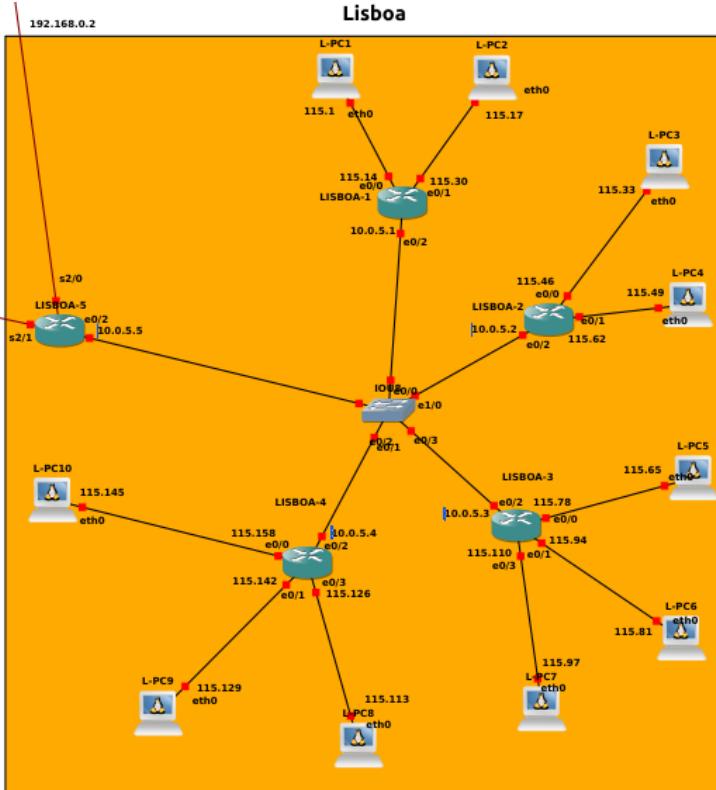
Braga

Braga utilizou o protocolo EIGRP tanto para IPv4 quanto para IPv6. A configuração incluiu a autenticação EIGRP e a criação de Policy-Based Routing (PBR). Além disso, uma prefix-list foi configurada para impedir determinados anúncios EIGRP.



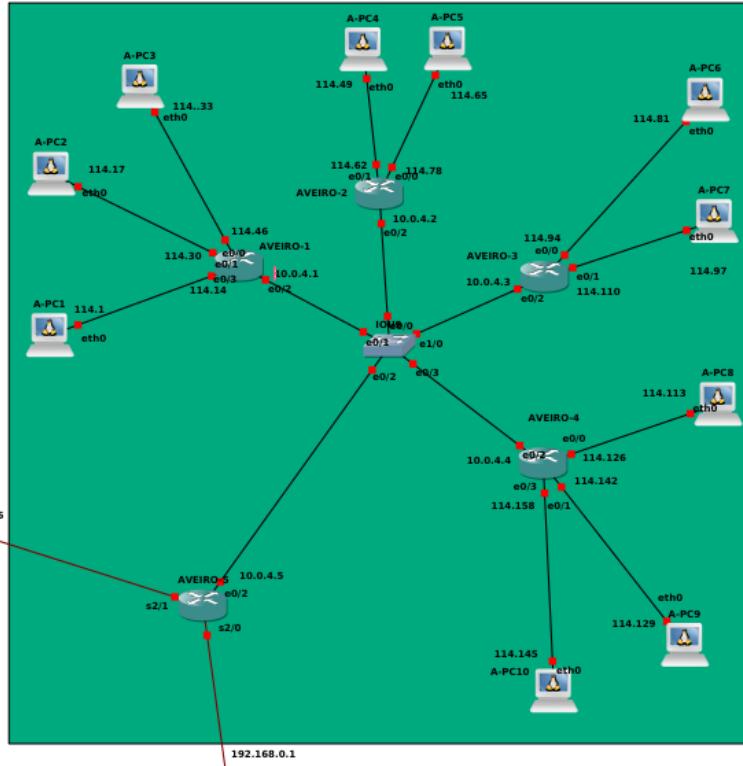
Lisboa

Em Lisboa, foi utilizado o protocolo RIP versão 2 com autenticação e com auto-summary .



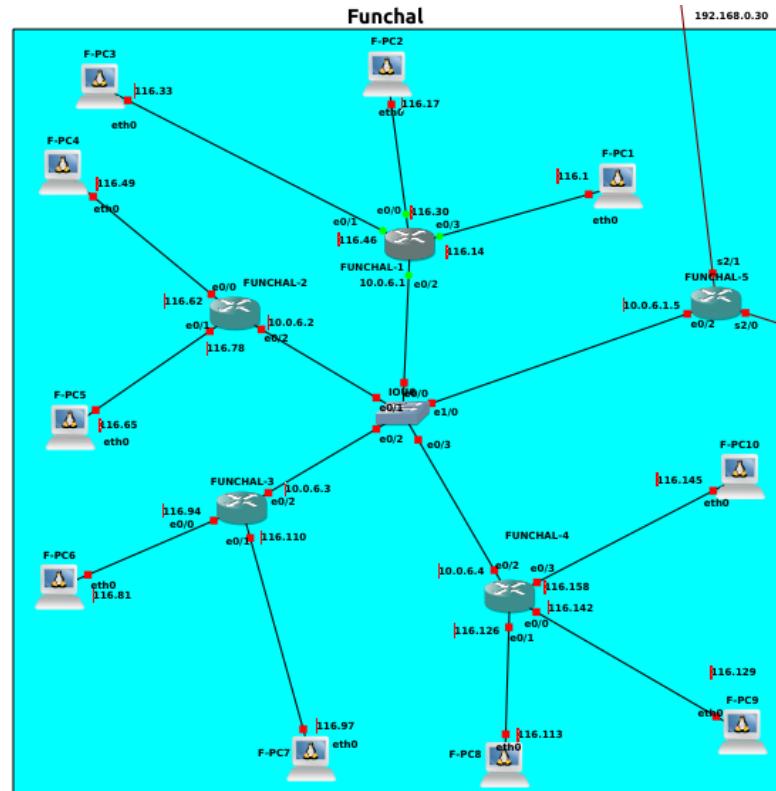
Aveiro

Em Aveiro, foi utilizado o protocolo RIP versão 2, autenticação e auto-summary.



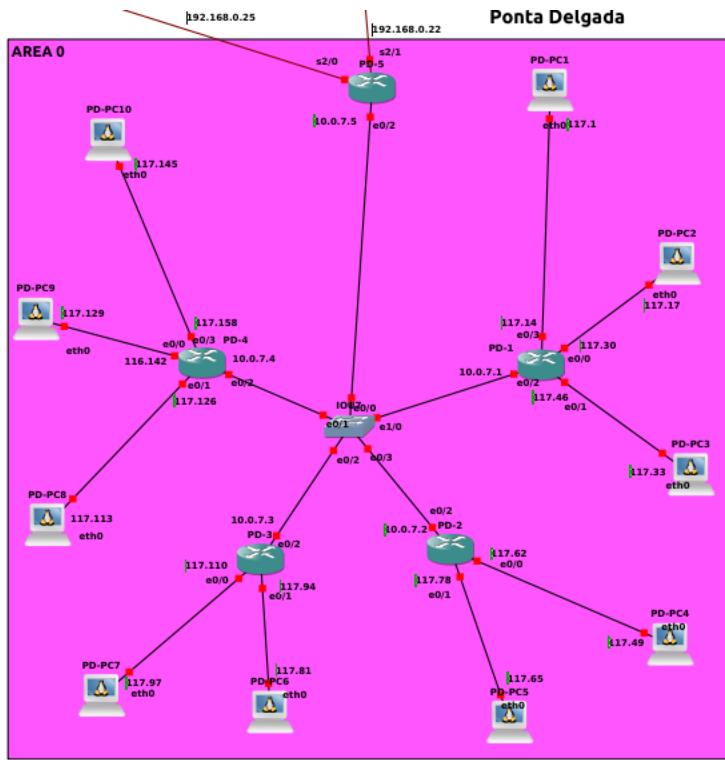
Funchal

No Funchal, foi utilizado o protocolo EIGRP para IPv4. A autenticação EIGRP também foi configurada e o auto-summary também..



Ponta Delgada

Em Ponta Delgada, foi utilizado o protocolo OSPF, configurado com autenticação OSPF e com auto-summary usado.



Saída primária e secundária

A sede está conectada à Internet através de uma ligação primária de 1 Gbps e uma ligação secundária de 100 Mbps via Braga. A ligação secundária é usada apenas quando a ligação primária está indisponível.

```
Serial2/2 is up, line protocol is down
Hardware is M4T
Internet address is 10.200.2.246/30
MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation PPP, LCP REQsent, crc 16, loopback not set
Keepalive set (10 sec)
Restart-Delay is 0 secs
Last input never, output 00:00:01, output hang never
Last clearing of "show interface" counters 01:18:30
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
```

Figura 1 - 1Gbs speed RISP

```
Serial2/3 is up, line protocol is up
Hardware is M4T
Internet address is 10.100.2.250/30
MTU 1500 bytes, BW 100000 Kbit/sec, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation PPP, LCP Open
Open: IPCP, CDPCP, crc 16, loopback not set
Keepalive set (10 sec)
Restart-Delay is 0 secs
Last input 00:00:04, output 00:00:04, output hang never
Last clearing of "show interface" counters 01:21:13
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
```

Figura 2 - 100Mbs speed RISP

```
RISP#ping 2.2.2.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2.2.2.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/9/30 ms
RISP#
```

Figura 3 - Conexão à rede através do RISP

Tabelas de routing

Abaixo estão as tabelas de roteamento coletadas de um router de cada filial e da sede quando em funcionamento normal:

```
S*  0.0.0.0/0 [10/0] via 10.100.2.250
    10.0.0.0/8 is variably subnetted, 6 subnets, 3 masks
C      10.0.1.0/29 is directly connected, Ethernet0/2
L      10.0.1.5/32 is directly connected, Ethernet0/2
D      10.0.6.0/29 [90/793600] via 192.168.0.30, 00:12:53, Serial2/1
C      10.100.2.248/30 is directly connected, Serial2/3
L      10.100.2.249/32 is directly connected, Serial2/3
C      10.100.2.250/32 is directly connected, Serial2/3
        192.168.0.0/24 is variably subnetted, 6 subnets, 2 masks
C          192.168.0.8/30 is directly connected, Serial2/0
L          192.168.0.9/32 is directly connected, Serial2/0
D          192.168.0.24/30 [90/1049600] via 192.168.0.30, 00:01:53, Serial2/1
D          192.168.0.25/32 [90/1049600] via 192.168.0.30, 00:01:53, Serial2/1
C          192.168.0.28/30 is directly connected, Serial2/1
L          192.168.0.29/32 is directly connected, Serial2/1
        194.65.116.0/28 is subnetted, 10 subnets
D          194.65.116.0 [90/819200] via 192.168.0.30, 00:00:56, Serial2/1
D          194.65.116.16 [90/819200] via 192.168.0.30, 00:00:56, Serial2/1
D          194.65.116.32 [90/819200] via 192.168.0.30, 00:00:56, Serial2/1
D          194.65.116.48 [90/819200] via 192.168.0.30, 00:00:53, Serial2/1
D          194.65.116.64 [90/819200] via 192.168.0.30, 00:00:53, Serial2/1
D          194.65.116.80 [90/819200] via 192.168.0.30, 00:00:53, Serial2/1
D          194.65.116.96 [90/819200] via 192.168.0.30, 00:00:53, Serial2/1
D          194.65.116.112 [90/819200] via 192.168.0.30, 00:00:56, Serial2/1
D          194.65.116.128 [90/819200] via 192.168.0.30, 00:00:56, Serial2/1
D          194.65.116.144 [90/819200] via 192.168.0.30, 00:00:56, Serial2/1
        194.65.118.0/28 is subnetted, 10 subnets
D          194.65.118.0 [90/307200] via 10.0.1.1, 00:00:52, Ethernet0/2
```

Figura 4 - Routing Table de Braga R5

```
10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C      10.0.3.0/29 is directly connected, Ethernet0/2
L      10.0.3.5/32 is directly connected, Ethernet0/2
R      10.0.4.0/29 [120/1] via 192.168.0.6, 00:00:08, Serial2/1
R      10.0.5.0/29 [120/2] via 192.168.0.6, 00:00:08, Serial2/1
        192.168.0.0/24 is variably subnetted, 6 subnets, 2 masks
R          192.168.0.0/30 [120/1] via 192.168.0.6, 00:00:08, Serial2/1
C          192.168.0.4/30 is directly connected, Serial2/1
L          192.168.0.5/32 is directly connected, Serial2/1
C          192.168.0.8/30 is directly connected, Serial2/0
L          192.168.0.10/32 is directly connected, Serial2/0
R          192.168.0.12/30 [120/2] via 192.168.0.6, 00:00:08, Serial2/1
        194.65.113.0/28 is subnetted, 10 subnets
R          194.65.113.0 [120/1] via 10.0.3.1, 00:00:10, Ethernet0/2
R          194.65.113.16 [120/1] via 10.0.3.1, 00:00:10, Ethernet0/2
R          194.65.113.32 [120/1] via 10.0.3.1, 00:00:10, Ethernet0/2
R          194.65.113.48 [120/1] via 10.0.3.2, 00:00:15, Ethernet0/2
R          194.65.113.64 [120/1] via 10.0.3.2, 00:00:15, Ethernet0/2
R          194.65.113.80 [120/1] via 10.0.3.3, 00:00:09, Ethernet0/2
R          194.65.113.96 [120/1] via 10.0.3.3, 00:00:09, Ethernet0/2
R          194.65.113.112 [120/1] via 10.0.3.4, 00:00:08, Ethernet0/2
R          194.65.113.128 [120/1] via 10.0.3.4, 00:00:08, Ethernet0/2
R          194.65.113.144 [120/1] via 10.0.3.4, 00:00:08, Ethernet0/2
        194.65.114.0/28 is subnetted, 10 subnets
R          194.65.114.0 [120/2] via 192.168.0.6, 00:00:08, Serial2/1
R          194.65.114.16 [120/2] via 192.168.0.6, 00:00:08, Serial2/1
R          194.65.114.32 [120/2] via 192.168.0.6, 00:00:08, Serial2/1
R          194.65.114.48 [120/2] via 192.168.0.6, 00:00:08, Serial2/1
R          194.65.114.64 [120/2] via 192.168.0.6, 00:00:08, Serial2/1
```

Figura 5 - Routing Table do Porto R5

```

10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
R   10.0.3.0/29 [120/1] via 192.168.0.5, 00:00:16, Serial2/1
C   10.0.4.0/29 is directly connected, Ethernet0/2
L   10.0.4.5/32 is directly connected, Ethernet0/2
R   10.0.5.0/29 [120/1] via 192.168.0.2, 00:00:07, Serial2/0
192.168.0.0/24 is variably subnetted, 6 subnets, 2 masks
C     192.168.0.0/30 is directly connected, Serial2/0
L     192.168.0.1/32 is directly connected, Serial2/0
C     192.168.0.4/30 is directly connected, Serial2/1
L     192.168.0.6/32 is directly connected, Serial2/1
R     192.168.0.8/30 [120/1] via 192.168.0.5, 00:00:16, Serial2/1
R     192.168.0.12/30 [120/1] via 192.168.0.2, 00:00:07, Serial2/0
194.65.113.0/28 is subnetted, 10 subnets
R       194.65.113.0 [120/2] via 192.168.0.5, 00:00:16, Serial2/1
R       194.65.113.16 [120/2] via 192.168.0.5, 00:00:16, Serial2/1
R       194.65.113.32 [120/2] via 192.168.0.5, 00:00:16, Serial2/1
R       194.65.113.48 [120/2] via 192.168.0.5, 00:00:16, Serial2/1
R       194.65.113.64 [120/2] via 192.168.0.5, 00:00:16, Serial2/1
R       194.65.113.80 [120/2] via 192.168.0.5, 00:00:16, Serial2/1
R       194.65.113.96 [120/2] via 192.168.0.5, 00:00:16, Serial2/1
R       194.65.113.112 [120/2] via 192.168.0.5, 00:00:16, Serial2/1
R       194.65.113.128 [120/2] via 192.168.0.5, 00:00:16, Serial2/1
R       194.65.113.144 [120/2] via 192.168.0.5, 00:00:16, Serial2/1
194.65.114.0/28 is subnetted, 10 subnets
R         194.65.114.0 [120/1] via 10.0.4.1, 00:00:16, Ethernet0/2
R         194.65.114.16 [120/1] via 10.0.4.1, 00:00:16, Ethernet0/2

```

Figura 6 - Routing Table Aveiro R5

```

10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
R   10.0.3.0/29 [120/2] via 192.168.0.1, 00:00:16, Serial2/0
R   10.0.4.0/29 [120/1] via 192.168.0.1, 00:00:16, Serial2/0
C   10.0.5.0/29 is directly connected, Ethernet0/2
L   10.0.5.5/32 is directly connected, Ethernet0/2
192.168.0.0/24 is variably subnetted, 6 subnets, 2 masks
C     192.168.0.0/30 is directly connected, Serial2/0
L     192.168.0.2/32 is directly connected, Serial2/0
R     192.168.0.4/30 [120/1] via 192.168.0.1, 00:00:16, Serial2/0
R     192.168.0.8/30 [120/2] via 192.168.0.1, 00:00:16, Serial2/0
C     192.168.0.12/30 is directly connected, Serial2/1
L     192.168.0.14/32 is directly connected, Serial2/1
194.65.113.0/28 is subnetted, 10 subnets
R       194.65.113.0 [120/3] via 192.168.0.1, 00:00:16, Serial2/0
R       194.65.113.16 [120/3] via 192.168.0.1, 00:00:16, Serial2/0
R       194.65.113.32 [120/3] via 192.168.0.1, 00:00:16, Serial2/0
R       194.65.113.48 [120/3] via 192.168.0.1, 00:00:16, Serial2/0
R       194.65.113.64 [120/3] via 192.168.0.1, 00:00:16, Serial2/0
R       194.65.113.80 [120/3] via 192.168.0.1, 00:00:16, Serial2/0
R       194.65.113.96 [120/3] via 192.168.0.1, 00:00:16, Serial2/0
R       194.65.113.112 [120/3] via 192.168.0.1, 00:00:16, Serial2/0
R       194.65.113.128 [120/3] via 192.168.0.1, 00:00:16, Serial2/0
R       194.65.113.144 [120/3] via 192.168.0.1, 00:00:16, Serial2/0
194.65.114.0/28 is subnetted, 10 subnets
R         194.65.114.0 [120/2] via 192.168.0.1, 00:00:16, Serial2/0
R         194.65.114.16 [120/2] via 192.168.0.1, 00:00:16, Serial2/0

```

Figura 7 - Routing Table de Lisboa R5

```

S*   0.0.0.0/0 [1/0] via 10.200.2.246
      10.0.0.0/8 is variably subnetted, 6 subnets, 4 masks
C       10.0.2.0/28 is directly connected, Ethernet0/1
L       10.0.2.7/32 is directly connected, Ethernet0/1
O       10.0.7.0/29 [110/12] via 192.168.1.2, 00:04:23, Serial2/0
C       10.200.2.244/30 is directly connected, Serial2/2
L       10.200.2.245/32 is directly connected, Serial2/2
C       10.200.2.246/32 is directly connected, Serial2/2
      192.168.0.0/24 is variably subnetted, 5 subnets, 2 masks
C       192.168.0.12/30 is directly connected, Serial2/1
L       192.168.0.13/32 is directly connected, Serial2/1
O       192.168.0.20/30 [110/2] via 192.168.1.2, 00:08:25, Serial2/0
O       192.168.0.24/30 [110/3] via 192.168.1.2, 00:08:25, Serial2/0
O E2     192.168.0.26/32 [110/20] via 192.168.1.2, 00:08:25, Serial2/0
      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/30 is directly connected, Serial2/0
L       192.168.1.1/32 is directly connected, Serial2/0
      194.65.112.0/28 is subnetted, 10 subnets
O IA     194.65.112.0 [110/20] via 10.0.2.1, 00:07:25, Ethernet0/1
O IA     194.65.112.16 [110/20] via 10.0.2.2, 00:07:25, Ethernet0/1
O IA     194.65.112.32 [110/20] via 10.0.2.3, 00:07:20, Ethernet0/1
O IA     194.65.112.48 [110/20] via 10.0.2.4, 00:07:25, Ethernet0/1
O IA     194.65.112.64 [110/20] via 10.0.2.5, 00:07:25, Ethernet0/1
O IA     194.65.112.80 [110/20] via 10.0.2.6, 00:07:25, Ethernet0/1
O IA     194.65.112.96 [110/20] via 10.0.2.6, 00:07:25, Ethernet0/1

```

Figura 8 - Routing Table de Coimbra R7

```

      10.0.0.0/8 is variably subnetted, 3 subnets, 3 masks
O       10.0.2.0/28 [110/11] via 192.168.0.21, 00:08:37, Serial2/1
C       10.0.7.0/29 is directly connected, Ethernet0/2
L       10.0.7.5/32 is directly connected, Ethernet0/2
      192.168.0.0/24 is variably subnetted, 6 subnets, 2 masks
O       192.168.0.12/30 [110/3] via 192.168.0.21, 00:09:41, Serial2/1
C       192.168.0.20/30 is directly connected, Serial2/1
L       192.168.0.22/32 is directly connected, Serial2/1
C       192.168.0.24/30 is directly connected, Serial2/0
L       192.168.0.25/32 is directly connected, Serial2/0
C       192.168.0.26/32 is directly connected, Serial2/0
      192.168.1.0/30 is subnetted, 1 subnets
O IA     192.168.1.0 [110/2] via 192.168.0.21, 00:09:46, Serial2/1
      194.65.112.0/28 is subnetted, 10 subnets
O IA     194.65.112.0 [110/21] via 192.168.0.21, 00:08:37, Serial2/1
O IA     194.65.112.16 [110/21] via 192.168.0.21, 00:08:37, Serial2/1
O IA     194.65.112.32 [110/21] via 192.168.0.21, 00:08:32, Serial2/1
O IA     194.65.112.48 [110/21] via 192.168.0.21, 00:08:37, Serial2/1
O IA     194.65.112.64 [110/21] via 192.168.0.21, 00:08:37, Serial2/1
O IA     194.65.112.80 [110/21] via 192.168.0.21, 00:08:37, Serial2/1
O IA     194.65.112.96 [110/21] via 192.168.0.21, 00:08:37, Serial2/1
O IA     194.65.112.112 [110/21] via 192.168.0.21, 00:08:37, Serial2/1
O IA     194.65.112.128 [110/21] via 192.168.0.21, 00:08:37, Serial2/1
O IA     194.65.112.144 [110/21] via 192.168.0.21, 00:08:37, Serial2/1
      194.65.117.0/28 is subnetted, 10 subnets
O       194.65.117.0 [110/20] via 10.0.7.1, 00:08:47, Ethernet0/2
O       194.65.117.16 [110/20] via 10.0.7.1, 00:08:47, Ethernet0/2
O       194.65.117.32 [110/20] via 10.0.7.1, 00:08:47, Ethernet0/2
O       194.65.117.48 [110/20] via 10.0.7.2, 00:08:37, Ethernet0/2

```

Figura 9 - Routing Table de Ponta Delgada R5

```

10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
D      10.0.1.0/29 [90/793600] via 192.168.0.29, 00:00:20, Serial2/1
C      10.0.6.0/29 is directly connected, Ethernet0/2
L      10.0.6.5/32 is directly connected, Ethernet0/2
192.168.0.0/24 is variably subnetted, 6 subnets, 2 masks
D      192.168.0.8/30 [90/1049600] via 192.168.0.29, 00:00:20, Serial2/1
C      192.168.0.24/30 is directly connected, Serial2/0
C      192.168.0.25/32 is directly connected, Serial2/0
L      192.168.0.26/32 is directly connected, Serial2/0
C      192.168.0.28/30 is directly connected, Serial2/1
L      192.168.0.30/32 is directly connected, Serial2/1
194.65.116.0/28 is subnetted, 10 subnets
D      194.65.116.0 [90/307200] via 10.0.6.1, 00:00:15, Ethernet0/2
D      194.65.116.16 [90/307200] via 10.0.6.1, 00:00:15, Ethernet0/2
D      194.65.116.32 [90/307200] via 10.0.6.1, 00:00:15, Ethernet0/2
D      194.65.116.48 [90/307200] via 10.0.6.2, 00:00:19, Ethernet0/2
D      194.65.116.64 [90/307200] via 10.0.6.2, 00:00:19, Ethernet0/2
D      194.65.116.80 [90/307200] via 10.0.6.3, 00:00:19, Ethernet0/2
D      194.65.116.96 [90/307200] via 10.0.6.3, 00:00:19, Ethernet0/2
D      194.65.116.112 [90/307200] via 10.0.6.4, 00:00:19, Ethernet0/2
D      194.65.116.128 [90/307200] via 10.0.6.4, 00:00:19, Ethernet0/2
D      194.65.116.144 [90/307200] via 10.0.6.4, 00:00:19, Ethernet0/2
194.65.118.0/28 is subnetted, 10 subnets
D      194.65.118.0 [90/819200] via 192.168.0.29, 00:00:20, Serial2/1
D      194.65.118.16 [90/819200] via 192.168.0.29, 00:00:20, Serial2/1
D      194.65.118.32 [90/819200] via 192.168.0.29, 00:00:20, Serial2/1
D      194.65.118.48 [90/819200] via 192.168.0.29, 00:00:20, Serial2/1
D      194.65.118.64 [90/819200] via 192.168.0.29, 00:00:20, Serial2/1
D      194.65.118.80 [90/819200] via 192.168.0.29, 00:00:20, Serial2/1

```

Figura 10 - Routing Table Funchal R5

Conclusão

Neste trabalho, todos os objetivos propostos foram alcançados. A rede foi planejada, configurada e testada conforme os requisitos do enunciado. A implementação dos protocolos de roteamento, autenticação e a configuração das ligações primária e secundária foram bem-sucedidas. O processo de planejamento e implementação reforçou os conceitos aprendidos em sala de aula e proporcionou uma experiência prática valiosa em redes de computadores.