

# Estudo de Caso de Sistema Autônomo (AS) com Conexão a PTT Local, Remoto e Provedores de Trânsito

Antonio Galvao de Rezende Filho <galvao@nic.br>

Eduardo Ascenço Reis <eascenco@nic.br>

GTER29

20100515

Algar Telecom (CTBC)

Aluísio da Silva, Epafras Schaden e Tiago Carrijo Setti

Fasternet

Israel Arruda Neto e Diego Zuaneti Arruda

NIC.br

PTTMetro – equipe

Ailton Soares da Rocha e Jose Eduardo de Oliveira

Operações

Marcelo Gardini do Amaral e equipe

Descrição do Caso

Descrição dos Recursos e da Estrutura Utilizada

Política de Roteamento

Configurações

Verificações

Referências

O objetivo desta apresentação é mostrar um estudo de caso de Sistema Autônomo (AS) com conexão a um ponto de troca de tráfego (PTT) local (PTTMetro Campinas), conexão com PTT remoto de grande interesse (PTTMetro São Paulo) e duas conexões de trânsito, como possível modelo de implementação de política de roteamento para ASes com conexões externas semelhantes.

O estudo de caso será com um AS real do próprio NIC.br (AS11752), implementado na prática com IPv4 e IPv6. A partir desse modelo, serão apresentadas também configurações genéricas utilizando ASN e endereçamento reservados para documentações.

- Aumento do Número de Sistemas Autônomos (AS) Brasileiros e Participantes no PTTMetro
- Aumento do número de AS presentes em mais de uma localidade do PTTMetro  
Situação com maior complexidade
- Demanda de documentação de apoio para AS

Implementação de AS real, localizado fisicamente na região da cidade de Campinas, no estado de São Paulo.

AS com dois provedores de trânsito e conexão com PTTMetro São Paulo e PTTMetro Campinas.

## Detalhes

PTTMetro otimiza a interconexão entre AS, pois possibilita:

- Melhor qualidade (menor latência) – evita intermediários externos
- Menor custo
- Maior organização da estrutura de rede regional (pontos concentradores)

AS utiliza conexão própria até o PTTMetro Campinas

- Opção mais barata
- Tráfego local fique local
- Maior preferência

AS utiliza capacidade de transporte contratado para chegar até o PTTMetro São Paulo, a partir do PTTMetro Campinas

- Vide PTTForum 2009
- Segunda opção de maior preferência

## Resumo de Preferência de Utilização

1<sup>a</sup> - PTTMetro Campinas

Tráfego local - sem restrição de banda

2<sup>a</sup> - PTTMetro São Paulo

Tráfego de interesse - capacidade de transporte contratada

3<sup>a</sup> - Provedores de Trânsito

Acesso aos demais AS da Internet não presentes no PTTMetro São Paulo e Campinas em modo de redundância e balanceamento do tráfego



```
asn:          AS11752
entidade:     Núcleo de Informação e Coordenação do Ponto BR
inetnum:      189.76.96/19
inetnum:      2001:12fe::/32
```

## 1x Roteador Juniper

Modelo J2300

## 4x Thin Client

Processador - \*AMD LX800 500MHz Processor (Fanless)

Memoria – 512 MB

HD - 1Gb Flash

```
root@labas-th2:~# lsb_release -a
No LSB modules are available.
Distributor ID: Ubuntu
Description: Ubuntu 9.10
Release: 9.10
Codename:    karmic
root@labas-th2:~#
root@labas-th2:~# uname -a
Linux labas-th2 2.6.31-14-generic #48-Ubuntu SMP
Fri Oct 16 14:04:26 UTC 2009 i586 GNU/Linux
root@labas-th2:~#
root@labas-th2:~# dpkg -l | grep quagga
ii quagga                                0.99.13-1
                                     BGP/OSPF/RIP routing daemon
root@labas-th2:~#
```



## IDC

Provedor: Fasternet

Local: Campinas - PIX do PTTMetro

Serviço: hospedagem dos equipamentos

## Transporte entre localidades do PTTMetro

Provedor: Fasternet

Serviço: Transporte com Isolamento Lógico de VLANs

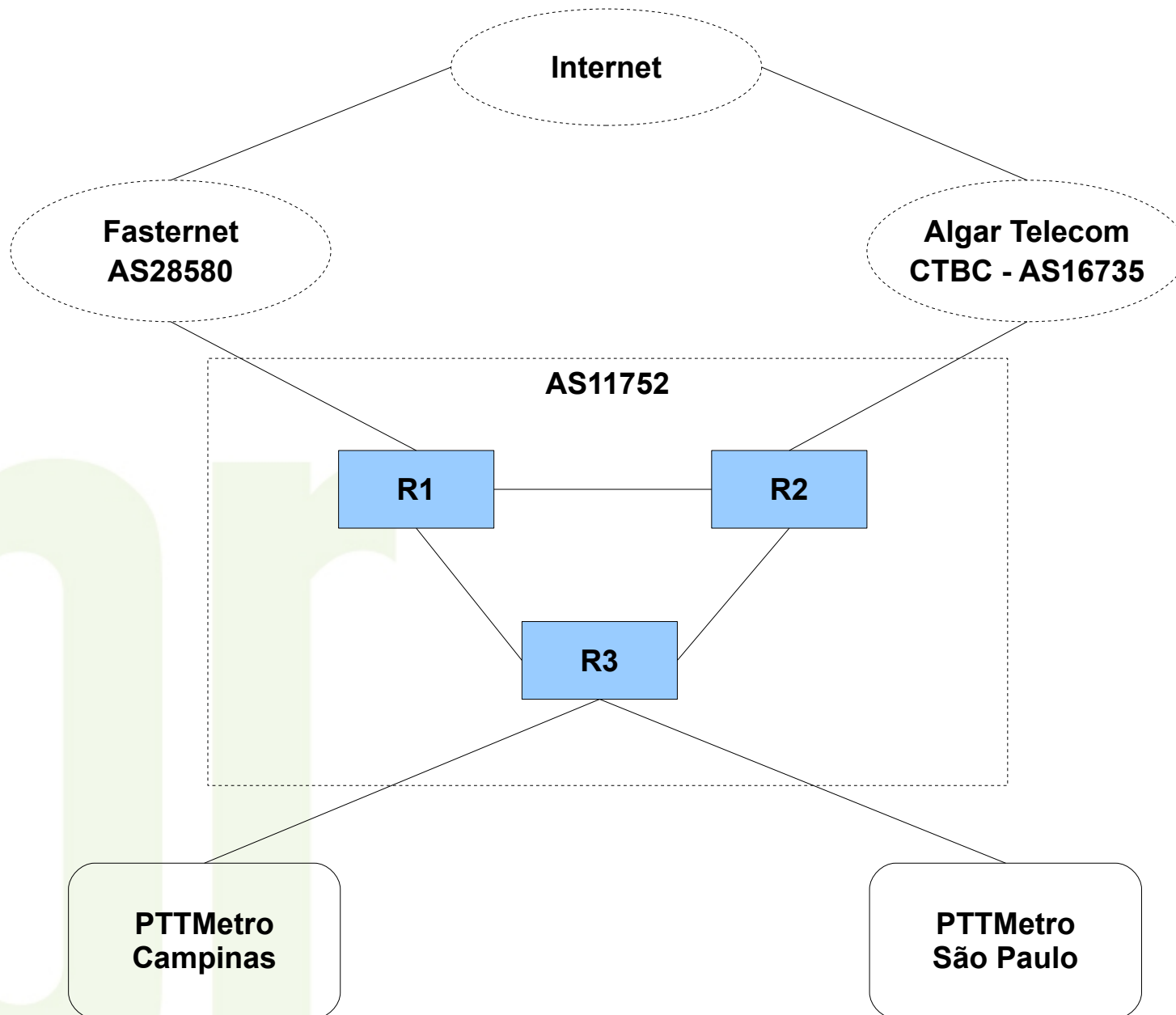
Locais: Campinas e São Paulo

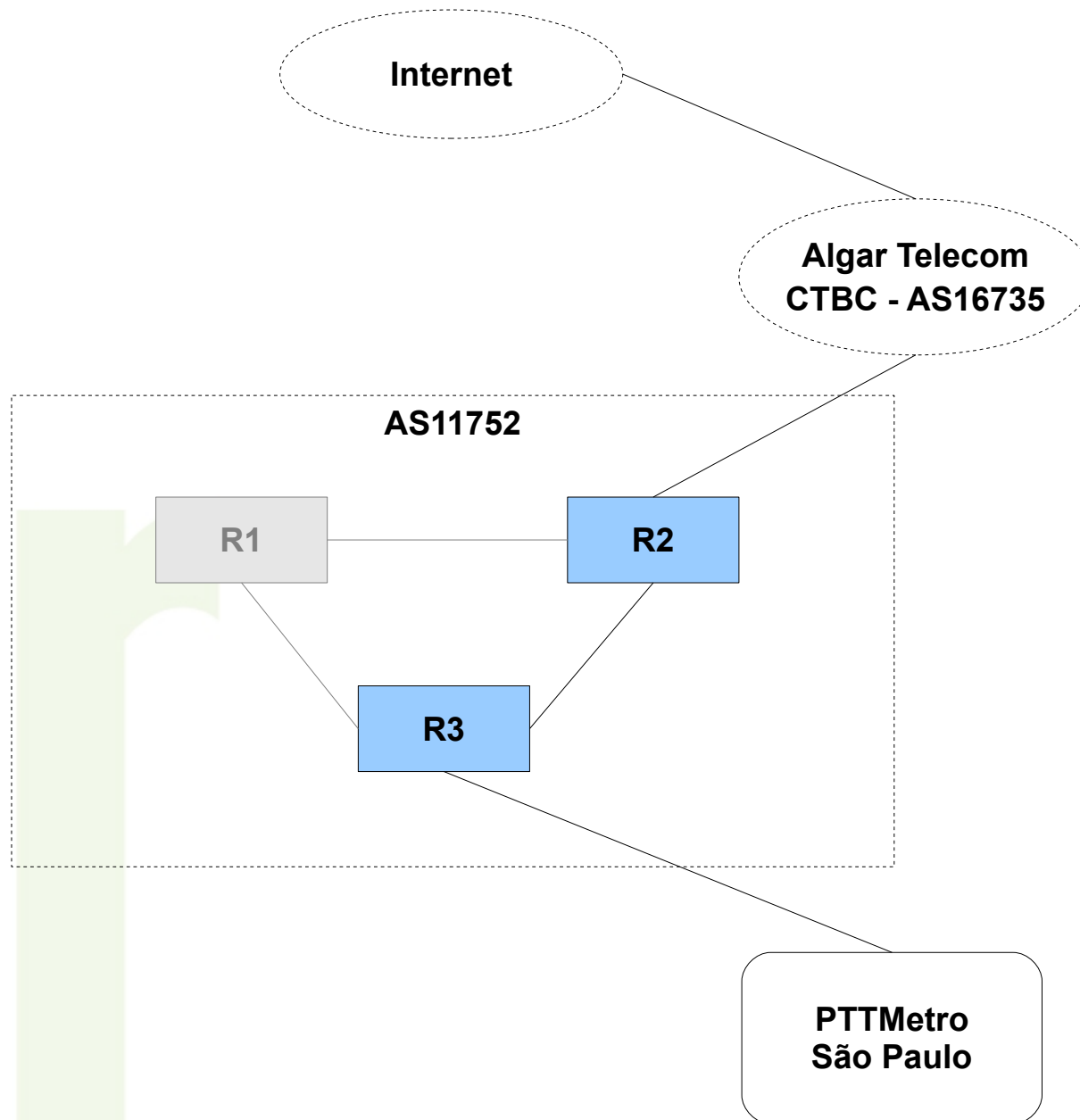
### **Algar Telecom (CTBC) - AS16735**

Serviço de Trânsito para a Internet IPv4 e IPv6 com tabelas BGP completas entregue no PTTMetro São Paulo em uma VLAN dedicada (acordo bilateral)

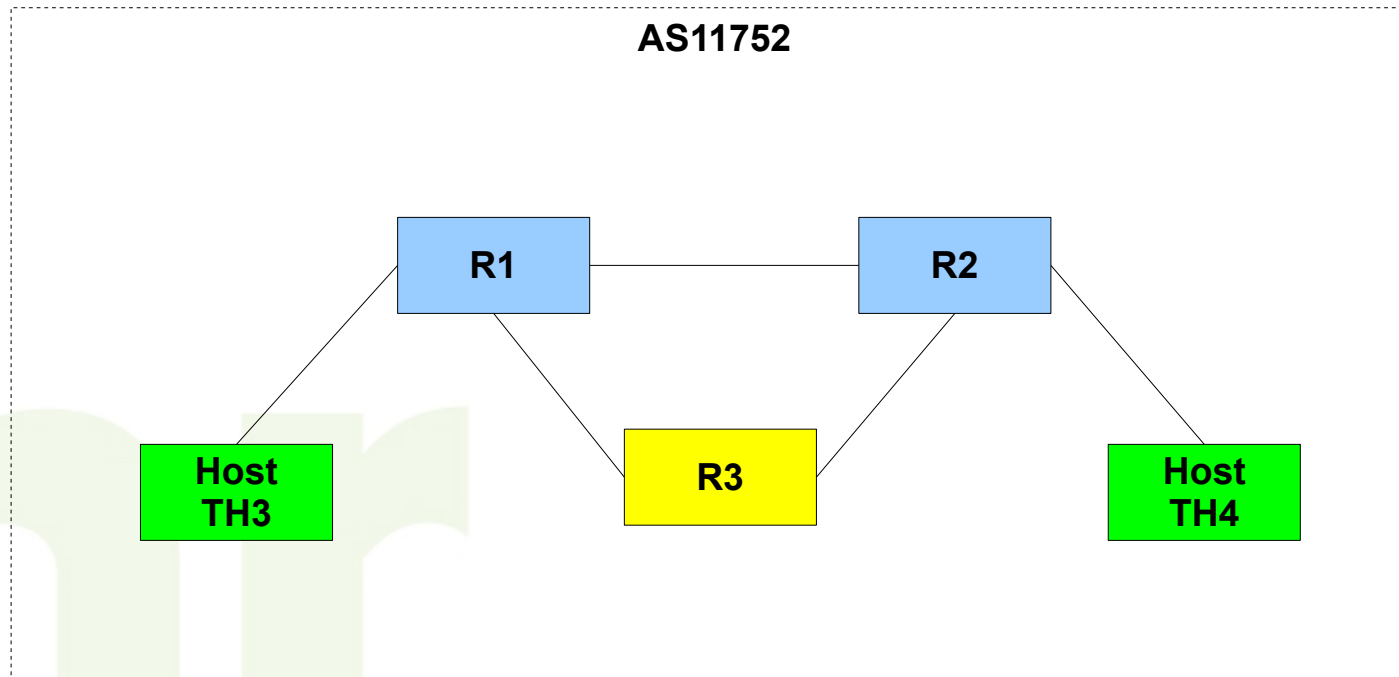
### **Fasternet - AS28580**

Serviço de Trânsito para a Internet IPv4 com tabela BGP completa entregue no PTTMetro Campinas em uma VLAN dedicada (acordo bilateral)

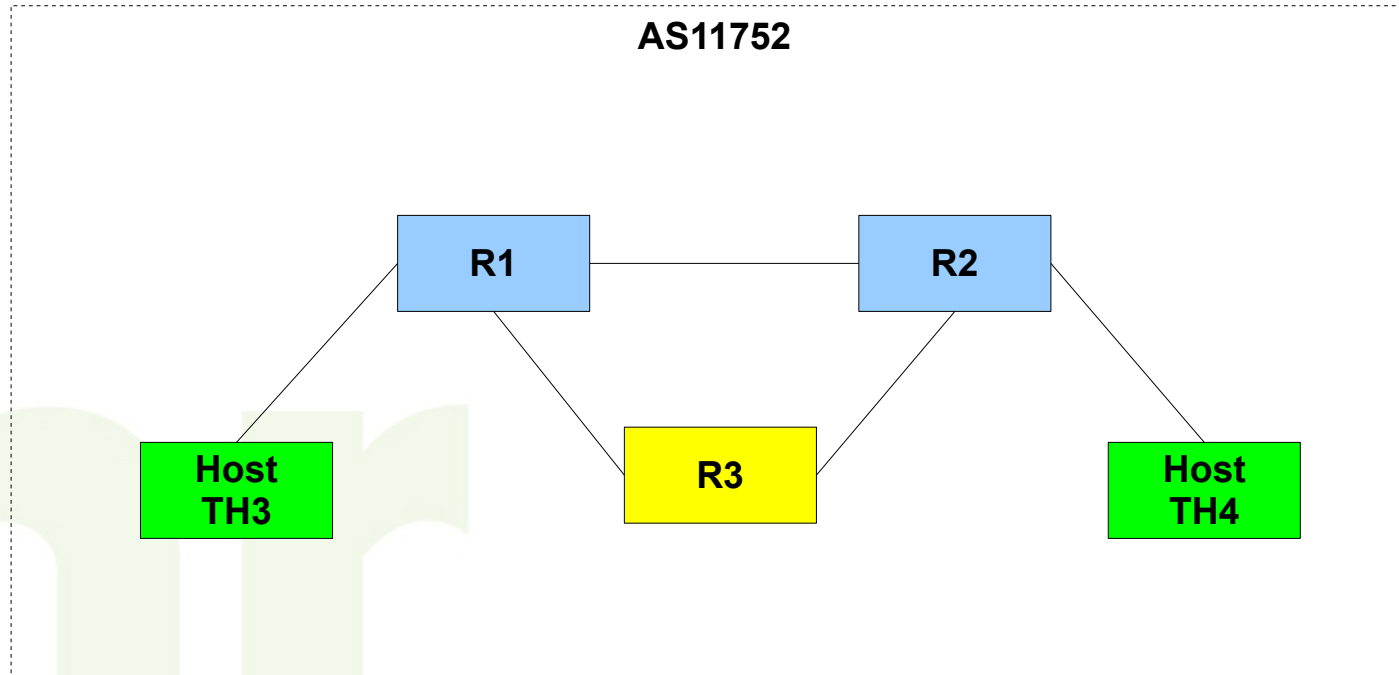







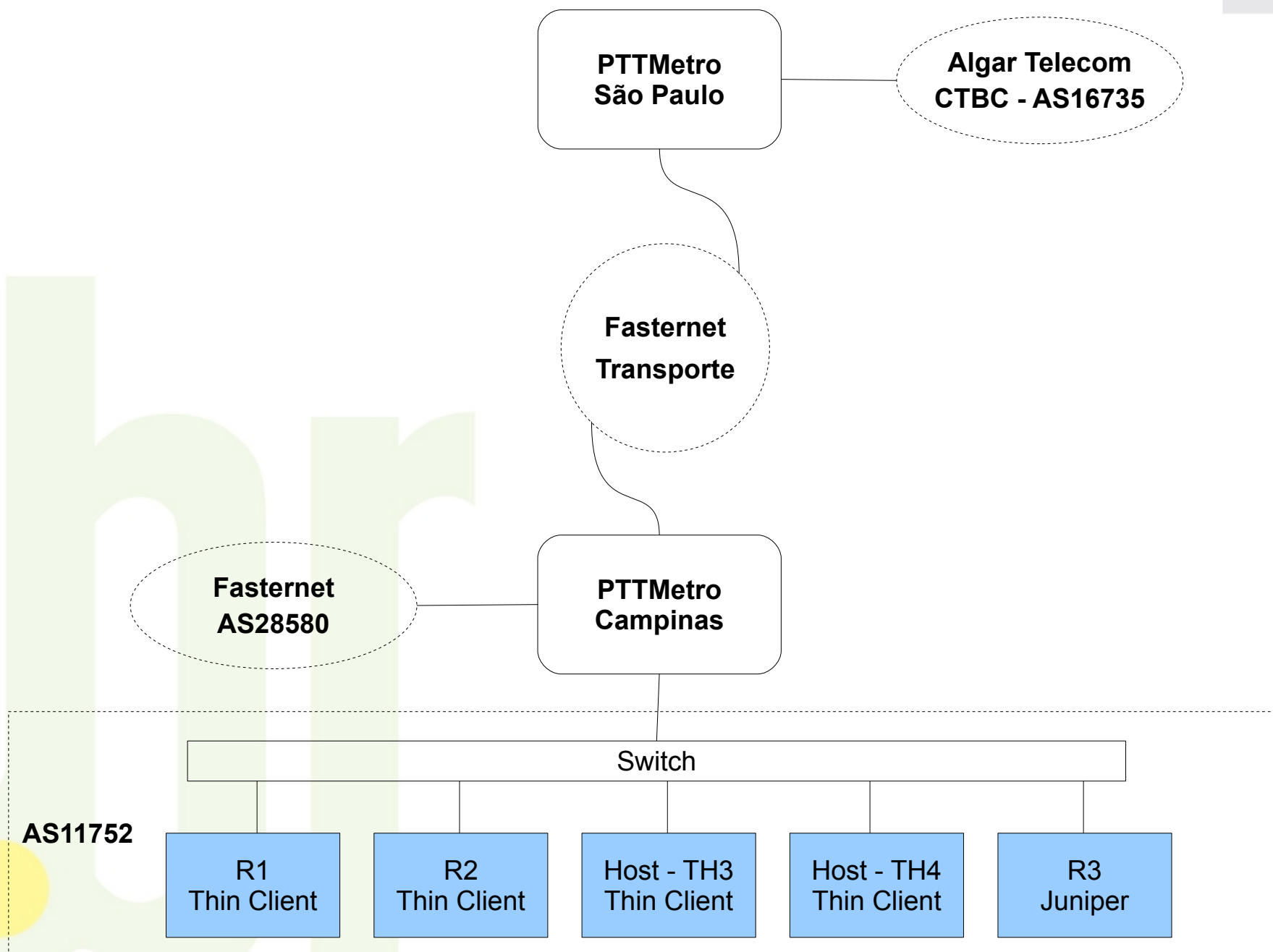


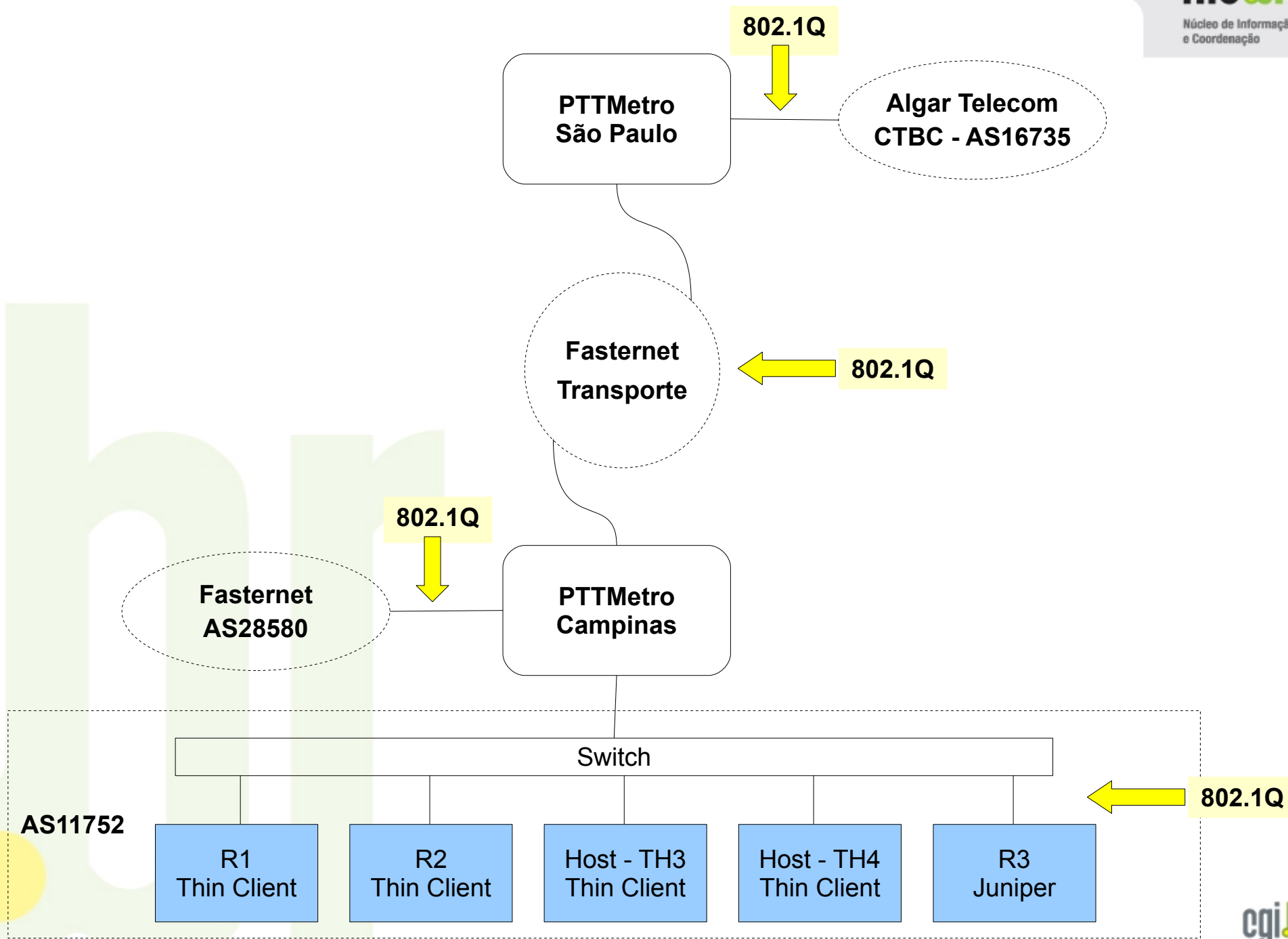


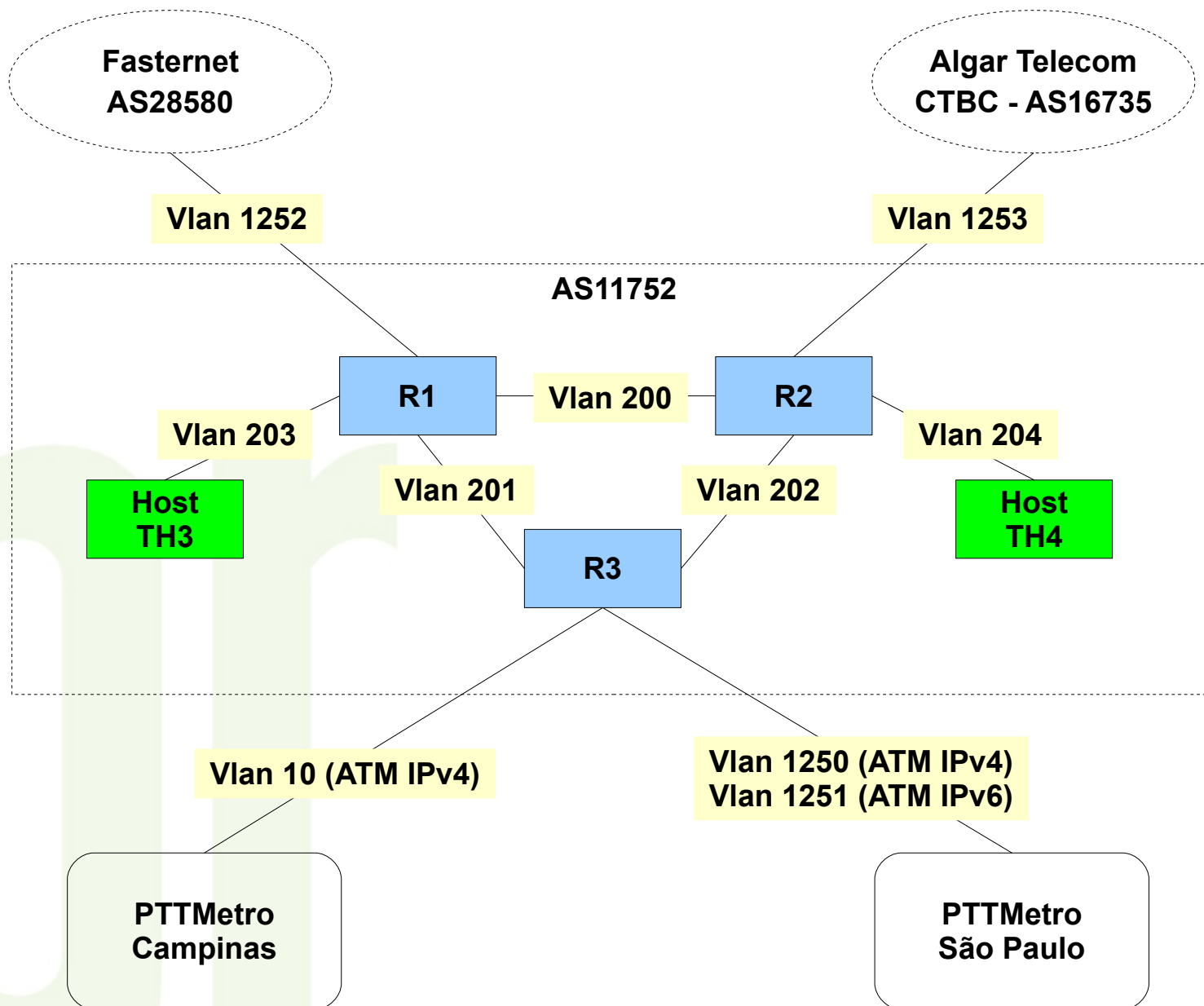
- Roteador Core / Borda
- Roteador Dedicado para Borda com PTTMetro
- Servidor ou Estação de Trabalho



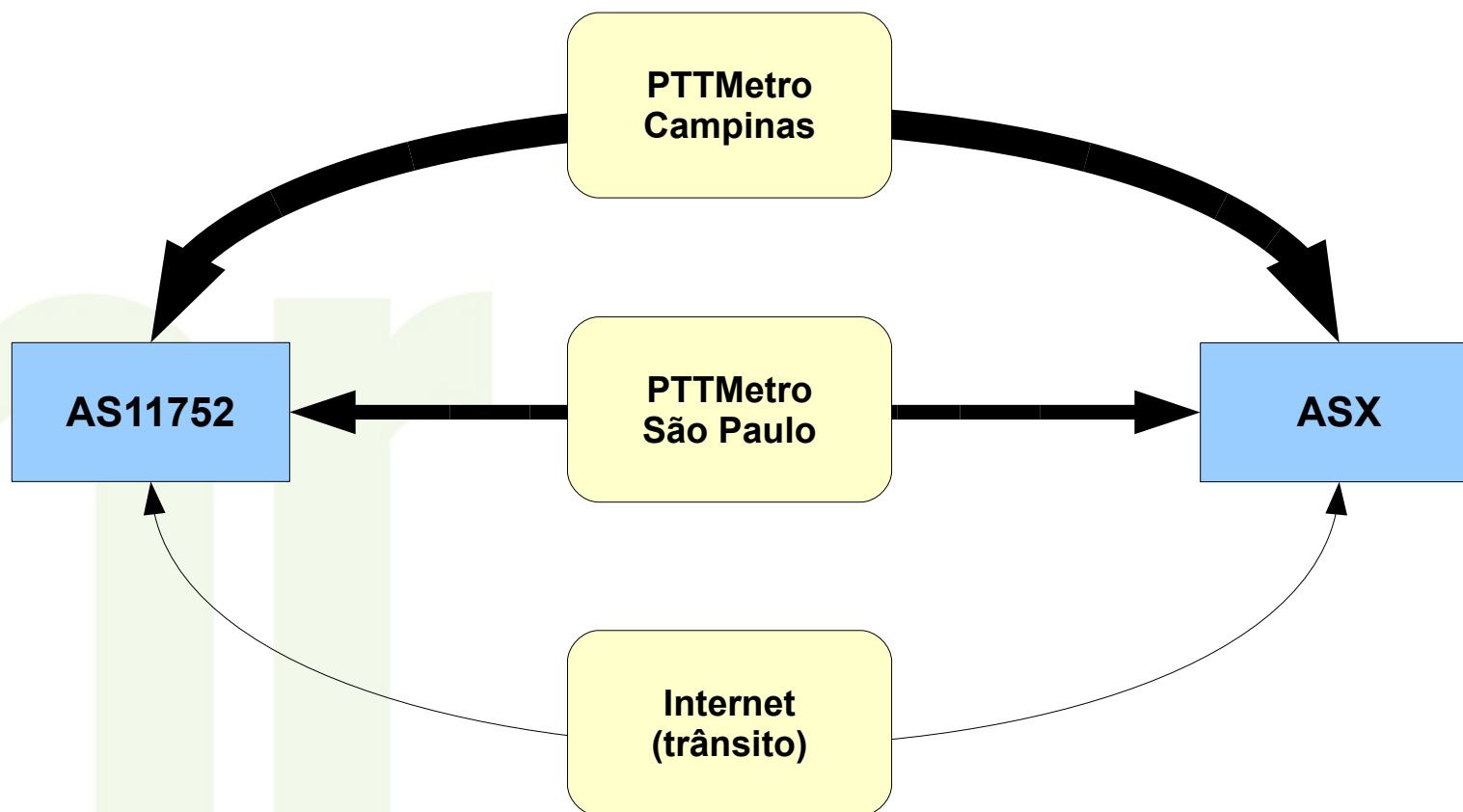
- |   |                    |
|---|--------------------|
|  Roteador Core / Borda                     | - Thin Client      |
|  Roteador Dedicado para Borda com PTTMetro | - Roteador Juniper |
|  Servidor ou Estação de Trabalho           | - Thin Client      |

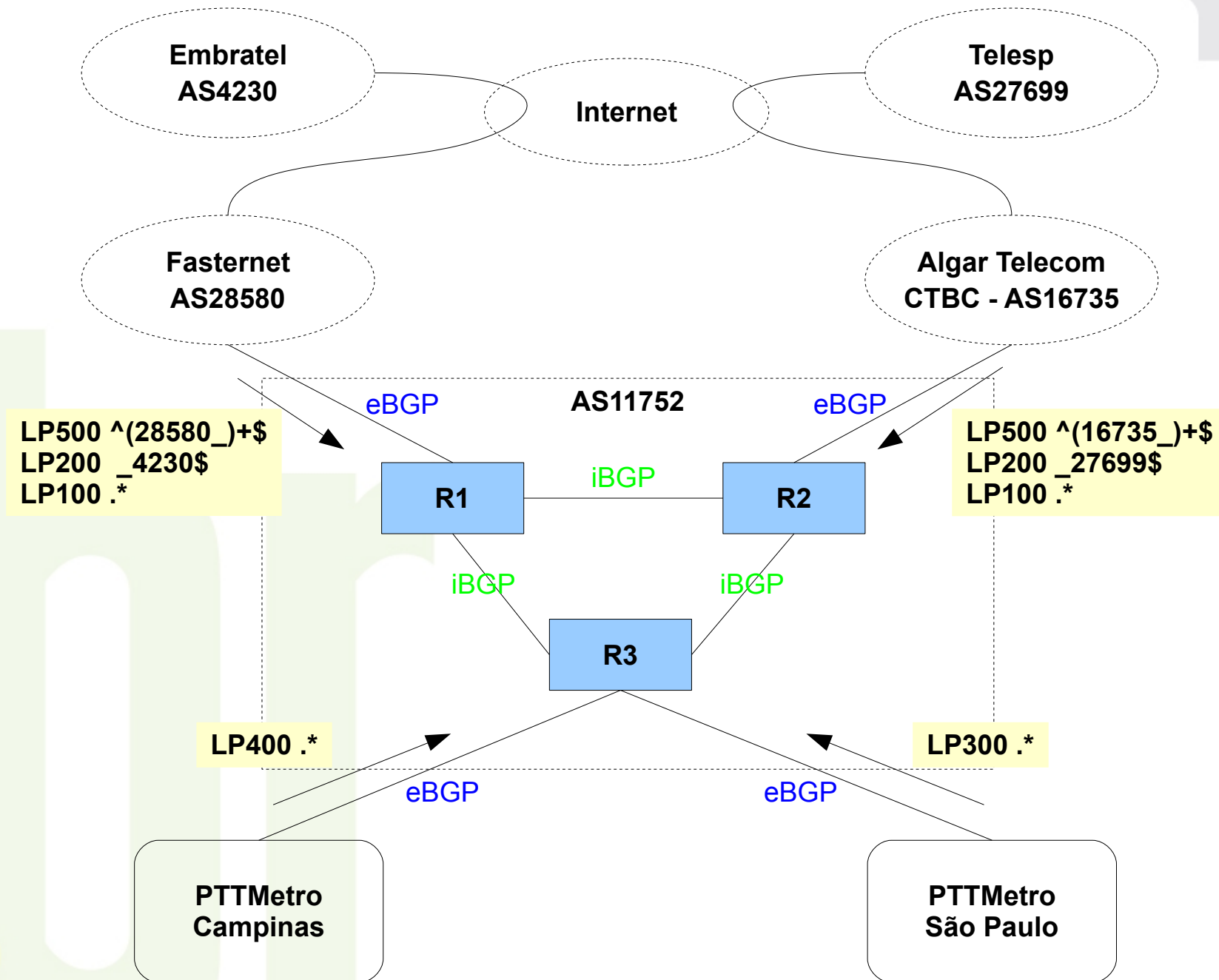






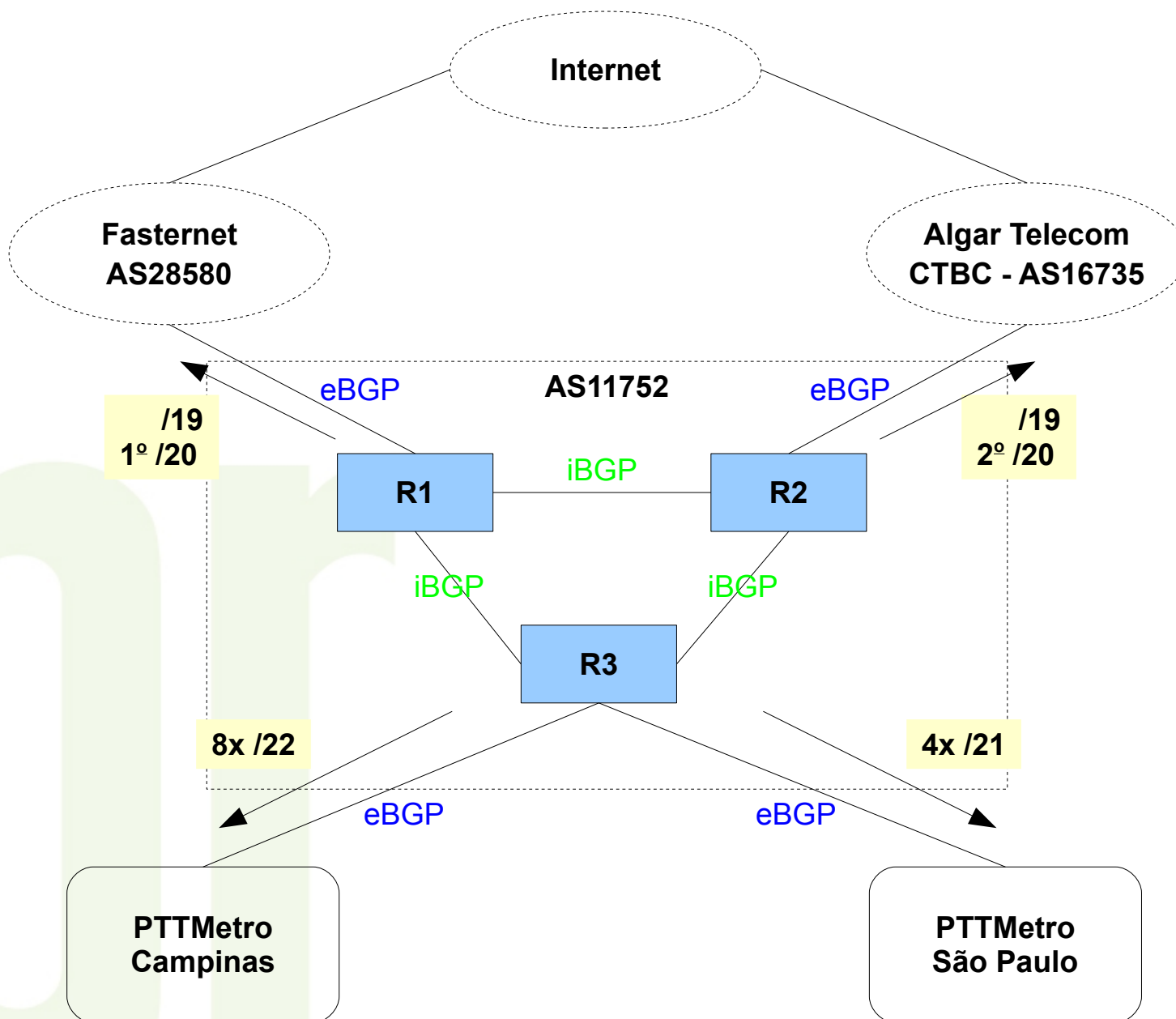
## Revisão da Preferência de Caminho



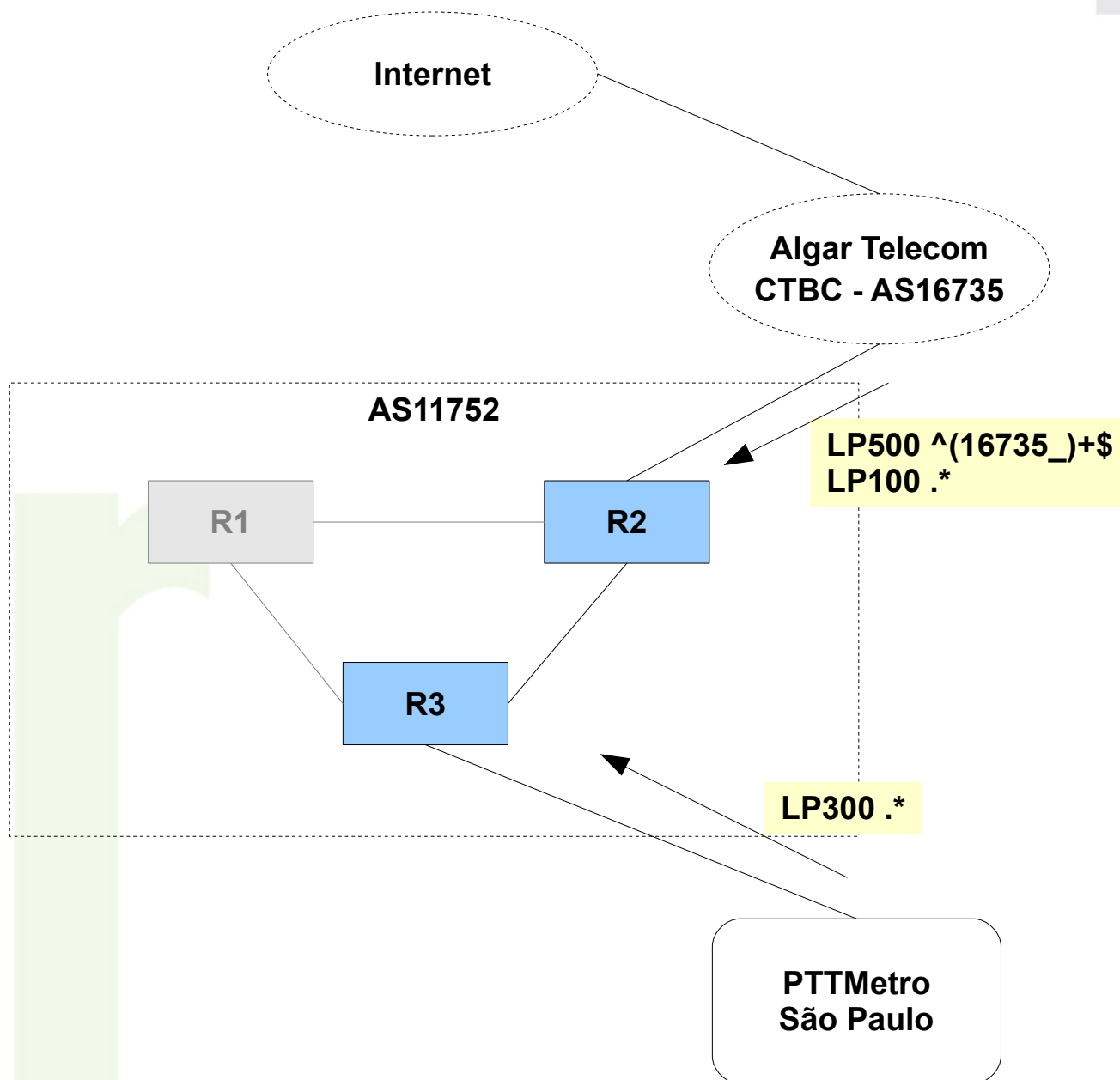


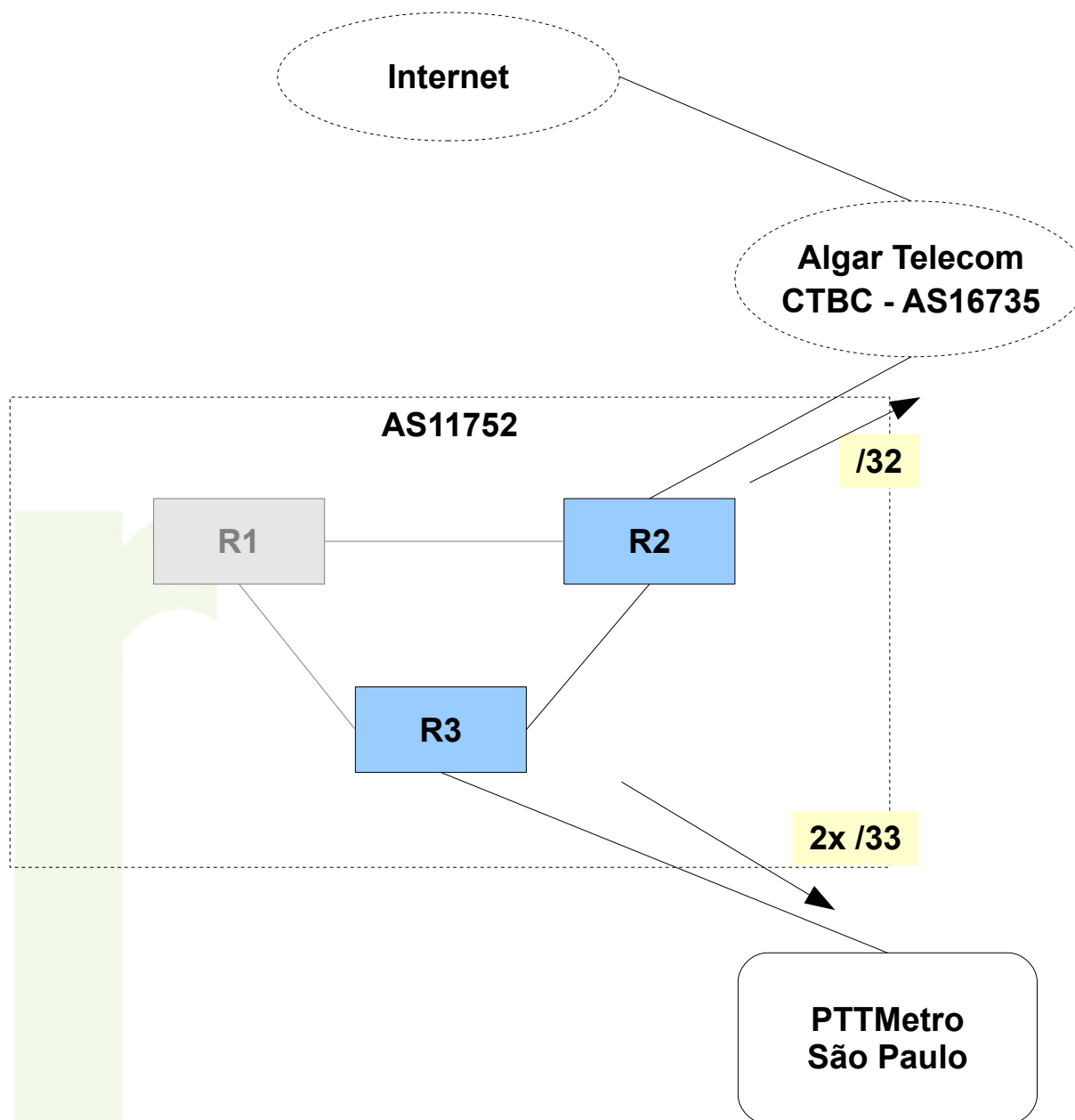
Conexão	Relacionamento	AS_PATH	LOCAL_PREF
Fasternet (AS28580)	Trânsito	^(28580_)+\$	500
		_4230\$	200
		.*	100
Algar Telecom (AS16735)	Trânsito	^(16735_)+\$	500
		_27699\$	200
		.*	100
PTTMetro São Paulo	Peering	.*	300
PTTMetro Campinas	Peering	.*	400



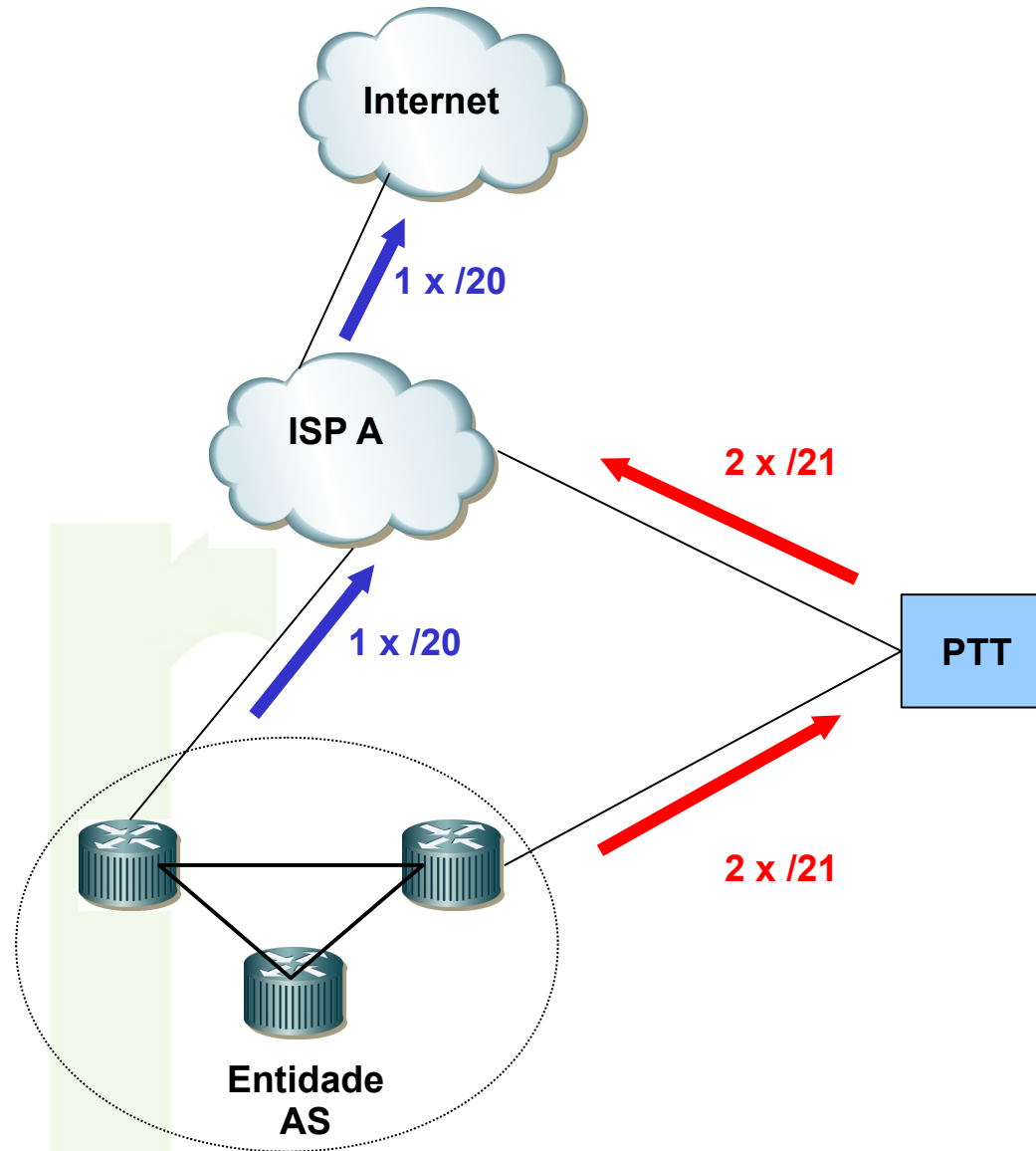


Conexão	Relacionamento	Prefixos
Fasternet (AS28580)	Trânsito	189.76.96.0/19
		189.76.96.0/20
Algar Telecom (AS16735)	Trânsito	189.76.96.0/19
		189.76.112.0/20
PTTMetro São Paulo	Peering	189.76.96.0/21
		189.76.104.0/21
		189.76.112.0/21
		189.76.120.0/21
PTTMetro Campinas	Peering	189.76.96.0/22
		189.76.100.0/22
		189.76.104.0/22
		189.76.108.0/22
		189.76.112.0/22
		189.76.116.0/22
		189.76.120.0/22
189.76.124.0/22		



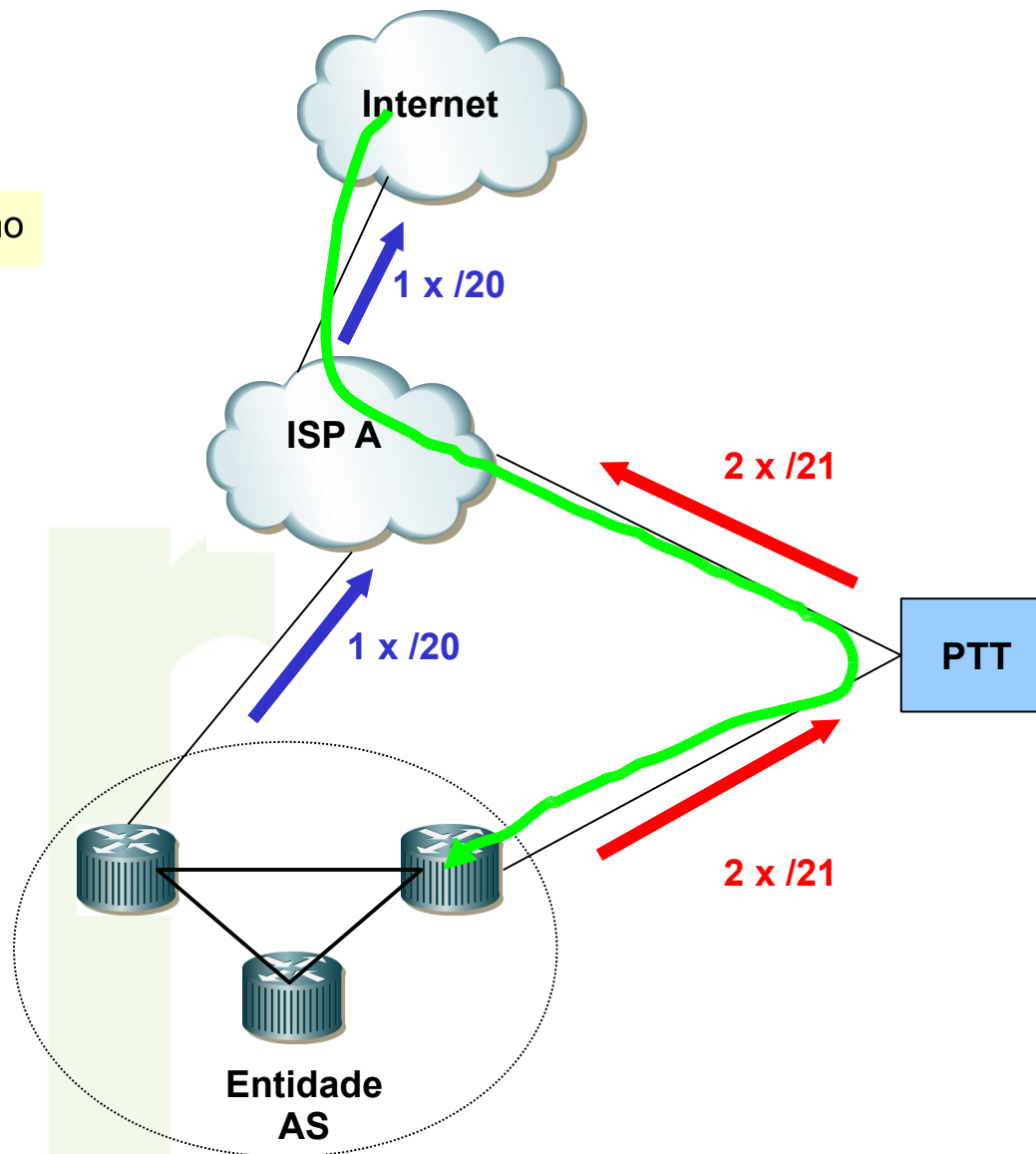


Modalidade: Todos Menos Alguns



Modalidade: Todos Menos Alguns

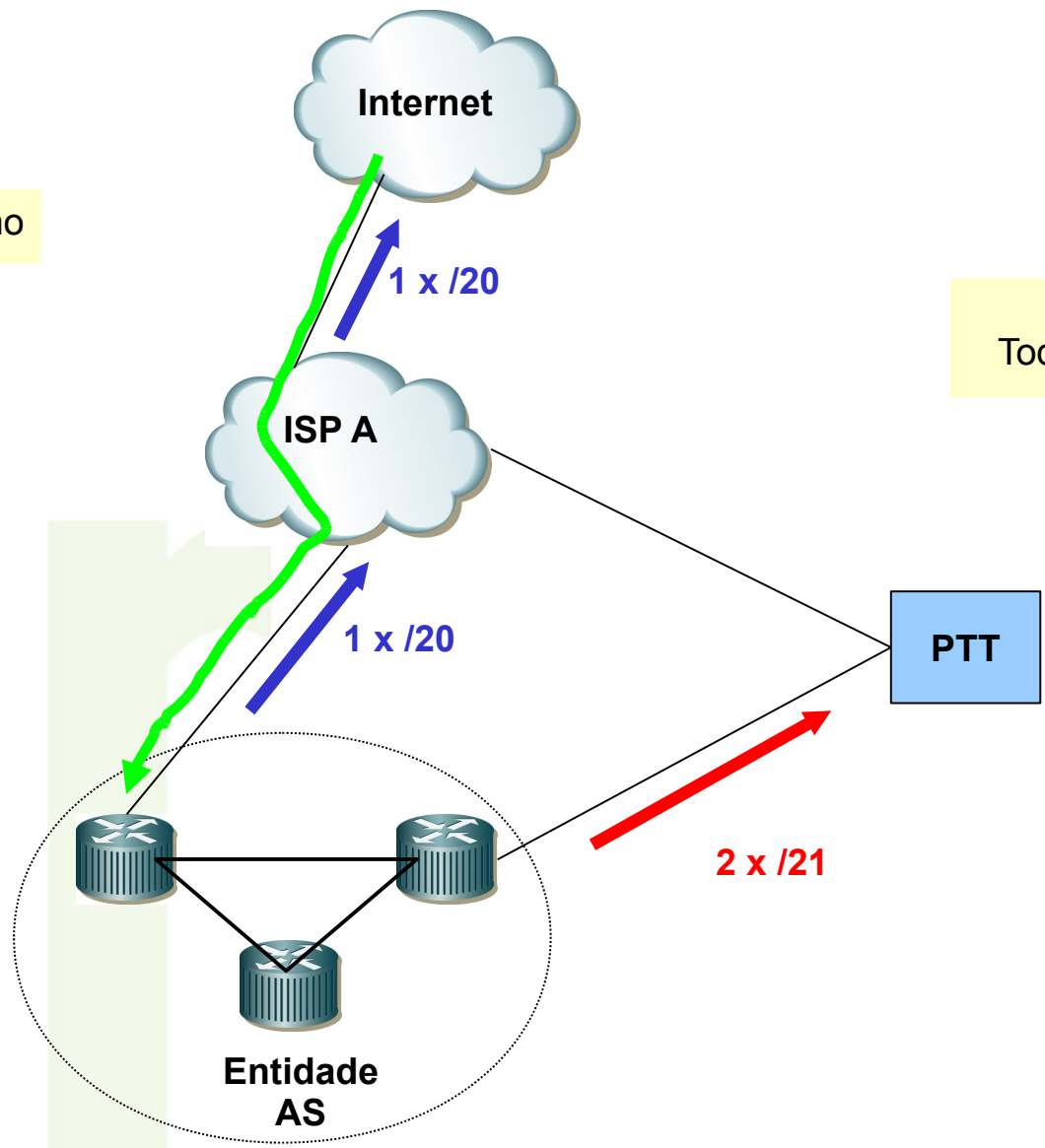
Roteamento por Destino



Modalidade: Todos Menos Alguns

Roteamento por Destino

ATM  
Todos menos alguns



```
!  
router bgp 11752  
  bgp router-id 189.76.127.255  
  no bgp default ipv4-unicast  
  network 189.76.96.0/19  
  network 189.76.96.0/20  
  network 189.76.96.0/21  
  network 189.76.96.0/22  
  network 189.76.100.0/22  
  network 189.76.104.0/21  
  network 189.76.104.0/22  
  network 189.76.108.0/22  
  network 189.76.112.0/21  
  network 189.76.112.0/22  
  network 189.76.116.0/22  
  network 189.76.120.0/21  
  network 189.76.120.0/22  
  network 189.76.124.0/22  
  neighbor 189.76.127.10 remote-as 11752  
  neighbor 189.76.127.10 description iBGP-Juniper-PTTMetro  
  neighbor 189.76.127.10 activate  
  neighbor 189.76.127.10 filter-list 20 out  
  neighbor 189.76.127.248 remote-as 11752  
  neighbor 189.76.127.248 description iBGP-R2  
  neighbor 189.76.127.248 update-source 189.76.127.249  
  neighbor 189.76.127.248 activate  
  neighbor 189.76.127.248 next-hop-self  
  neighbor 200.187.80.246 remote-as 28580  
  neighbor 200.187.80.246 description eBGP-Transito-Fasternet (AS28580)  
  neighbor 200.187.80.246 ebgp-multihop 3  
  neighbor 200.187.80.246 update-source 189.76.127.247  
  neighbor 200.187.80.246 activate  
  neighbor 200.187.80.246 prefix-list BGPout-IPv4-AS28580 out  
  neighbor 200.187.80.246 route-map BGPin-IPv4-AS28580 in  
!
```



```
!  
ip prefix-list BGPout-IPv4-AS28580 description Prefixos para AS28580 (Fasternet)  
ip prefix-list BGPout-IPv4-AS28580 seq 10 permit 189.76.96.0/19  
ip prefix-list BGPout-IPv4-AS28580 seq 20 permit 189.76.96.0/20  
ip prefix-list IPv4-AS11752-all description Todos Blocos IPv4  
ip prefix-list IPv4-AS11752-all seq 10 permit 189.76.96.0/19 le 32  
ip prefix-list IPv4-block-deny description Prefixos Gerais Bloquados  
ip prefix-list IPv4-block-deny seq 10 permit 0.0.0.0/0  
ip prefix-list IPv4-block-deny seq 20 permit 0.0.0.0/8 le 32  
ip prefix-list IPv4-block-deny seq 30 permit 127.0.0.0/8 le 32  
ip prefix-list IPv4-block-deny seq 40 permit 169.254.0.0/16 le 32  
ip prefix-list IPv4-block-deny seq 50 permit 192.0.2.0/24 le 32  
ip prefix-list IPv4-block-deny seq 60 permit 192.168.0.0/16 le 32  
ip prefix-list IPv4-block-deny seq 70 permit 10.0.0.0/8 le 32  
ip prefix-list IPv4-block-deny seq 80 permit 172.16.0.0/12 le 32  
!  
ip as-path access-list 20 permit ^$  
ip as-path access-list 32 permit .*  
ip as-path access-list 50 permit ^(28580_)+$  
ip as-path access-list 60 permit _4230$  
ip as-path access-list 69 deny .*  
!
```

```
!  
route-map BGPIn-IPv4-AS28580 deny 10  
  match ip address prefix-list IPv4-AS11752-all  
!  
route-map BGPIn-IPv4-AS28580 deny 20  
  match ip address prefix-list IPv4-block-deny  
!  
route-map BGPIn-IPv4-AS28580 permit 30  
  match as-path 50  
  set local-preference 500  
!  
route-map BGPIn-IPv4-AS28580 permit 40  
  match as-path 60  
  set local-preference 200  
!  
route-map BGPIn-IPv4-AS28580 permit 100  
  match as-path 32  
!
```

## Configurações – Roteador R2 (Conexão com Algar Telecom - CTBC)

```
!  
router bgp 11752  
  bgp router-id 189.76.127.254  
  no bgp default ipv4-unicast  
  network 189.76.96.0/19  
  network 189.76.96.0/21  
  network 189.76.96.0/22  
  network 189.76.100.0/22  
  network 189.76.104.0/21  
  network 189.76.104.0/22  
  network 189.76.108.0/22  
  network 189.76.112.0/20  
  network 189.76.112.0/21  
  network 189.76.112.0/22  
  network 189.76.116.0/22  
  network 189.76.120.0/21  
  network 189.76.120.0/22  
  network 189.76.124.0/22  
  neighbor 189.76.127.6 remote-as 11752  
  neighbor 189.76.127.6 description iBGP-Juniper-PTTMetro  
  neighbor 189.76.127.6 activate  
  neighbor 189.76.127.6 filter-list 20 out  
  neighbor 189.76.127.249 remote-as 11752  
  neighbor 189.76.127.249 description iBGP-R1  
  neighbor 189.76.127.249 update-source 189.76.127.248  
  neighbor 189.76.127.249 activate  
  neighbor 189.76.127.249 next-hop-self  
  neighbor 200.225.196.250 remote-as 16735  
  neighbor 200.225.196.250 description eBGP-Transito-Algar-Telecom (CTBC-AS16735)  
  neighbor 200.225.196.250 activate  
  neighbor 200.225.196.250 prefix-list BGPout-IPv4-AS16735 out  
  neighbor 200.225.196.250 route-map BGPin-IPv4-AS16735 in  
  neighbor 2001:1291:1301:4::a remote-as 16735  
  neighbor 2001:1291:1301:4::a description eBGP-Transito-Algar-Telecom (CTBC-AS16735)  
  neighbor 2001:12fe:a:202:4::6 remote-as 11752  
  neighbor 2001:12fe:a:202:4::6 description iBGP-Juniper-PTTMetro
```

!

```
!  
router bgp 11752  
!  
  address-family ipv6  
    network 2001:12fe::/32  
    network 2001:12fe::/33  
    network 2001:12fe:8000::/33  
    neighbor 2001:1291:1301:4::a activate  
    neighbor 2001:1291:1301:4::a prefix-list BGPout-IPv6-AS16735 out  
    neighbor 2001:1291:1301:4::a route-map BGPin-IPv6-AS16735 in  
    neighbor 2001:12fe:a:202:4::6 activate  
    neighbor 2001:12fe:a:202:4::6 filter-list 20 out  
  exit-address-family  
!
```

```
!  
ip prefix-list BGPout-IPv4-AS16735 description Prefixos para AS16735 (CTBC/Algar)  
ip prefix-list BGPout-IPv4-AS16735 seq 10 permit 189.76.96.0/19  
ip prefix-list BGPout-IPv4-AS16735 seq 20 permit 189.76.112.0/20  
ip prefix-list IPv4-AS11752-all description Todos Blocos IPv4  
ip prefix-list IPv4-AS11752-all seq 10 permit 189.76.96.0/19 le 32  
ip prefix-list IPv4-block-deny description Prefixos Gerais Bloquados  
ip prefix-list IPv4-block-deny seq 10 permit 0.0.0.0/0  
ip prefix-list IPv4-block-deny seq 20 permit 0.0.0.0/8 le 32  
ip prefix-list IPv4-block-deny seq 30 permit 127.0.0.0/8 le 32  
ip prefix-list IPv4-block-deny seq 40 permit 169.254.0.0/16 le 32  
ip prefix-list IPv4-block-deny seq 50 permit 192.0.2.0/24 le 32  
ip prefix-list IPv4-block-deny seq 60 permit 192.168.0.0/16 le 32  
ip prefix-list IPv4-block-deny seq 70 permit 10.0.0.0/8 le 32  
ip prefix-list IPv4-block-deny seq 80 permit 172.16.0.0/12 le 32  
!  
ipv6 prefix-list BGPout-IPv6-AS16735 description Prefixos para AS16735 (CTBC/Algar)  
ipv6 prefix-list BGPout-IPv6-AS16735 seq 10 permit 2001:12fe::/32  
ipv6 prefix-list IPv6-IPv6-AS11752-all description Todos Blocos IPv6  
ipv6 prefix-list IPv6-IPv6-AS11752-all seq 10 permit 2001:12fe::/32 le 128  
ipv6 prefix-list IPv6-block-deny description Prefixos Gerais Bloquados  
ipv6 prefix-list IPv6-block-deny seq 10 permit ::/0  
ipv6 prefix-list IPv6-block-deny seq 20 permit 2001:db8::/32 le 128  
!
```

```
!  
ip as-path access-list 20 permit ^$  
ip as-path access-list 30 permit ^(16735_)+$  
ip as-path access-list 32 permit .*  
ip as-path access-list 40 permit _27699$  
ip as-path access-list 69 deny .*  
!
```

```
!  
route-map BGPIn-IPv4-AS16735 deny 10  
  match ip address prefix-list IPv4-AS11752-all  
!  
route-map BGPIn-IPv4-AS16735 deny 20  
  match ip address prefix-list IPv4-block-deny  
!  
route-map BGPIn-IPv4-AS16735 permit 30  
  match as-path 30  
  set local-preference 500  
!  
route-map BGPIn-IPv4-AS16735 permit 40  
  match as-path 40  
  set local-preference 200  
!  
route-map BGPIn-IPv4-AS16735 permit 100  
  match as-path 32  
!  
route-map BGPIn-IPv6-AS16735 deny 10  
  match ipv6 address prefix-list IPv6-IPv6-AS11752-all  
!  
route-map BGPIn-IPv6-AS16735 deny 20  
  match ipv6 address prefix-list IPv6-block-deny  
!  
route-map BGPIn-IPv6-AS16735 permit 30  
  match as-path 30  
  set local-preference 500  
!  
route-map BGPIn-IPv6-AS16735 permit 40  
  match as-path 32  
!
```

```
routing-options {  
  router-id 189.76.127.253;  
  autonomous-system 11752;  
}
```



```
protocols {
  bgp {
    group eBGP_PTTMetro_SaoPaulo {
      type external;
      neighbor 200.219.130.253 {
        import BGPIn-IPv4-PTTMetro;
        export BGPout-IPv4-PTTMetro-SPO;
        peer-as 26162;
      }
      neighbor 2001:12F8::253 {
        import BGPIn-IPv6-PTTMetro;
        export BGPout-IPv6-PTTMetro-SPO;
        peer-as 26162;
      }
    }
    group eBGP_PTTMetro_Campinas {
      type external;
      neighbor 200.192.108.253 {
        export BGPout-IPv4-PTTMetro-CAS;
        peer-as 26162;
      }
    }
    group iBGP {
      type internal;
      neighbor 189.76.127.9 {
        export next-hop-self;
      }
      neighbor 189.76.127.5 {
        export next-hop-self;
      }
      neighbor 2001:12fe:a:202:4::5 {
        export next-hop-self;
      }
    }
  }
}
```

```
policy-options {
  policy-statement BGPIn-IPv4-PTTMetro {
    term term-1 {
      from policy IPv4-AS11752-all;
      then reject;
    }
    term term-2 {
      from policy IPv4-block-deny;
      then reject;
    }
    term term-3 {
      from as-path ALL;
      then {
        local-preference 300;
        next term;
      }
    }
    term accept {
      then accept;
    }
  }
}
```

```
policy-statement BGPIn-IPv6-PTTMetro {  
  term term-1 {  
    from policy IPv6-AS11752-all;  
    then reject;  
  }  
  term term-2 {  
    from policy IPv6-block-deny;  
    then reject;  
  }  
  term term-3 {  
    from as-path ALL;  
    then {  
      local-preference 300;  
      next term;  
    }  
  }  
  term accept {  
    then accept;  
  }  
}
```

```
policy-statement BGPout-IPv4-PTTMetro-CAS {
  term term-1 {
    from {
      route-filter 189.76.96.0/22 exact;
      route-filter 189.76.100.0/22 exact;
      route-filter 189.76.104.0/22 exact;
      route-filter 189.76.108.0/22 exact;
      route-filter 189.76.112.0/22 exact;
      route-filter 189.76.116.0/22 exact;
      route-filter 189.76.120.0/22 exact;
      route-filter 189.76.124.0/22 exact;
    }
    then accept;
  }
  term implicit-deny {
    then reject;
  }
}
```

```
policy-statement BGPout-IPv4-PTTMetro-SPO {
  term term-1 {
    from {
      route-filter 189.76.96.0/21 exact;
      route-filter 189.76.104.0/21 exact;
      route-filter 189.76.112.0/21 exact;
      route-filter 189.76.120.0/21 exact;
    }
    then accept;
  }
  term implicit-deny {
    then reject;
  }
}
```

```
policy-statement BGPout-IPv6-PTTMetro-SPO {  
  term term-1 {  
    from {  
      route-filter 2001:12fe::/33 exact;  
      route-filter 2001:12fe:8000::/33 exact;  
    }  
    then accept;  
  }  
  term implicit-deny {  
    then reject;  
  }  
}
```

```
policy-statement IPv4-AS11752-all {
  term term-1 {
    from {
      route-filter 189.76.96.0/19 orlonger;
    }
    then accept;
  }
  term implicit-deny {
    then reject;
  }
}
policy-statement IPv4-block-deny {
  term term-1 {
    from {
      route-filter 0.0.0.0/0 exact;
      route-filter 0.0.0.0/8 orlonger;
      route-filter 127.0.0.0/8 orlonger;
      route-filter 169.254.0.0/16 orlonger;
      route-filter 192.0.2.0/24 orlonger;
      route-filter 192.168.0.0/16 orlonger;
      route-filter 10.0.0.0/8 orlonger;
      route-filter 172.16.0.0/12 orlonger;
    }
    then accept;
  }
  term implicit-deny {
    then reject;
  }
}
```

```
policy-statement IPv6-AS11752-all {
  term term-1 {
    from {
      route-filter 2001:12fe::/32 orlonger;
    }
    then accept;
  }
  term implicit-deny {
    then reject;
  }
}
policy-statement IPv6-block-deny {
  term term-1 {
    from {
      route-filter ::/0 exact;
      route-filter 2001:db8::/32 orlonger;
    }
    then accept;
  }
  term implicit-deny {
    then reject;
  }
}
```



```
policy-statement next-hop-self {  
  term all {  
    from {  
      external;  
    }  
    then {  
      next-hop self;  
    }  
  }  
}  
as-path ALL .*;  
}
```

[http://www.ris.ripe.net/cgi-bin/lg/index.cgi?rrc=RRC031&query=12&arg=\\_11752\\_](http://www.ris.ripe.net/cgi-bin/lg/index.cgi?rrc=RRC031&query=12&arg=_11752_)

```
BGP table version is 0, local router ID is 195.69.144.69
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, R Removed
Origin code: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*> 189.76.96.0/19    195.69.144.208      0         0 12956 16735 11752 i
*                   193.111.172.55      0         0 31477 3549 16735 11752 i
*                   195.69.144.234      0         0 20932 3549 16735 11752 i
*                   195.69.144.111      0         0 30132 6939 12956 16735 11752 i
*                   195.69.145.167      0         0 6453 3549 16735 11752 i
*                   195.69.144.178      0         0 6320 3549 16735 11752 i
*                   195.69.144.196     100        0 6762 3549 16735 11752 i
*                   195.69.144.200     100        0 12859 3549 16735 11752 i
*                   195.69.144.212      0         0 13237 3356 12956 16735 11752 i
*                   195.69.145.56      0         0 29686 3257 12956 16735 11752 i
*                   195.69.144.34      0         0 1103 3257 3549 16735 11752 i
* 189.76.96.0/20     195.69.144.111      0         0 30132 6939 3549 28580 11752 i
*                   193.111.172.55      0         0 31477 3549 28580 11752 i
*                   195.69.144.178      0         0 6320 3549 28580 11752 i
*                   195.69.145.167      0         0 6453 3549 28580 11752 i
*                   195.69.144.234      0         0 20932 3549 28580 11752 i
*>                   195.69.144.196     100        0 6762 3549 28580 11752 i
*                   195.69.144.200     100        0 12859 3549 28580 11752 i
*                   195.69.145.56      0         0 29686 3257 3549 28580 11752 i
*                   195.69.144.34      0         0 1103 3257 3549 28580 11752 i
*                   195.69.144.212      0         0 13237 3356 3549 28580 11752 i
* 189.76.112.0/20   193.111.172.55      0         0 31477 3549 16735 11752 i
*                   195.69.144.111      0         0 30132 6939 12956 16735 11752 i
*                   195.69.144.234      0         0 20932 3549 16735 11752 i
*                   195.69.144.178      0         0 6320 3549 16735 11752 i
*                   195.69.145.167      0         0 6453 3549 16735 11752 i
*                   195.69.144.196     100        0 6762 3549 16735 11752 i
*                   195.69.144.200     100        0 12859 3549 16735 11752 i
*                   195.69.144.212      0         0 13237 3356 12956 16735 11752 i
*>                   195.69.144.208      0         0 12956 16735 11752 i
*                   195.69.145.56      0         0 29686 3257 12956 16735 11752 i
*                   195.69.144.34      0         0 1103 3257 3549 16735 11752 i
```

Total number of prefixes 3  
rrc03

<http://www.routeviews.org/>

telnet route-views.routeviews.org

```
route-views>show ip bgp regexp _11752_
BGP table version is 47822665, local router ID is 128.223.51.103
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
*  189.76.96.0/20   66.110.0.124      0      0      0 6453 3549 28580 11752 i
*                   196.7.106.245     0      0      0 2905 3549 28580 11752 i
*                   217.75.96.60      0      0      0 16150 3549 28580 11752 i

(...)

*  189.76.96.0/19   66.110.0.124      0      0      0 6453 3549 16735 11752 i
*                   134.222.87.1      0      0      0 286 3549 16735 11752 i
*                   196.7.106.245     0      0      0 2905 3549 16735 11752 i
*                   217.75.96.60      0      0      0 16150 3549 16735 11752 i

(...)

*  189.76.112.0/20  66.110.0.124      0      0      0 6453 3549 16735 11752 i
*                   134.222.87.1      0      0      0 286 3549 16735 11752 i
*                   196.7.106.245     0      0      0 2905 3549 16735 11752 i
*                   217.75.96.60      0      0      0 16150 3549 16735 11752 i

(...)
route-views>
```

telnet lg.sp.ptt.br

```
lg.sp.ptt.br> show ip bgp regexp _11752_
BGP table version is 0, local router ID is 200.219.130.252
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
* 189.76.96.0/19    200.219.130.24          0 16735 11752 i
(...)
* 189.76.96.0/20    200.219.130.76          0 28647 28580 11752 i
(...)
* 189.76.96.0/21    200.219.130.100         0 21911 11752 i
(...)
* 189.76.96.0/22    200.219.130.81          0 28649 11752 i
(...)
* 189.76.100.0/22   200.219.130.81          0 28649 11752 i
(...)
* 189.76.104.0/21   200.219.130.100         0 21911 11752 i
(...)
* 189.76.104.0/22   200.219.130.81          0 28649 11752 i
(...)
* 189.76.108.0/22   200.219.130.81          0 28649 11752 i
(...)
* 189.76.112.0/20   200.219.130.24          0 28647 16735 11752 i
(...)
* 189.76.112.0/21   200.219.130.100         0 21911 11752 i
(...)
* 189.76.112.0/22   200.219.130.81          0 28649 11752 i
(...)
* 189.76.116.0/22   200.219.130.81          0 28649 11752 i
(...)
* 189.76.120.0/21   200.219.130.100         0 21911 11752 i
(...)
* 189.76.120.0/22   200.219.130.81          0 28649 11752 i
(...)
* 189.76.124.0/22   200.219.130.81          0 28649 11752 i
(...)

Total number of prefixes 15
lg.sp.ptt.br>
```

telnet lg.sp.ptt.br

```
lg.sp.ptt.br> show ip bgp neighbors 200.219.130.253 received-routes
(...)
*> 189.76.96.0/19 200.219.130.76 0 28580 11752 i
*> 189.76.96.0/20 200.219.130.76 0 28580 11752 i
*> 189.76.96.0/21 200.219.130.100 0 11752 i
*> 189.76.104.0/21 200.219.130.100 0 11752 i
*> 189.76.112.0/20 200.219.130.24 0 16735 11752 i
*> 189.76.112.0/21 200.219.130.100 0 11752 i
*> 189.76.120.0/21 200.219.130.100 0 11752 i
```

[http://www.ris.ripe.net/cgi-bin/lg/index.cgi?rrc=RRC031&query=17&arg=\\_11752\\_](http://www.ris.ripe.net/cgi-bin/lg/index.cgi?rrc=RRC031&query=17&arg=_11752_)

```
BGP table version is 0, local router ID is 195.69.144.69
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network        Next Hop           Metric LocPrf Weight Path
*  2001:12fe::/32  2001:7f8:1::a500:3257:1
                                     0           0 3257 12956 16735 11752 i
*
                                     2001:7f8:1::a500:6762:1
                                     100          0 6762 3549 16735 11752 i
*
                                     2001:7f8:1::a501:3030:1
                                     1           0 13030 12956 16735 11752 i
*
                                     2001:7f8:1::a500:1273:1
                                     1           0 1273 12956 16735 11752 i
*>
                                     2001:7f8:1::a500:2914:1
                                     0           0 2914 12956 16735 11752 i
*
                                     2001:7f8:1::a503:132:1
                                     0           0 30132 6939 12956 16735 11752 i
*
                                     2001:7f8:1::a502:9686:1
                                     0           0 29686 3257 3549 16735 11752 i
*
                                     2001:7f8:1::a501:2859:2
                                     10          0 12859 6939 12956 16735 11752 i
*
                                     2001:7f8:1::a501:2859:1
                                     0           0 12859 6939 12956 16735 11752 i
*
                                     2001:7f8:1::a500:6939:1
                                     0           0 1103 6939 12956 16735 11752 i

Total number of prefixes 1
rrc03
```

<http://www.routeviews.org/>

telnet route-views6.routeviews.org

```
route-views6.routeviews.org> show bgp ipv6 regexp _11752_
BGP table version is 0, local router ID is 128.223.51.112
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop          Metric LocPrf Weight Path
* 2001:12fe::/32    2001:428::205:171:203:138
                                     256
                                     0 209 3549 16735 11752 i
*
                                     2001:428::205:171:203:141
                                     937
                                     0 209 3549 16735 11752 i
*
                                     2001:428::205:171:203:140
                                     258
                                     0 209 3549 16735 11752 i
*
                                     2001:4830::5
                                     339
                                     0 30071 3549 16735 11752 i
*
                                     2001:4830::e
                                     59
                                     0 30071 3549 16735 11752 i
*
                                     2001:1890:111d::1
                                     0 7018 30071 3549 16735 11752 i
*
                                     2610:38:1::1
                                     0 7781 6939 12956 16735 11752 i
*
                                     2001:470:0:1a::1
                                     0 6939 12956 16735 11752 i
*>
                                     2001:418:0:1000::f002
                                     20
                                     0 2914 3549 16735 11752 i
*
                                     2001:418:0:1000::f000
                                     21
                                     0 2914 3549 16735 11752 i
*
                                     2001:4810::1
                                     0 33437 6939 12956 16735 11752 i
*
                                     2001:240:100:ff::2497:2
                                     0 2497 3257 3549 16735 11752 i
*
                                     2001:200:901::5
                                     0 7660 4635 6939 12956 16735 11752 i

Total number of prefixes 1
route-views6.routeviews.org>
```

telnet lg.sp.ptt.br

```

lg.sp.ptt.br> show bgp regexp _11752_
BGP table version is 0, local router ID is 200.219.130.252
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, R Removed
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network                Next Hop                Metric LocPrf Weight Path
*  2001:12fe::/32         2001:12f8::56           0 14026 16735 11752 i
*                          2001:12f8::24           0 16735 11752 i
*                          2001:12f8::24           0 26592 16735 11752 i
*                          2001:12f8::24           0 16735 11752 i
*                          2001:12f8::24           0 16397 16735 11752 i
*                          2001:12f8::24           0 1916 16735 11752 i
(...)
*                          2001:12f8::24           0 16397 16735 11752 i
*                          2001:12f8::24           0 21911 16735 11752 i
*>                         2001:12f8::24           0 16735 11752 i
*                          2001:12f8::24           0 28571 16735 11752 i
*  2001:12fe::/33         2001:12f8::100          0 53070 11752 i
*                          2001:12f8::100          0 8167 11752 i
*                          2001:12f8::56           0 14026 11752 i
(...)
*                          2001:12f8::100          0 1916 11752 i
*>                         2001:12f8::100          0 11752 i
*                          2001:12f8::100          0 26592 11752 i
*                          2001:12f8::100          0 16397 11752 i
*                          2001:12f8::100          0 28571 11752 i
*  2001:12fe:8000::/33    2001:12f8::100          0 53070 11752 i
*                          2001:12f8::100          0 8167 11752 i
(...)
*                          2001:12f8::100          0 21911 11752 i
*                          2001:12f8::100          0 1916 11752 i
*>                         2001:12f8::100          0 11752 i
*                          2001:12f8::100          0 26592 11752 i
*                          2001:12f8::100          0 28571 11752 i
*                          2001:12f8::100          0 16397 11752 i

Total number of prefixes 3
lg.sp.ptt.br>
    
```



```
root@labas-th4:~# ifconfig | grep "189.76"
    inet addr:189.76.112.2 Bcast:189.76.112.15 Mask:255.255.255.240
root@labas-th4:~# tcptraceroute nic.br
Selected device eth0.204, address 189.76.112.2, port 43462 for outgoing packets
Tracing the path to nic.br (200.160.4.6) on TCP port 80 (www), 30 hops max
 1 189.76.112.1 0.384 ms 0.185 ms 0.182 ms
 2 189.76.127.6 25.230 ms 27.701 ms 20.759 ms
 3 as22548.sp.ptt.BR (200.219.130.1) 3.796 ms 2.660 ms 3.280 ms
 4 ar02.bbl.registro.br (200.160.0.229) 3.579 ms 3.699 ms 4.335 ms
 5 www.nic.br (200.160.4.6) [open] 3.545 ms 3.693 ms 3.717 ms
root@labas-th4:~#

root@labas-th4:~# tcptraceroute www.ams-ix.net
Selected device eth0.204, address 189.76.112.2, port 44703 for outgoing packets
Tracing the path to www.ams-ix.net (91.200.16.42) on TCP port 80 (www), 30 hops max
 1 189.76.112.1 0.362 ms 0.184 ms 0.161 ms
 2 200-225-196-250.static.ctbctelecom.com.br (200.225.196.250) 2.723 ms 2.693 ms 2.666 ms
 3 201-048-044-094.static.ctbctelecom.com.br (201.48.44.94) 2.745 ms 2.759 ms 2.762 ms
 4 Ge7-3-6-0-grtsaosi2.red.telefonica-wholesale.net (84.16.11.21) 22.273 ms 22.194 ms 22.155 ms
 5 Xe0-1-0-0-grtmiabr3.red.telefonica-wholesale.net (84.16.12.193) 110.396 ms 110.495 ms 110.489 ms
 6 Xe3-3-0-0-grtnycpt2.red.telefonica-wholesale.net (213.140.37.153) 148.976 ms 149.192 ms 148.913 ms
 7 So5-1-0-0-grtlontl3.red.telefonica-wholesale.net (213.140.43.41) 242.087 ms 242.106 ms 242.095 ms
 8 So3-1-0-0-graamstc2.red.telefonica-wholesale.net (213.140.38.234) 218.066 ms 218.089 ms 218.053 ms
 9 * * *
10 www.ams-ix.net (91.200.16.42) [open] 225.098 ms 228.421 ms 225.665 ms
root@labas-th4:~#
```

```
root@labas-th4:~# mtr -r -c 5 ipv6.google.com
HOST: labas-th4
Loss% Snt Last Avg Best Wrst StDev
1. 2001:12fe:8000::1 0.0% 5 0.3 1.1 0.3 4.0 1.6
2. 2001:12fe:a:202:4::6 0.0% 5 28.4 32.6 24.4 47.2 8.8
3. as15169.sp.ptt.br 0.0% 5 5.7 5.4 4.8 5.8 0.5
4. 2001:4860::1:0:14 0.0% 5 4.9 5.5 4.9 7.2 1.0
5. 2001:4860::1:0:3be 0.0% 5 119.0 133.2 119.0 184.8 28.8
6. 2001:4860::1:0:9ff 0.0% 5 126.6 147.7 124.6 234.1 48.3
7. 2001:4860:0:1::149 0.0% 5 125.9 127.7 125.9 130.4 2.3
8. iad04s01-in-x68.1e100.net 0.0% 5 126.9 126.3 125.0 127.3 0.9
root@labas-th4:~#

root@labas-th4:~# mtr -r -c 5 ipv6.br
HOST: labas-th4
Loss% Snt Last Avg Best Wrst StDev
1. 2001:12fe:8000::1 0.0% 5 0.3 0.9 0.3 3.2 1.3
2. 2001:12fe:a:202:4::6 0.0% 5 28.9 29.1 19.4 47.0 10.9
3. as22548.sp.ptt.br 0.0% 5 3.9 3.9 3.8 4.0 0.1
4. ar01.bb1.registro.br 0.0% 5 5.4 5.7 5.3 6.4 0.4
5. ipv6.br 0.0% 5 4.7 4.6 4.2 4.7 0.2
root@labas-th4:~#
```

```
R2-BGPd> show ip bgp summary
BGP router identifier 189.76.127.254, local AS number 11752
RIB entries 588468, using 36 MiB of memory
Peers 5, using 12 KiB of memory
```

Neighbor	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	State/PfxRcd
189.76.127.6	4	11752	3497	784	0	0	0	06:32:09	2560
189.76.127.249	4	11752	57290	76248	0	0	0	06:31:18	235873
200.225.196.250	4	16735	143058	786	0	0	0	06:32:10	317046

```
Total number of neighbors 3
R2-BGPd>
```

```
R2-BGPd> show bgp summary
BGP router identifier 189.76.127.254, local AS number 11752
RIB entries 5528, using 346 KiB of memory
Peers 5, using 12 KiB of memory
```

Neighbor	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	State/PfxRcd
2001:1291:1301:4::a	4	16735	9044	786	0	0	0	06:32:11	2863
2001:12fe:a:202:4::6	4	11752	1025	786	0	0	0	06:32:13	66

```
Total number of neighbors 2
R2-BGPd>
```

PTTMetro - PTT.br

<http://ptt.br/>

PTTMetro - Documentação

<http://ptt.br/doc/>

<http://ptt.br/doc/nic.br-ceptro.br-pttmetro.apresentacao.pdf>

GTER27 - Análise de Vulnerabilidades de Redes em Conexões com PTT

<ftp://ftp.registro.br/pub/gter/gter27/06-vul-con-ptt.pdf>

3º PTTForum - 2009

<http://ceptro.br/pttforum>

Obrigado!

Equipe de Engenharia do PTTMetro  
eng@ptt.br