



# Roteamento Dinâmico com Softrouter



# Agenda

---

- Motivação
- Historia do BSDRP
- Historia do FRR
- Conhecendo o BSDRP
- Conhecendo o FRR
- Exemplo de uso
- Cases de sucesso
- Agradecimentos



# Quem Somos

---

- Consultoria em Routing, Switching e Virtualização para ISP's e ITP's.
- Nascemos em 2007 atendendo apenas empresas
- Em 2014 começamos a atender provedores
- Em 2019 iniciamos como um Transit Provider



# Motivação

---

- Aumento da demanda dos pequenos provedores.
- Melhores opções do que as existentes no mercado.
- Facilidade na operação / reposição.
- Baixo Investimento.
- Suporte a novas funcionalidades.
- Desenvolvimento constante.
- Falta de documentação.



# Historia do BSDRP

---

- Soft-router baseado em FreeBSD
- Open source
- Teve seu inicio em 2009
- Versão 1.0 lançada em 10/2011
- No inicio usava Quagga/Bird
- Na versão 1.8 o Quagga foi trocado pelo FRR
- Atualmente está na versão 1.97
- <https://bsdrp.net>

*Don't buy a router: download it !*



# Historia do FRRouting

---

1996 começa o desenvolvimento do Zebra



2002 inicia-se o Quagga, um fork do Zebra



2016 Inicia-se o FRR, um fork do Quagga



2017 lança-se a primeira release – FRR 2.0



Novembro de 2020 – Ultima release – FRR 7.5

<https://frrouting.org/>



# Protocolos Suportados

---

- BGP  
Large Communities, EVPN, VxLan, RPKI, VPN's baseadas em MPLS, VPN/VRF Route Leaking, RFC5549
- BGP Flowspec
- OSPF
- ISISD
- PIM
- VRF
- RIP
- BABEL
- EIGRP
- NHRPD
- PBR

Lista completa em <https://github.com/FRRouting/frr/wiki>



# Protocolos suportados

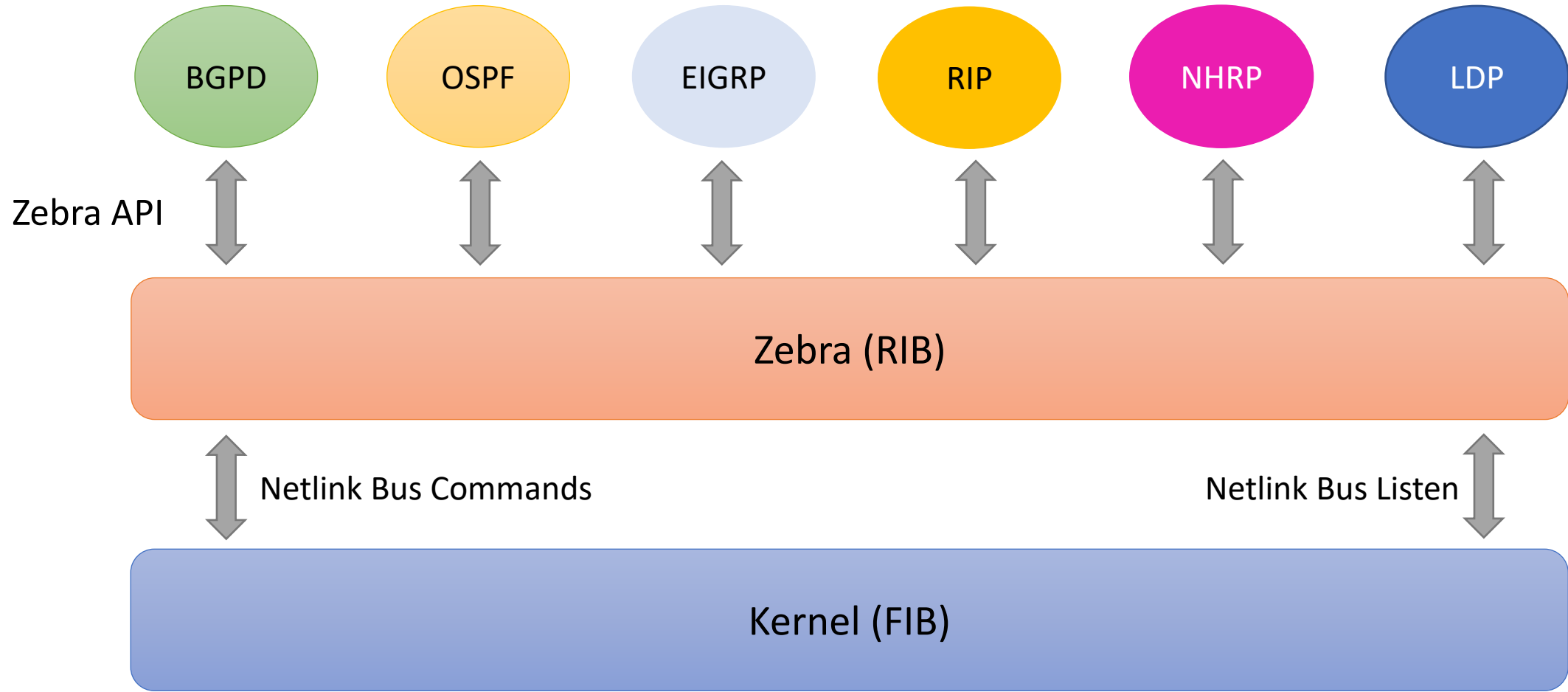
---

- VRF  
Depende de l3mdev e está funcional nas versões de kernel acima de 4.4
- BGP EVPN  
Depende de NFT\_EXT\_LEARNED e Arp Suppression, kernel 4.14 e 4.17
- Homologado com FreeBSD, NetBSD, OpenBSD, Solaris, Debian, Ubuntu e RedHat
- VRF e BGP EVPN somente disponíveis para distribuições Linux





# Arquitetura do Free Range Routing



# Por que usar BSD Router Project?

---

- Baseado em FreeBSD
- Suporta os principais protocolos necessários para um ISP
- Desenvolvimento ativo e constante
- Otimizado para forward de pacotes
- Dispensa alto conhecimento em S.O.
- Fácil operação
- Vem com FRR embarcado
- Compatível com NETMAP



# Comandos BSDRP

Alguns comandos para administração e troubleshooting

- **help**
- **config** – save, apply, factory, diff, rollback
- **show** – version, route, packages, process, traffic, ifstat
- **system** – halt, reboot
- **sysrc** – hostname, frr\_enable, sshd\_enable
- **service** – start | stop ffr, sshd
- **cli / vtysh**
- **passwd**

```
[root@router]~# help
Welcome to BSD Router Project (BSDRP) help

BSDRP is an embedded FreeBSD with some customized tools:
- config : Manage config files
- show   : Display some system information
- upgrade : upgrade BSDRP
- system : System actions
- cli    : Enter into frr router mode
          Need to start it first with
          sysrc frr_enable=yes
          service frr start
- graphpath: helper tool to graph path
- tuning   : Give some tuning advice
- help     : Display this help message

Command completion is available with TAB key
More information with: tools-name help
Display all rc variables configured with: sysrc -a
```



# Iniciando a configuração

---

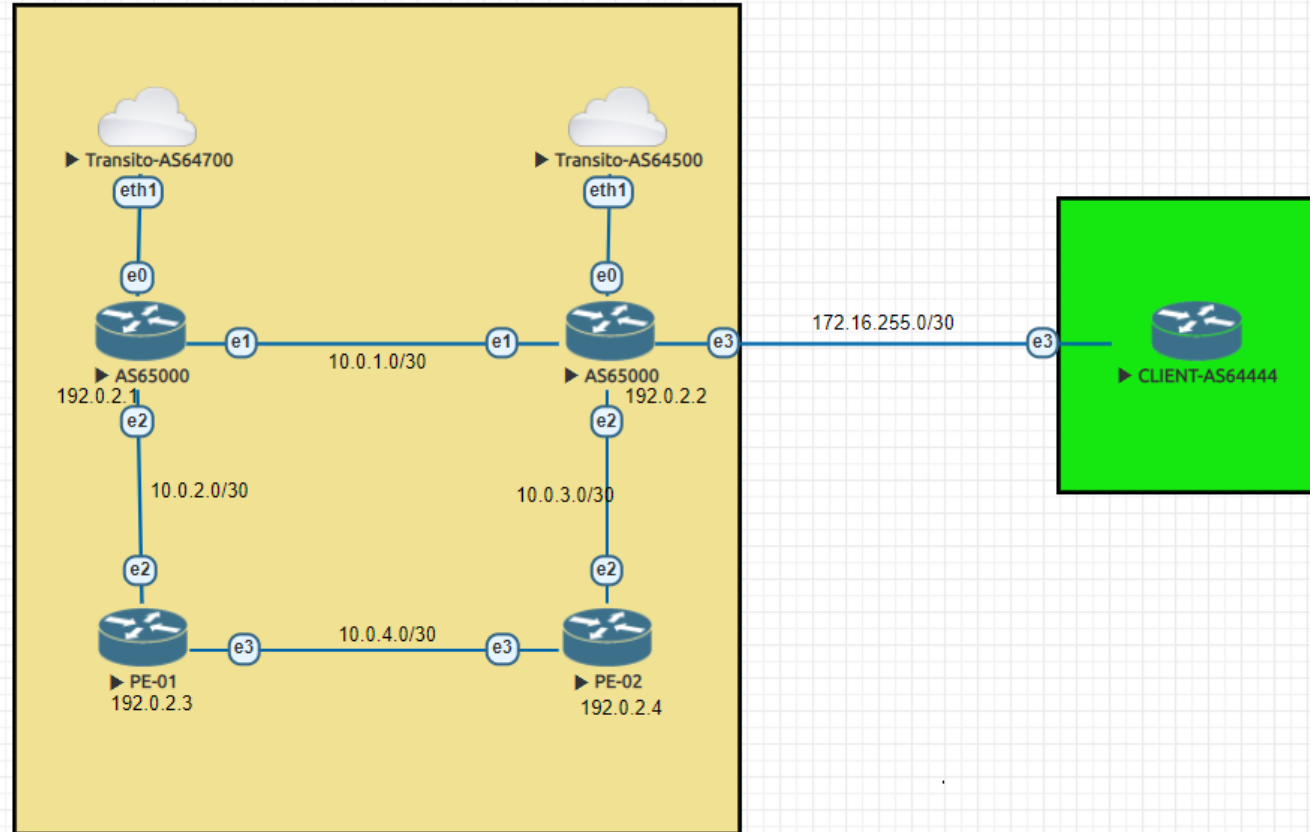
Existem duas maneiras de efetuar a configuração do equipamento.

A primeira é direto na interface do FRR com o comando **cli** ou **vttysh** e a segunda é editando manualmente o arquivo de configuração de cada protocolo de roteamento e do zebra

```
/usr/local/etc/frr/zebra.conf  
/usr/local/etc/frr/ripd.conf  
/usr/local/etc/frr/ripngd.conf  
/usr/local/etc/frr/ospfd.conf  
/usr/local/etc/frr/ospf6d.conf  
/usr/local/etc/frr/bgpd.conf  
/usr/local/etc/frr/isisd.conf  
/usr/local/etc/frr/eigrpd.conf  
/usr/local/etc/frr/babeld.conf
```



# Cenário Proposto



# Exemplo de configuração

```
hostname BGP65000-01
!
ip route 100.17.0.0/21 Null0
ip route 100.17.0.0/22 Null0
ipv6 route 2100:16:8000::/33 Null0
ipv6 route 2100:16::/32 Null0
!
interface lo0
ip address 192.0.2.1/32
ipv6 address 2801:db8::1/128
!
interface vtnet0
description TRANSITO-AS64700
ip address 172.16.0.2/30
ipv6 address 2000:16::2/126
!
interface vtnet1
description BORDA-02
ip address 10.0.1.2/30
ip ospf network point-to-point
ipv6 address 2001:10:1::2/126
ipv6 ospf6 network point-to-point
!
interface vtnet2
description PE01
ip address 10.0.2.1/30
ip ospf network point-to-point
ipv6 address 2001:10:2::1/126
ipv6 ospf6 network point-to-point
!
router bgp 65000
bgp router-id 192.0.2.1
no bgp default ipv4-unicast
neighbor 172.16.0.1 remote-as 64700
neighbor 172.16.0.1 description TRANSITO-AS64500
neighbor 192.0.2.2 remote-as 65000
neighbor 192.0.2.2 description IBGP
neighbor 192.0.2.2 update-source 192.0.2.2
neighbor 2000:16::1 remote-as 64700
neighbor 2000:16::1 description TRANSITO-AS64500
neighbor 2801:db8::2 remote-as 65000
neighbor 2801:db8::2 update-source 2801:db8::1
```

```
address-family ipv4 unicast
network 100.17.0.0/21
network 100.17.4.0/22
neighbor 172.16.0.1 activate
neighbor 172.16.0.1 route-map UP-AS64700-OUT out
neighbor 192.0.2.2 activate
exit-address-family
!
address-family ipv6 unicast
network 2100:16::/32
network 2100:16:8000::/33
neighbor 2000:16::1 activate
neighbor 2000:16::1 route-map UP-AS64700-OUT out
neighbor 2801:db8::2 activate
exit-address-family
!
router ospf
ospf router-id 192.0.2.1
redistribute connected
redistribute static
network 10.0.1.0/30 area 0
network 10.0.2.0/30 area 0
default-information originate always
!
router ospf6
ospf6 router-id 192.0.2.1
redistribute connected
redistribute static
interface vtnet2 area 0.0.0.0
interface vtnet1 area 0.0.0.0
```

```
ip prefix-list BLOCO-ROUTER01 seq 10 permit 100.17.0.0/21
ip prefix-list BLOCO-ROUTER01 seq 5 permit 100.17.4.0/22
!
ipv6 prefix-list BLOCO-ROUTER01-V6 seq 10 permit 2100:16:8000::/33
ipv6 prefix-list BLOCO-ROUTER01-V6 seq 5 permit 2100:16::/32
!
bgp community-list standard ANUNCIA-AS64500 permit 65000:64500
bgp community-list standard ANUNCIA-AS64700 permit 65000:64700
!
route-map UP-AS64700-OUT deny 999
!
route-map UP-AS64700-OUT permit 5
match community ANUNCIA-AS64700
!
route-map UP-AS64700-OUT permit 500
match ip address prefix-list BLOCO-ROUTER01
!
route-map UP-AS64700-OUT permit 501
match ipv6 address BLOCO-ROUTER01-V6
!
line vty
!
end
```



# Exemplo de configuração

```
hostname BGP65000-02
!
ip route 100.17.0.0/21 Null0
ip route 100.17.0.0/22 Null0
!
interface lo0
ip address 192.0.2.2/32
ipv6 address 2801:db8::2/128
!
interface vtnet0
description TRANSITO-AS65000
ip address 172.17.0.2/30
ipv6 address 2000:17::2/126
!
interface vtnet1
description BORDA-01
ip address 10.0.1.1/30
ip ospf network point-to-point
ipv6 address 2001:10:1::1/126
ipv6 ospf6 network point-to-point
!
interface vtnet2
description PE02
ip address 10.0.3.1/30
ip ospf network point-to-point
ipv6 address 2001:10:3::1/126
ipv6 ospf6 network point-to-point
!
interface vtnet3
description CLIENTE-AS64444
ip address 172.16.255.1/30
ipv6 address 2001:16:255:1/126
!
router bgp 65000
bgp router-id 192.0.2.2
no bgp default ipv4-unicast
neighbor 172.16.255.2 remote-as 64444
neighbor 172.16.255.2 description TRANSIT-CUSTOMER
neighbor 172.17.0.1 remote-as 64500
neighbor 172.17.0.1 description TRANSITO-AS64500
neighbor 192.0.2.1 remote-as 65000
neighbor 192.0.2.1 description IBGP
neighbor 192.0.2.1 update-source 192.0.2.2
neighbor 2000:17::1 remote-as 64500
neighbor 2000:17::1 description TRANSITO-AS64500

neighbor 2001:16:255::2 remote-as 64444
neighbor 2001:16:255::2 description CUSTOMER-IPV6
neighbor 2801:db8::1 remote-as 65000
neighbor 2801:db8::1 update-source 2801:db8::2
!
address-family ipv4 unicast
network 100.17.0.0/21
network 100.17.0.0/22
neighbor 172.16.255.2 activate
neighbor 172.16.255.2 route-map DOWN-AS64444-IN in
neighbor 172.16.255.2 route-map CLIENTE-FULL out
neighbor 172.17.0.1 activate
neighbor 172.17.0.1 route-map UP-AS64700-OUT out
neighbor 192.0.2.1 activate
exit-address-family
!
address-family ipv6 unicast
network 2100:17::/32
network 2100:17::/33
neighbor 2000:17::1 activate
neighbor 2000:17::1 route-map UP-AS64700-OUT out
neighbor 2001:16:255:2 activate
neighbor 2001:16:255:2 route-map DOWN-AS64444-IN in
neighbor 2001:16:255:2 route-map CLIENTE-FULL out
neighbor 2801:db8::1 activate
exit-address-family
!
router ospf
ospf router-id 192.0.2.2
redistribute connected
redistribute static
network 10.0.1.0/30 area 0
network 10.0.3.0/30 area 0
default-information originate always
!
router ospf6
ospf6 router-id 192.0.2.2
redistribute connected
redistribute static
interface vtnet2 area 0.0.0.0
interface vtnet1 area 0.0.0.0

!
ip prefix-list BLOCO-ROUTER02 seq 10 permit 100.17.0.0/21
ip prefix-list BLOCO-ROUTER02 seq 5 permit 100.17.0.0/22
ip prefix-list CLIENTE seq 5 permit 200.200.0.0/21 le 24
!
ipv6 prefix-list BLOCO-ROUTER02-V6 seq 10 permit 2100:17::/33
ipv6 prefix-list BLOCO-ROUTER02-V6 seq 5 permit 2100:17::/32
ipv6 prefix-list CLIENTE seq 5 permit 2000:200::/32 le 48
!
bgp community-list standard ANUNCIA-AS64500 permit 65000:64500
bgp community-list standard ANUNCIA-AS64700 permit 65000:64700
!
route-map CLIENTE-FULL permit 5
match ip address prefix-list BLOCO-ROUTER02
!
route-map CLIENTE-FULL permit 9
!
route-map DOWN-AS64444-IN permit 10
match ipv6 address prefix-list CLIENTE
set community 65000:64500 65000:64700
set local-preference 200
!
route-map DOWN-AS64444-IN permit 5
match ip address prefix-list CLIENTE
set community 65000:64500 65000:64700
set local-preference 200
!
route-map UP-AS64700-OUT deny 999
!
route-map UP-AS64700-OUT permit 5
match community ANUNCIA-AS64700
!
route-map UP-AS64700-OUT permit 500
match ip address prefix-list BLOCO-ROUTER02
!
route-map UP-AS64700-OUT permit 501
match ipv6 address BLOCO-ROUTER02-V6
!
```



# Exemplo de configuração

```
hostname PE-02
!  
interface lo0  
ip address 192.0.2.4/32  
ipv6 address 2801:db8::4/128  
!  
interface vtnet2  
description BDR02  
ip address 10.0.3.2/30  
ip ospf network point-to-point  
ipv6 address 2001:10:3::2/126  
ipv6 ospf6 network point-to-point  
!  
interface vtnet3  
description PE-01  
ip address 10.0.4.2/30  
ip ospf network point-to-point  
ipv6 address 2001:10:4::2/126  
ipv6 ospf6 network point-to-point  
!  
router ospf  
ospf router-id 192.0.2.4  
redistribute connected  
redistribute static  
network 10.0.3.0/30 area 0  
network 10.0.4.0/30 area 0  
!  
router ospf6  
ospf6 router-id 192.0.2.4  
redistribute connected  
redistribute static  
interface vtnet2 area 0.0.0.0  
interface vtnet3 area 0.0.0.0  
!
```





# Exemplo de configuração

```
hostname PE-02
!  
interface lo0  
ip address 192.0.2.4/32  
ipv6 address 2801:db8::4/128  
!  
interface vtnet2  
description BDR02  
ip address 10.0.3.2/30  
ip ospf network point-to-point  
ipv6 address 2001:10:3::2/126  
ipv6 ospf6 network point-to-point  
!  
interface vtnet3  
description PE-01  
ip address 10.0.4.2/30  
ip ospf network point-to-point  
ipv6 address 2001:10:4::2/126  
ipv6 ospf6 network point-to-point  
!  
router ospf  
ospf router-id 192.0.2.4  
redistribute connected  
redistribute static  
network 10.0.3.0/30 area 0  
network 10.0.4.0/30 area 0  
!  
router ospf6  
ospf6 router-id 192.0.2.4  
redistribute connected  
redistribute static  
interface vtnet2 area 0.0.0.0  
interface vtnet3 area 0.0.0.0  
!
```



# Exemplos básicos de troubleshooting

---

show running-config

show bgp ipv4 summary

show bgp ipv6 summary

show bgp ipv4 neighbors 187.16.216.253 advertised-routes

show bgp ipv6 neighbors 2001:12f8::253 advertised-routes

show bgp ipv4 neighbors 187.16.216.253 received-routes

show bgp ipv6 neighbors 2001:12f8::253 received-routes

show bgp ipv4 8.8.8.0/24

show bgp ipv6 2001:4860::/32

show ip ospf neighbor

show ipv6 ospf6 neighbor

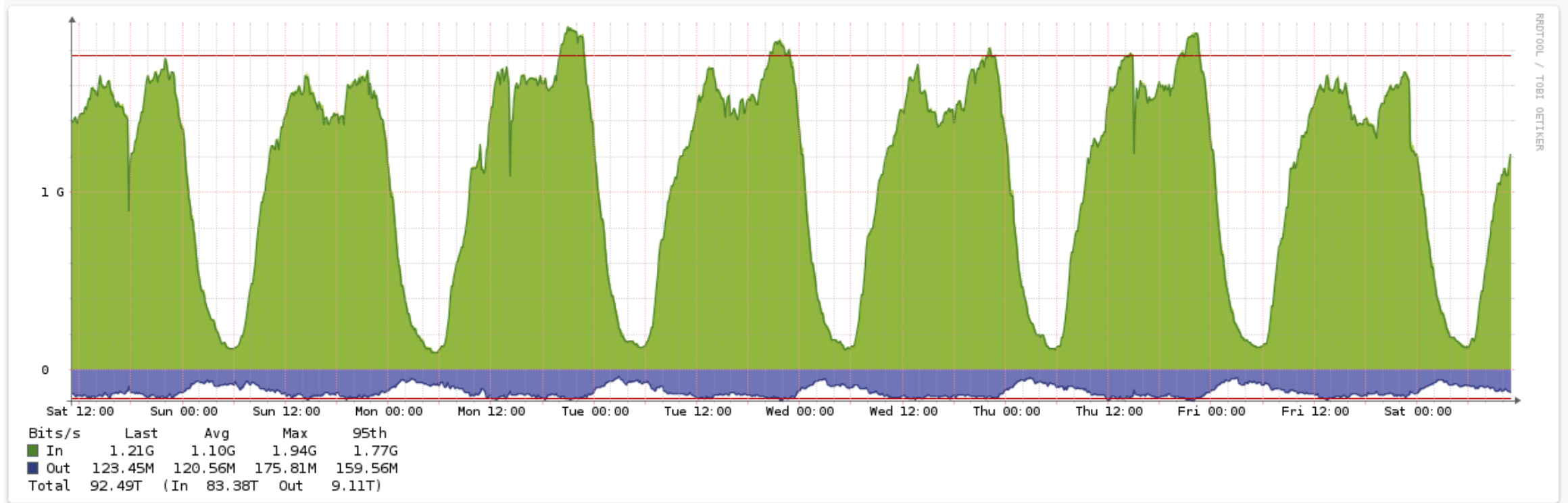


# Cases de Sucesso

Cenário:

eBGP com dois upstreams

Dell r410 com uma Intel x520-da2 Dual port



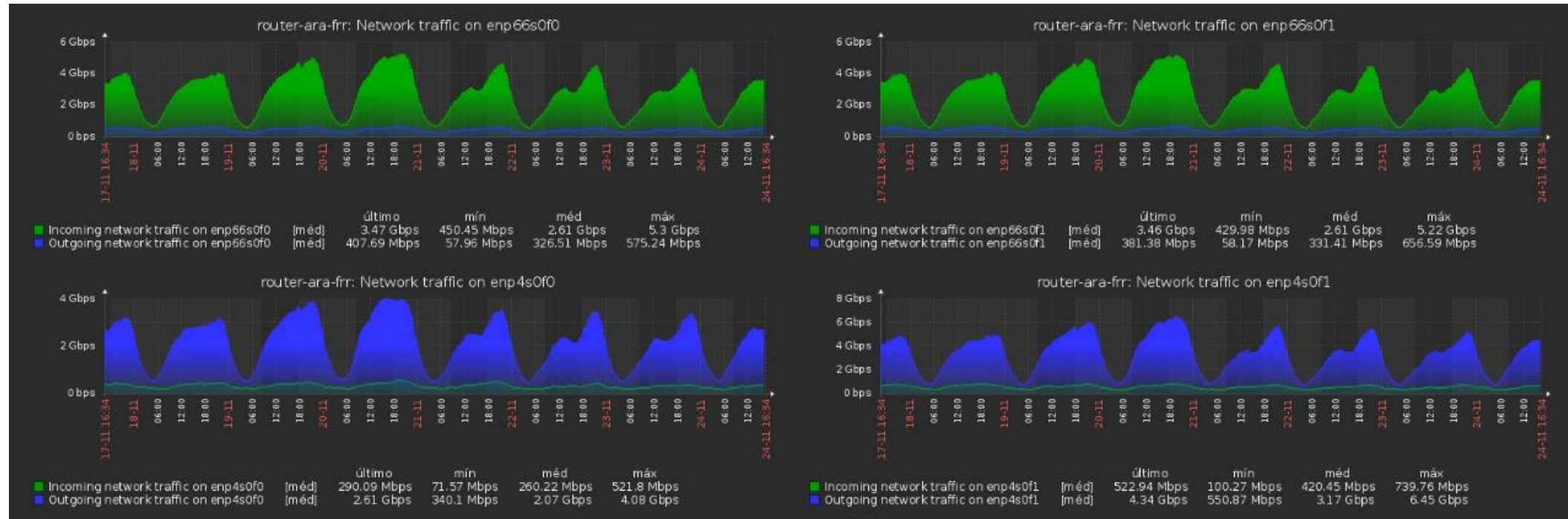
# Cases de Sucesso

Cenário:

Debian 9.6 (kernel 4.18) + FRR

OSPF / OSPFv3 + Firewall

Dell r720 com duas Intel x520-sr2



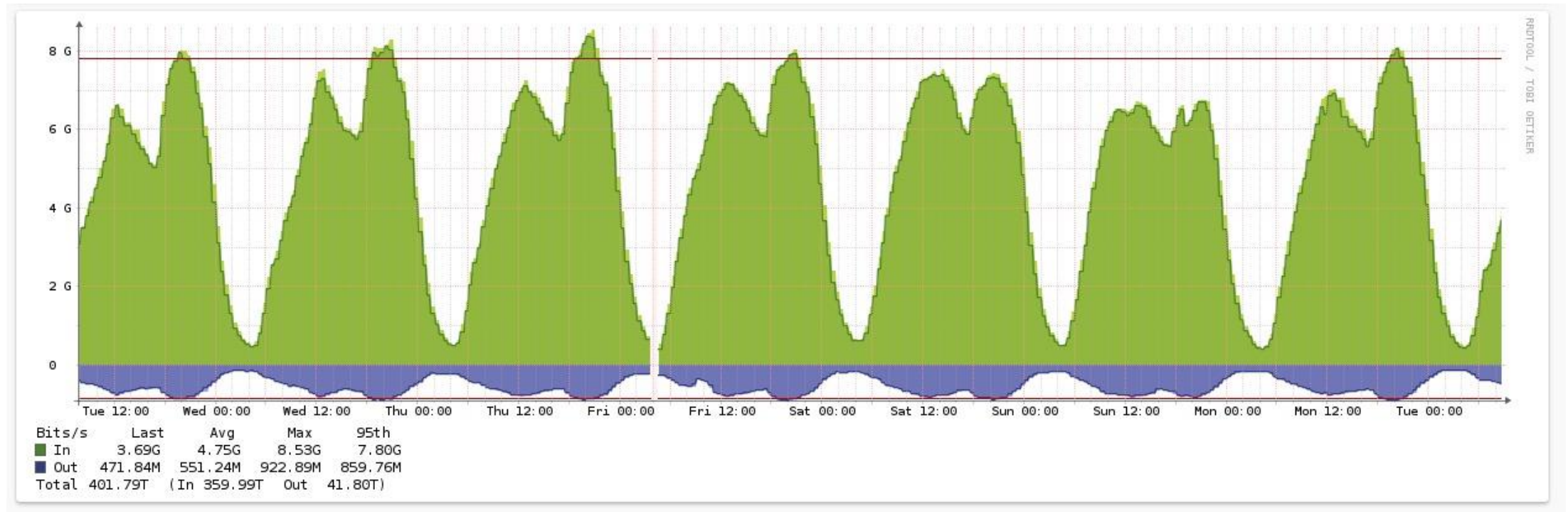
# Cases de Sucesso

Cenário:

eBGP com dois upstreams e IX

eBGP com um cliente de trânsito

Dell r410 com uma Intel x520-da2



# Referências e utilidades

---

## Referências

- <https://youtu.be/NxP9lBvoawE>
- <https://frrouting.org/>
- <https://bsdrrp.net/>

## Utilidades

- Imagem BSDRP para EVE  
<https://bit.ly/32XCR8U>
- Template OVA para Vmware  
<https://bit.ly/3fdQAgF>
- Tutorial instalação de FRR em Debian  
<https://blog.remontti.com.br/4771>



# Perguntas

---



# Obrigado!

---

## Contatos



[corazza@incert.com.br](mailto:corazza@incert.com.br)



[linkedin.com/in/jrcorazza](https://www.linkedin.com/in/jrcorazza)



[facebook.com/corazzajr](https://www.facebook.com/corazzajr)



[\(17\) 9711-5311](tel:(17)9711-5311)

