

Conversando sobre **SD-WAN!**

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Evento organizado por:



Em Guarapuava-PR, 26 de outubro de 2023.

Prof. Hermano (hp)

Lorenzo
(enteado)

Gi (S2)



Experiência:

- Acadêmica: **Redes**, Segurança, IoT;
- Mercado: Redes, **Cisco**, Linux, **Segurança**.

Atuação:

- Acadêmica: Pesquisa Cifras, **IoT**;
- Mercado: Redes, Cisco, **Linux**.

Estudando:

- OpenStack (DevOps)
- SD-WAN

Lysie na área :D

Grupo Boticário  Colaborador

Professor
RT-20

UTFPR
UNIVERSIDADE TECNOLÓGICA FEDERAL DO PARANÁ

Agenda

01

Por que SD?
SDN? SD-WAN?

De Software-Defined a um
serviço de WAN

02

Soluções
SD-WAN

Um pouco sobre as
soluções de SD-WAN.

03

Como ingressar na
SD-WAN?

Sobre as Controladoras e
como ingressar um site na
SD-WAN.

04

Como funciona a
Rede em SD-WAN?

Como a rede é organizada,
e como a rede overlay é
formada.

05

Avançando com
SD-WAN

O que podemos fazer a
mais com SD-WAN?

06

Considerações
sobre SD-WAN

Considerações finais, prós e
contras.





01

Por que SD? SDN? SD-WAN?

De Software-Defined para WAN.

Por que SD?

Cloud Service Layers

SaaS
SOFTWARE



User: Quero **usar** uma aplicação!

PaaS
PLATAFORMA



Dev: Quero **hospedar** minha aplicação!

IaaS
INFRAESTRUTURA



Admin: Quero **controlar** essa hospedagem!

Por que SD?

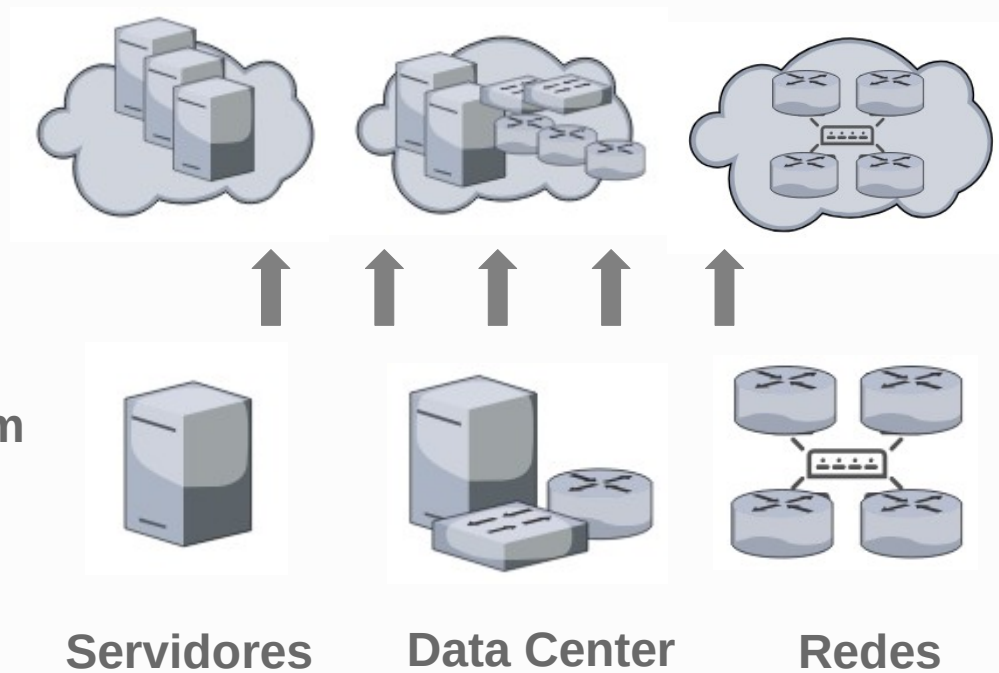
Cloud Service Layers

SaaS
SOFTWARE

PaaS
PLATAFORMA

IaaS
INFRAESTRUTURA

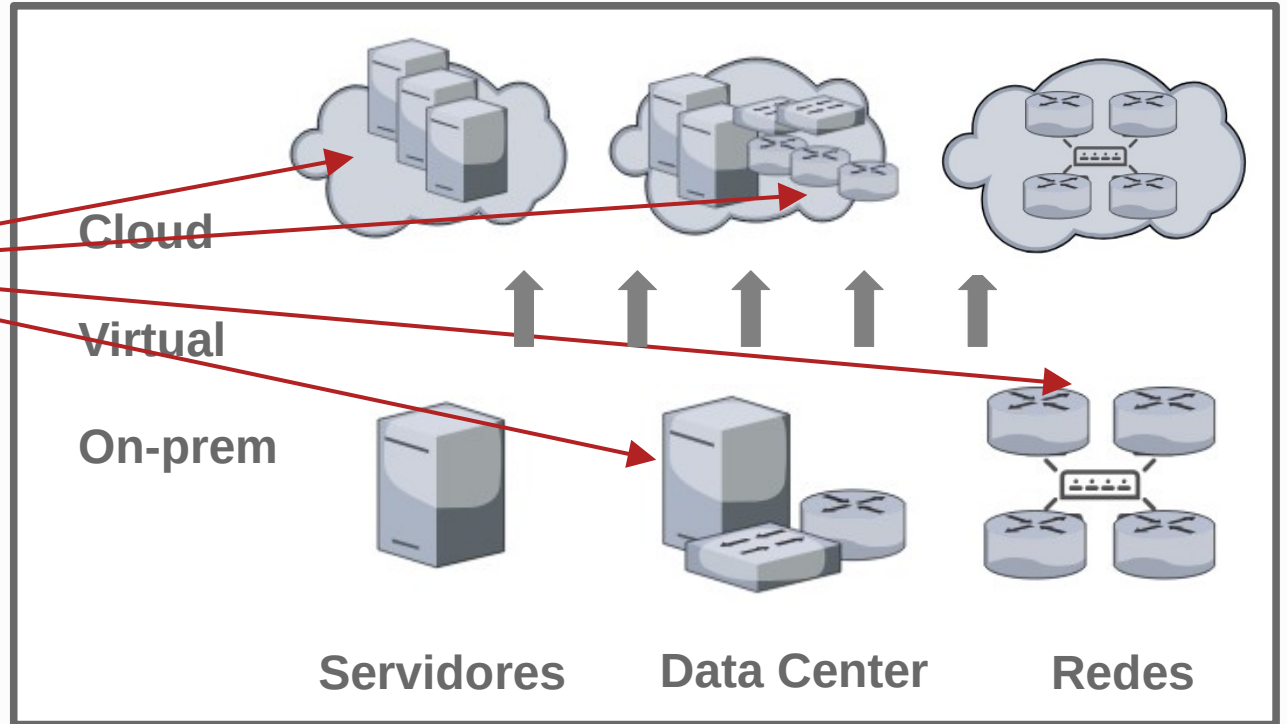
Cloud
Virtual
On-prem



Por que SD?



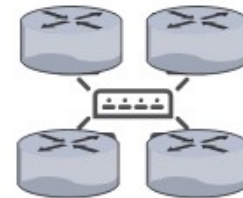
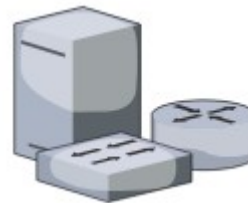
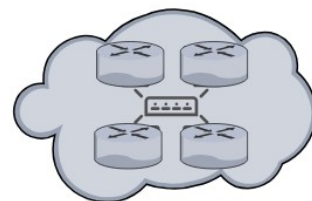
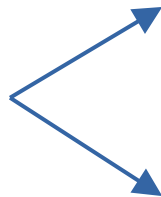
Admin



Por que SD?



Admin



Servidores

Data Center

Redes

- 1) Dissociar SW do HW
- 2) Abstrair HW

Por que SD?



Admin



Software-Defined

+ Virtual

+ Centralizado/Controlado

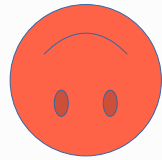
SDN (SD Network)

SDDC (SD Data Center)

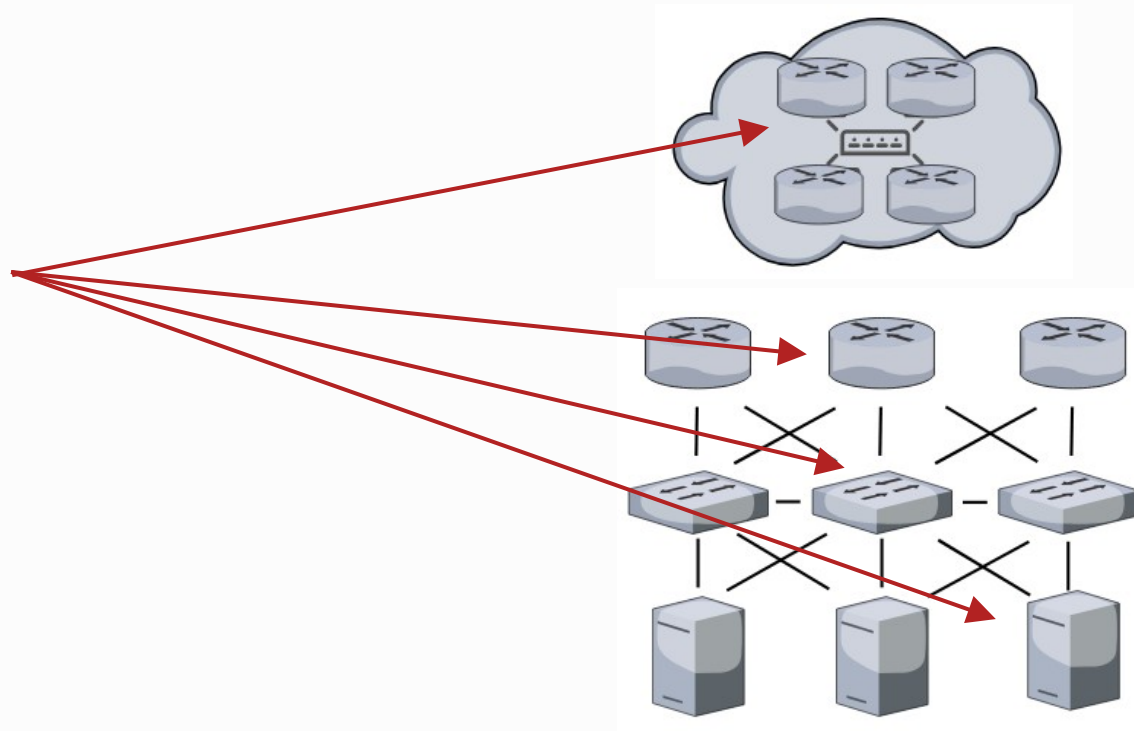
SDS (SD Storage)

SD*

Por que SDN?



Admin



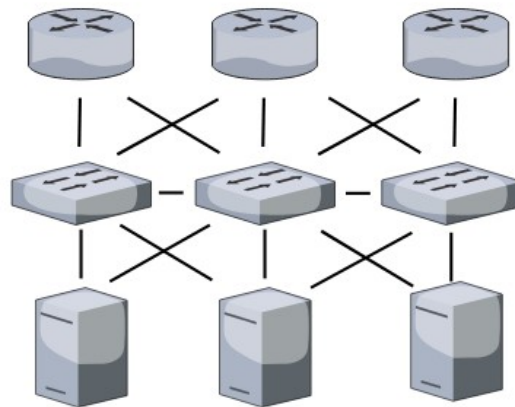
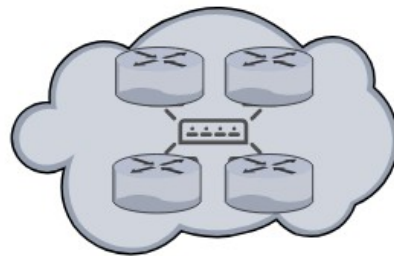
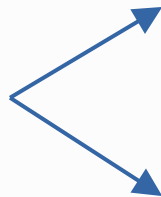
Por que SDN?



Admin



- Aplicação
- Controlador



Por que SDN?

Software-Defined Network

- OpenFlow (Stanford) ~2008



Admin



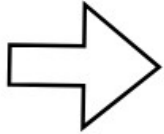
SDN vs Clássico

- + Programabilidade
- + Controle Centralizado
- Erros de Configuração
- Complexidade
- + Flexibilidade
- + Performance
- + Implementação (facilidade)
- + Configuração Eficiente
- + Gerenciamento

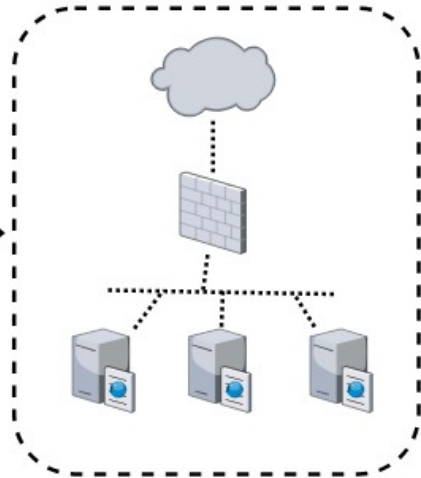
Por que SDN?

SDN: Distinção entre Underlay e Overlay.

Underlay



Overlay



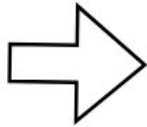
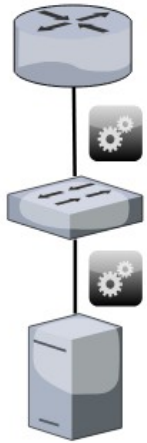
Visão da rede a partir do seu desenho
(redes sobrepostas)

A partir da rede Underlay
(geralmente física) criam-se
as redes Overlay (virtual).

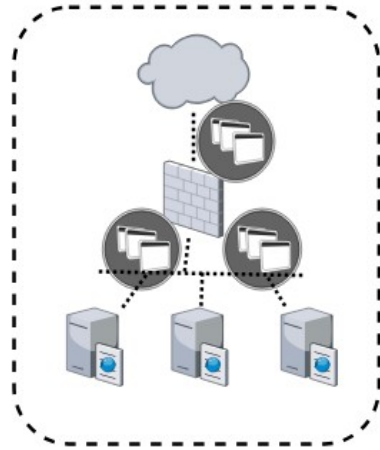
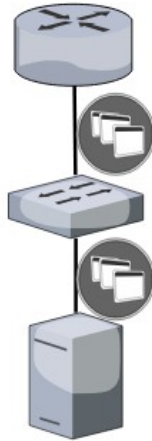
Por que SDN?

SDN: Distinção entre Control Plane e Data Plane.

Control Plane



Data Plane

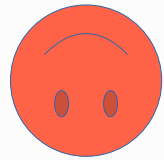


Visão da rede a partir do tráfego.

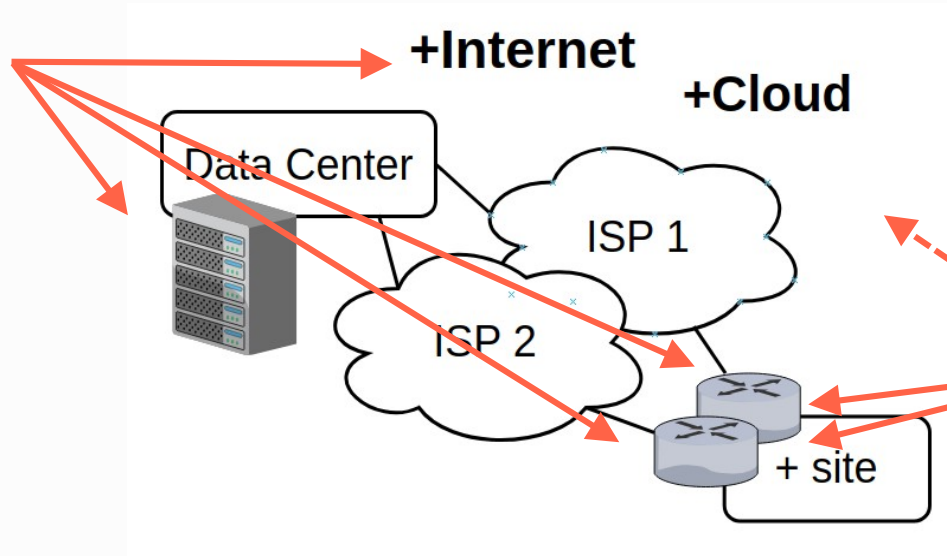
O tráfego de controle (geralmente na rede física) que antecede e permite a configuração do tráfego de dados (geralmente virtual).

Por que SD-WAN?

WAN Tradicional



Admin



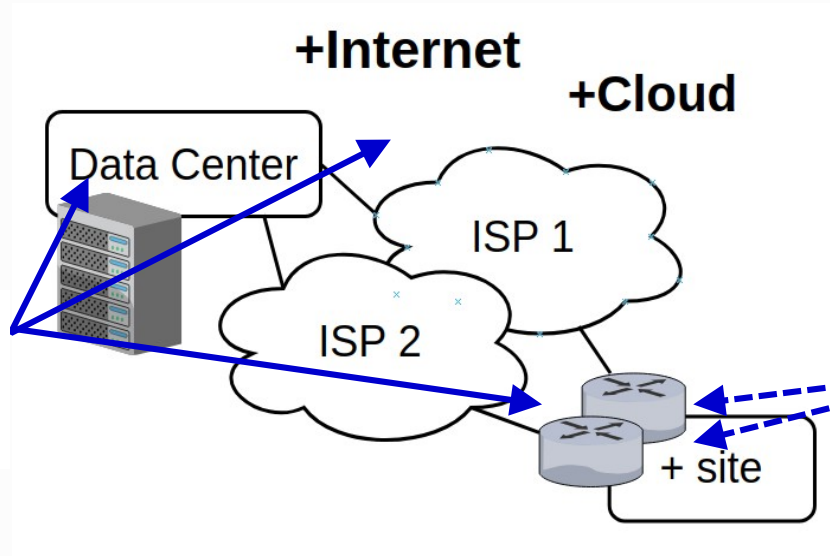
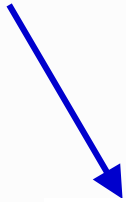
Técnico

Por que SD-WAN?

Com SD-WAN



Admin



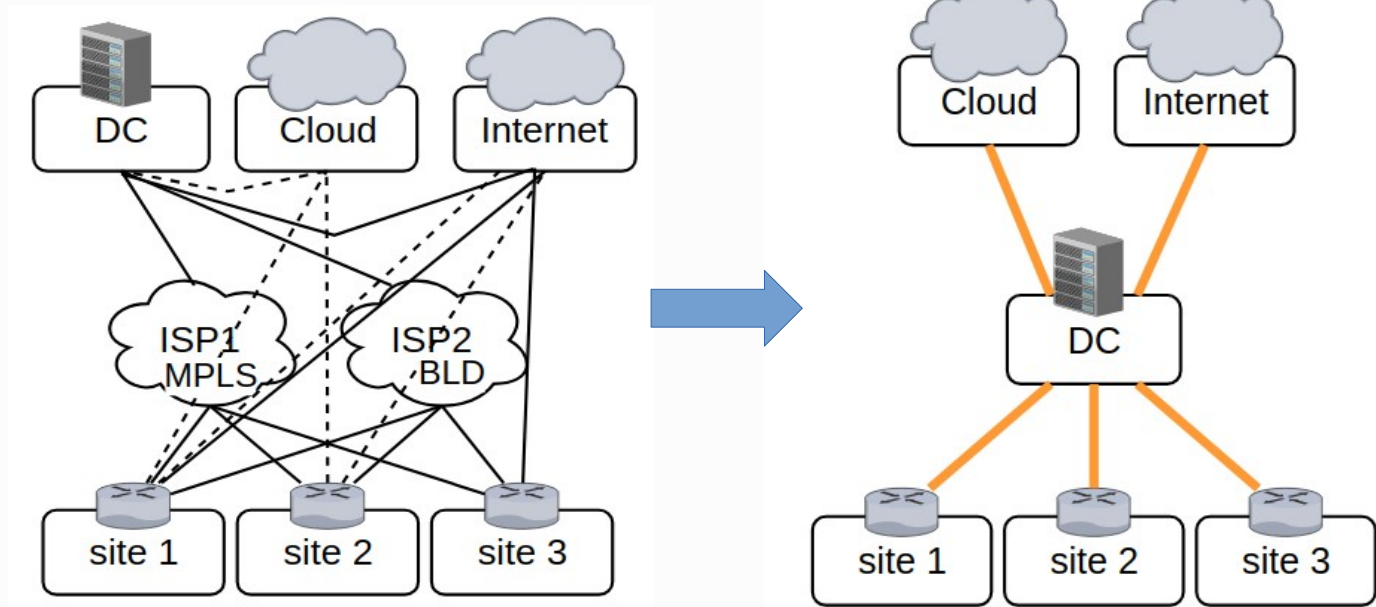
ZTP
PnP
Manual



Técnico

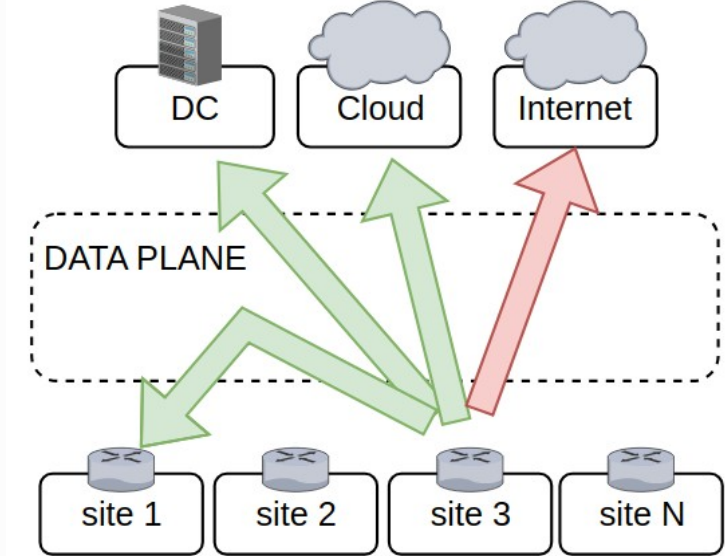
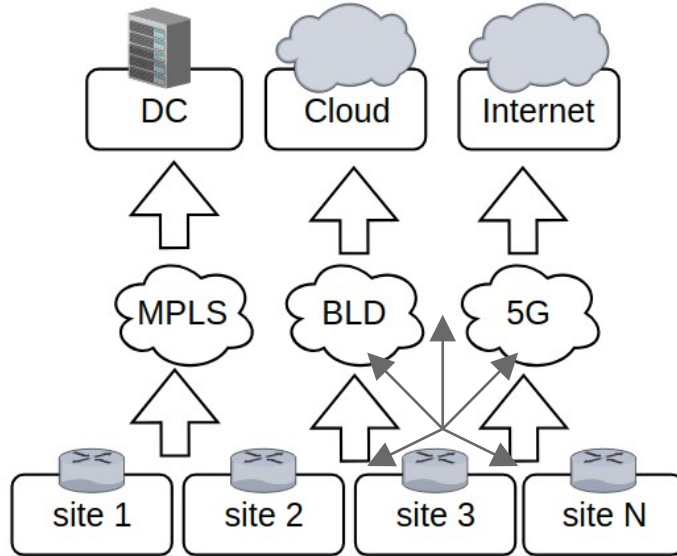
Por que SD-WAN?

SD-WAN: desenhar Topologia Overlay!



Por que SD-WAN?

SD-WAN: controle sobre o tráfego! Ex. Site 3.





Por que SD-WAN?

SD-WAN **herda** vantagens da SDN para WAN.

Tem mais ... vamos conversando ...





02

Soluções SD-WAN

Produtos de prateleira SD-WAN.

Soluções SD-WAN

aruba

a Hewlett Packard
Enterprise company


CISCO



velocloud
vmware®

FORTINET®


CISCO

Meraki

Cisco SD-WAN

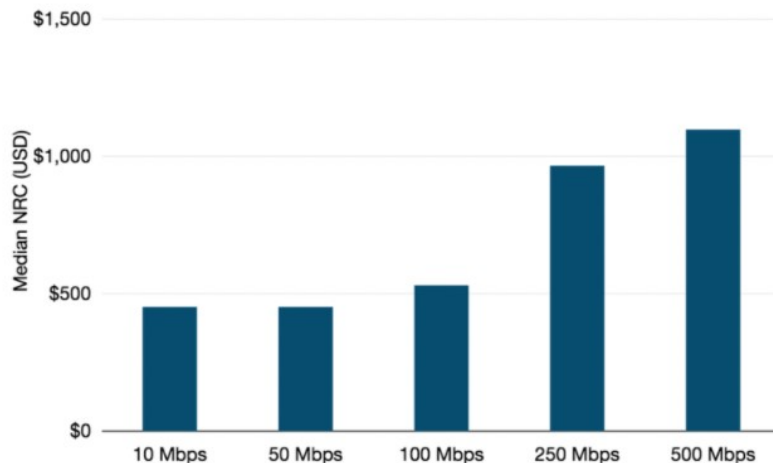
Viptela (2012):

Produto SD-WAN baseado em Cloud para gerência, orquestração de redes overlay em topologias de WAN, permite roteamento avançado, segmentação e segurança.

Aquisição em 2017 por \$610 mi.



Median Non-Recurring SD-WAN Charges by Site Capacity, 2021



Estimar Realidade x WAN

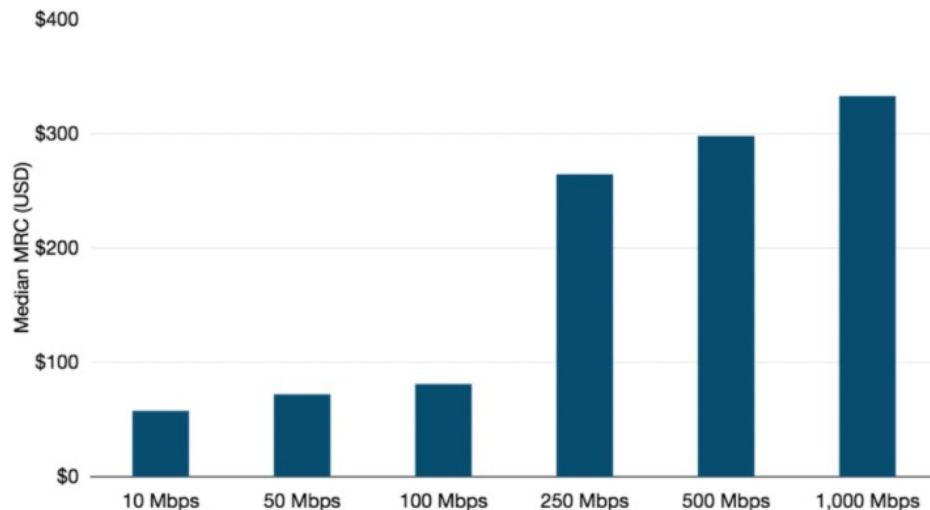
Nessa pesquisa (10 Mbps):

- NRC: \$452 ~R\$ 2260,00

- MRC: \$58 ~R\$ 290,00

Preços

Median Monthly Recurring SD-WAN Charges by Site Capacity, 2021



Source: TeleGeography, © 2022 TeleGeography



03

Como ingressar na SD-WAN

Deploy das Controladoras. Ingressar um site.

Cisco SD-WAN

vManage



vBond



vSmart



Deploy das Controladoras:

- Nuvem Cisco
- Nuvem Pública (AWS, Azure)
- On-premises (KVM, ESXi)

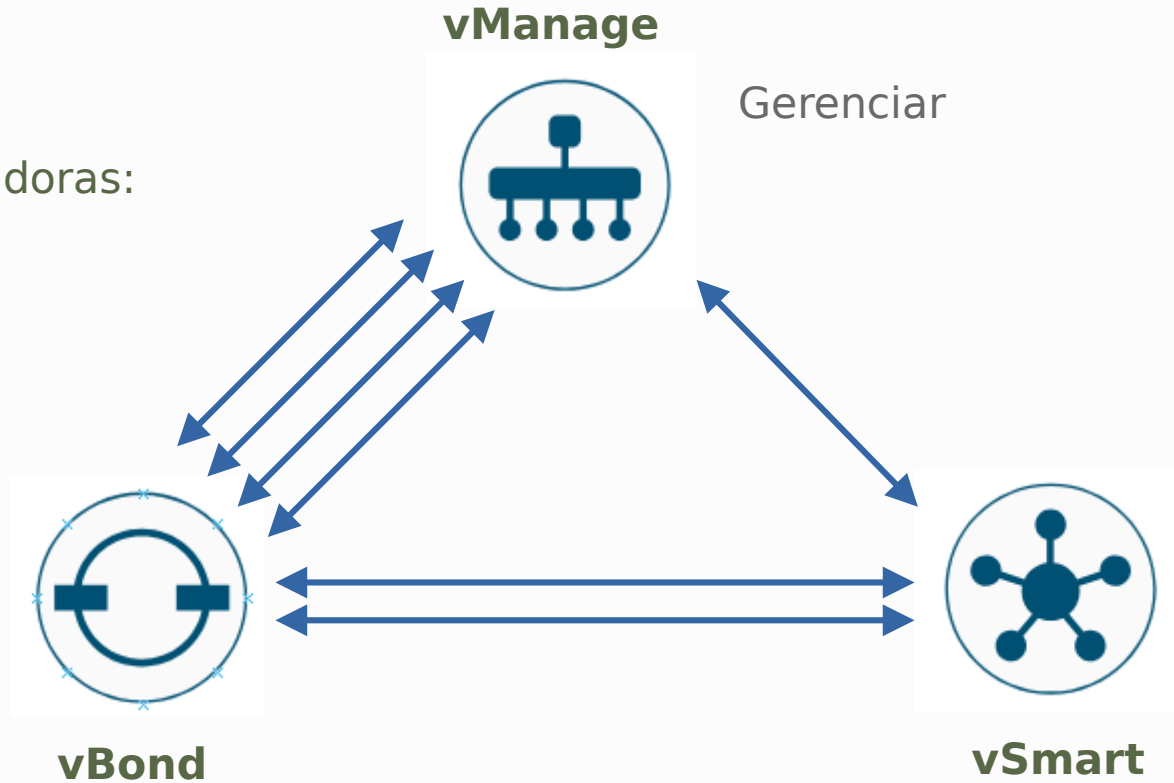
Cisco SD-WAN:

Conexões Controladoras:

DTLS UDP 12346

TLS TCP 23456

Orquestrar

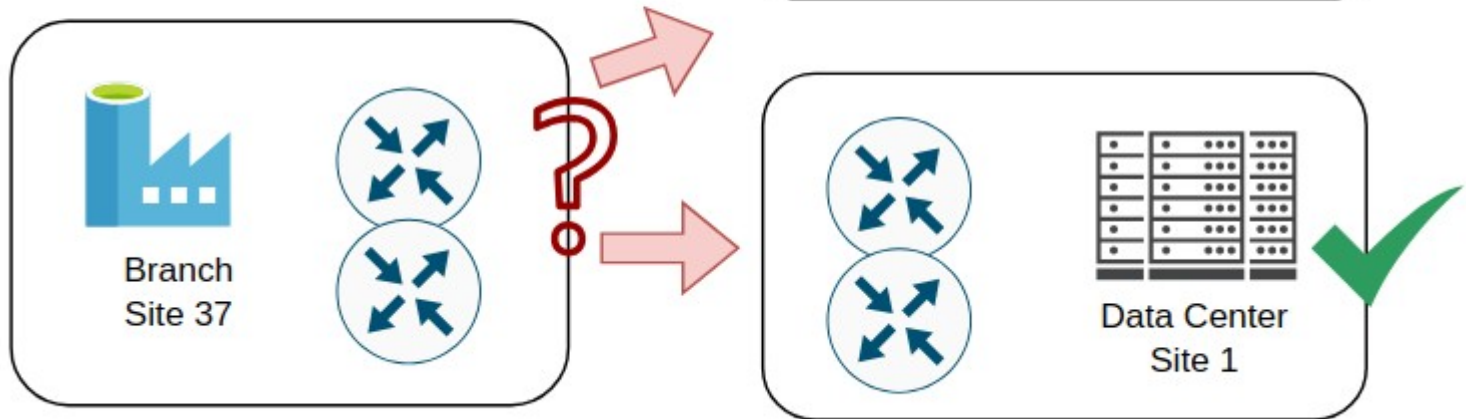


Controlar

Ingressar site na SD-WAN

Cenário:

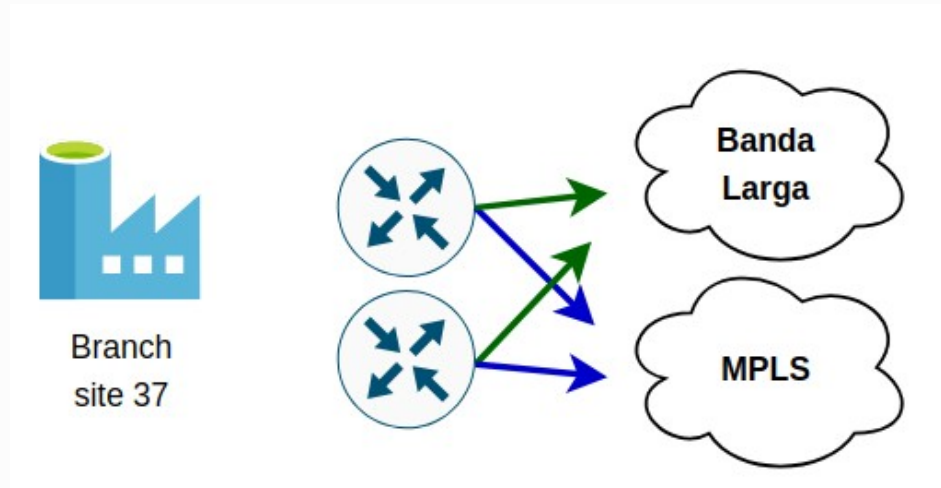
- Controladoras Ok
- Data Center Ok
- Filial (por fazer)



Ingressar site na SD-WAN

Cenário:

- Dois Links
- Dois Roteadores (edges)



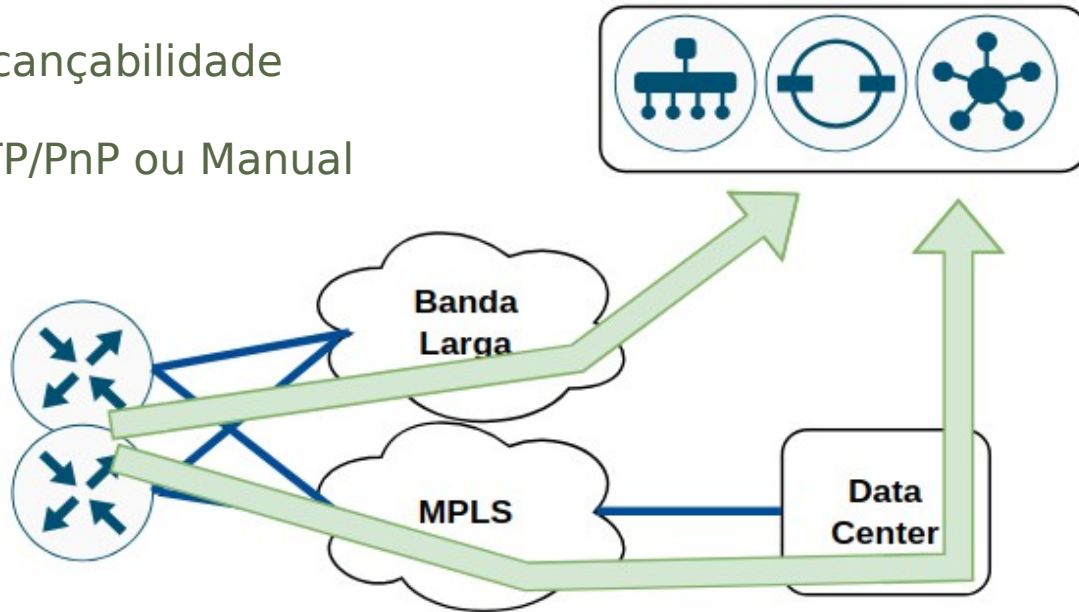
Ingressar site na SD-WAN

Passo 1) Alcançabilidade

Passo 2) ZTP/PnP ou Manual

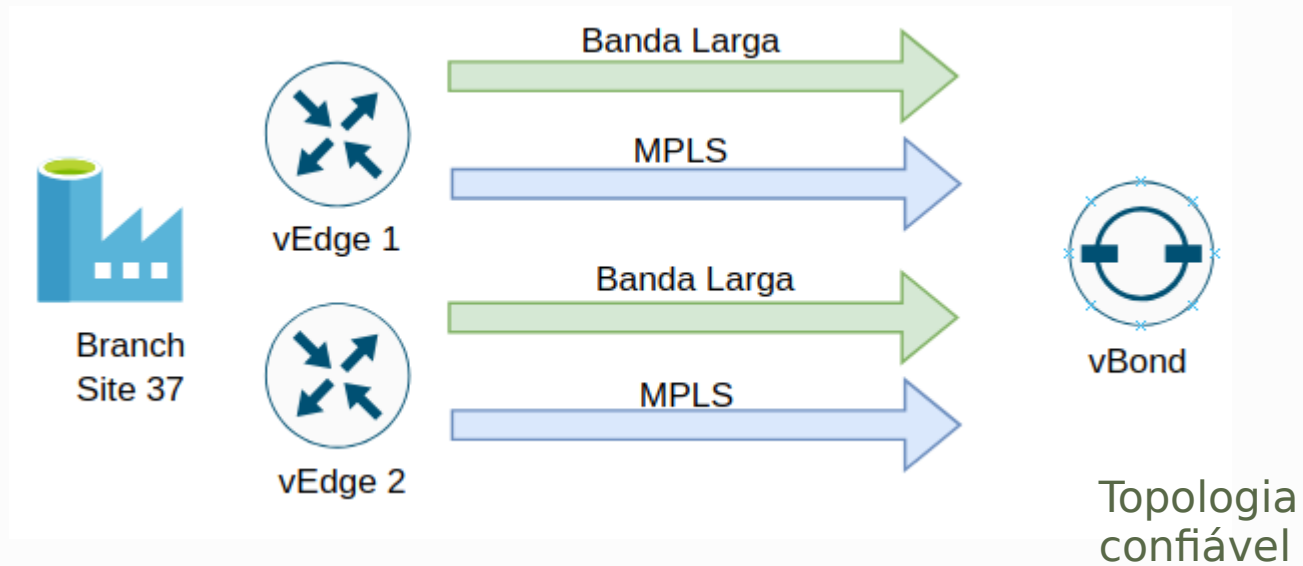


Branch
Site 37



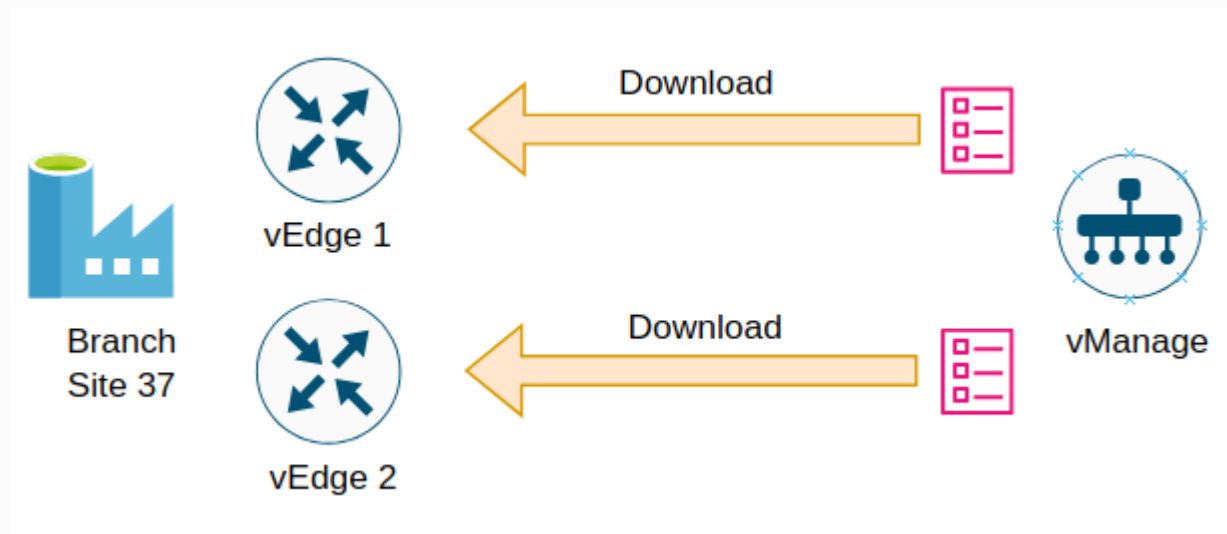
Ingressar site na SD-WAN

Passo 3) Autenticação



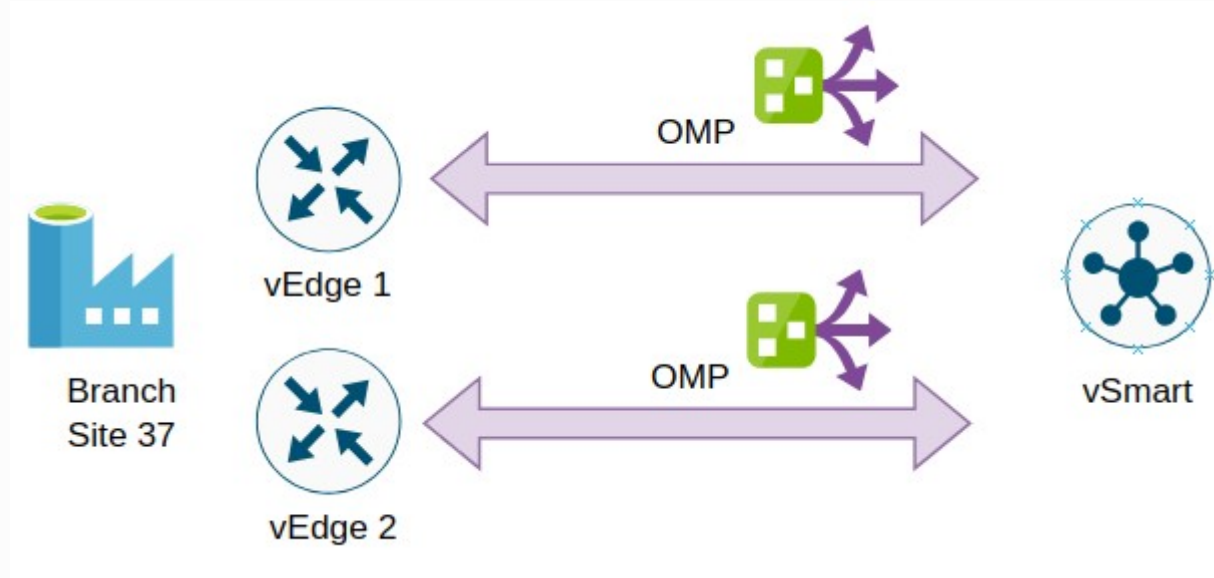
Ingressar site na SD-WAN

Passo 4) Autenticação



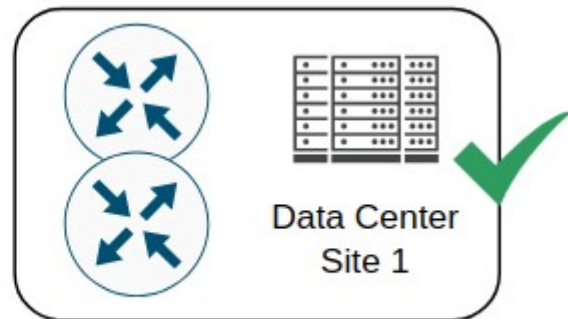
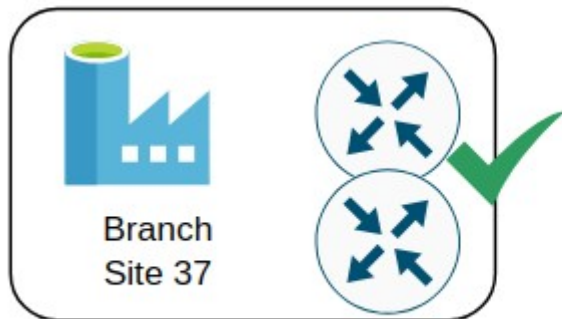
Ingressar site na SD-WAN

Passo 5) Roteamento



Pronto!?

Vamos avançar?!



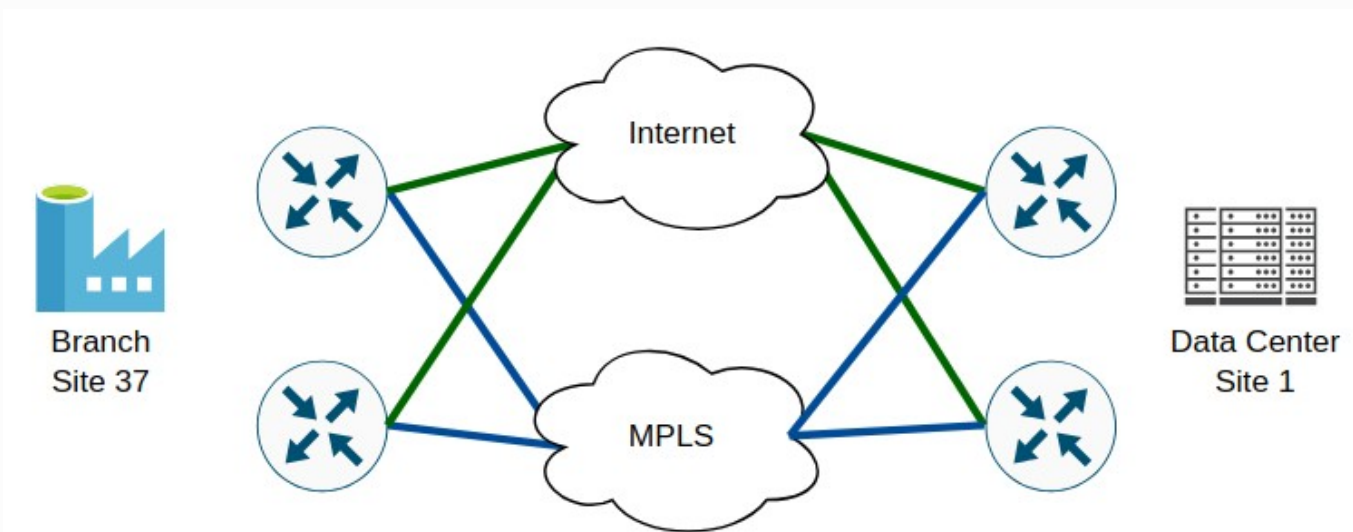


04

Como funciona a rede em SD-WAN?

Como as redes são separadas, como funciona a rede overlay.

Como funciona?



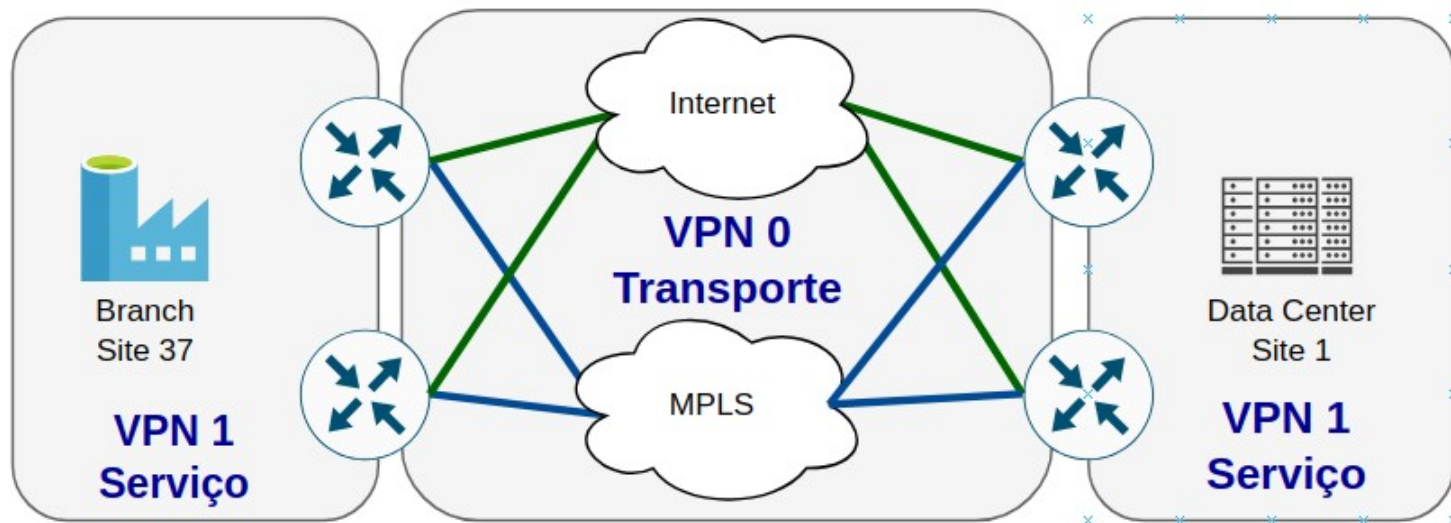
Cenário:

Alcançar a rede no novo site com o site Data Center.

Transporte vs Serviço

VPN = Virtual Private Network

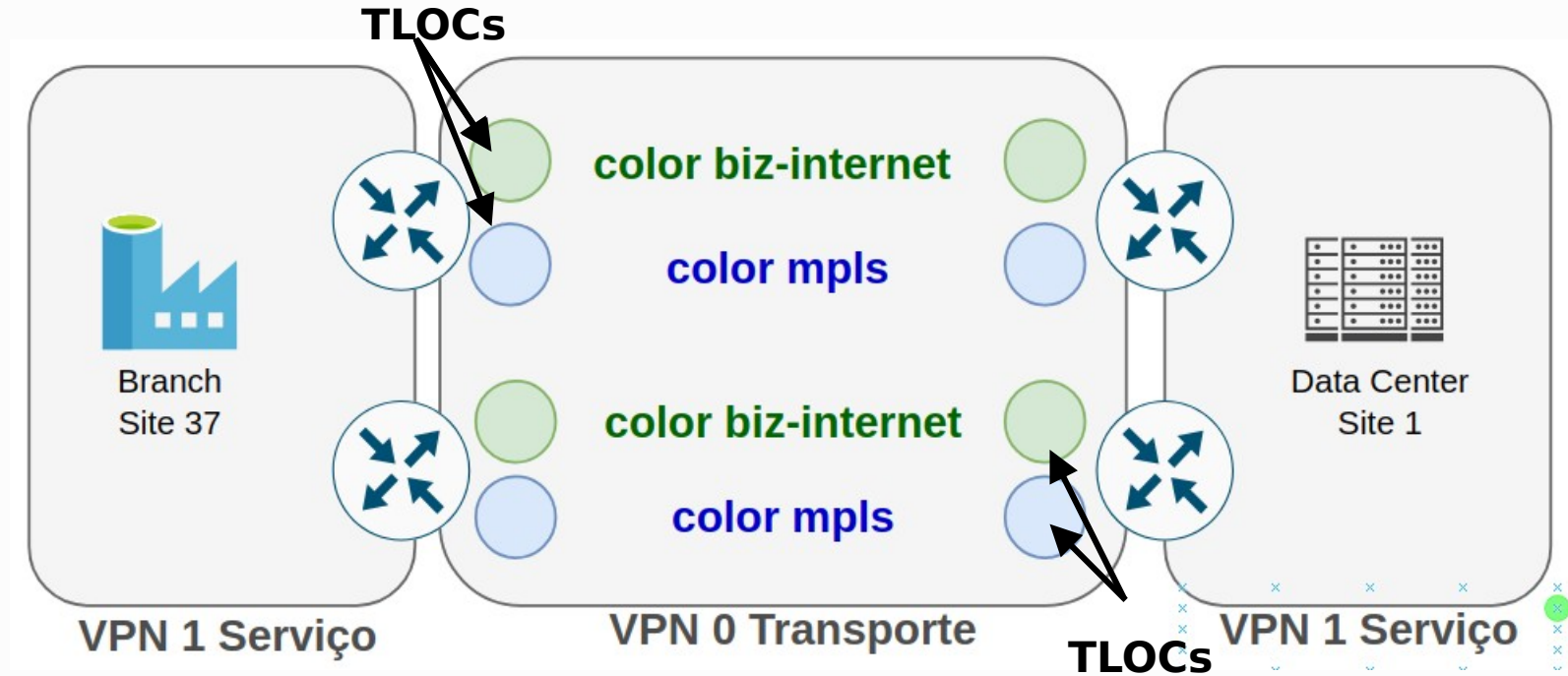
Marcação pacotes: VPN ~ VRF



*roteamento entre
serviço e transporte*

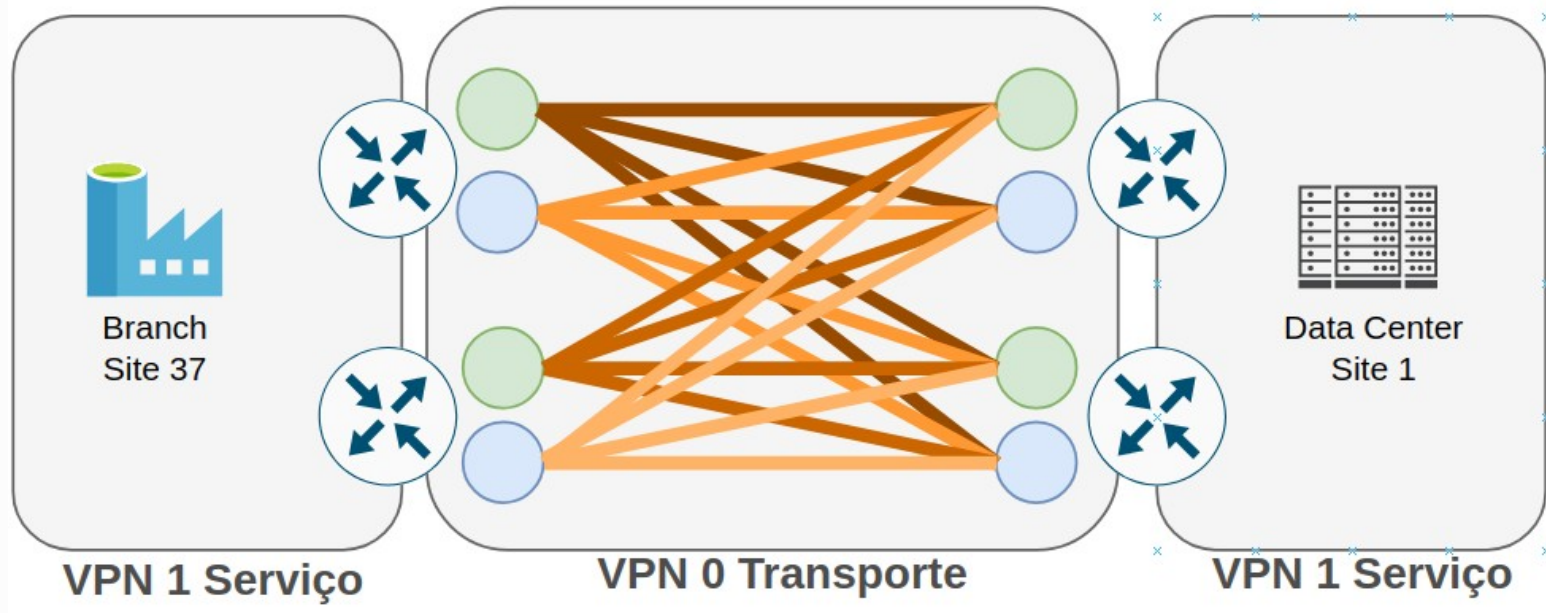
Obs: VPN 512 - oob-mgmt.

Transport Locators + Colors



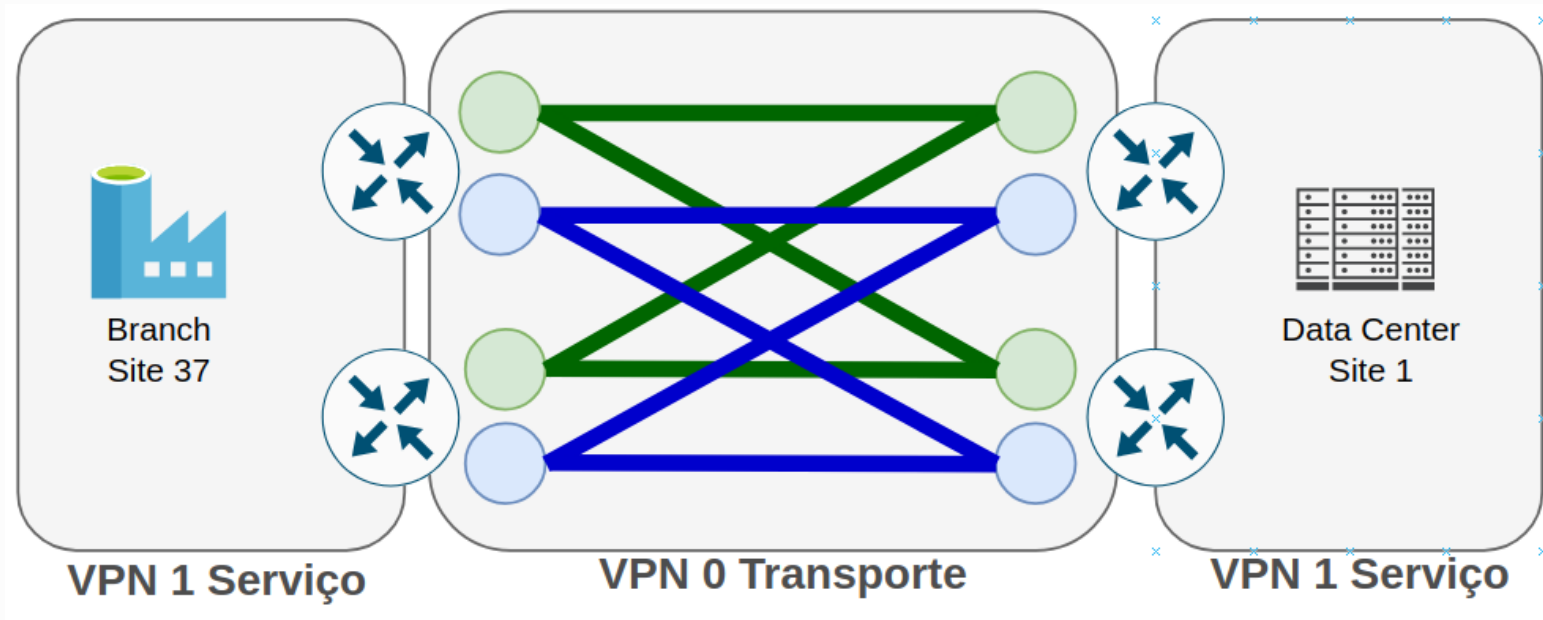
Obs1: TLOC (IP,Color,Encap). Obs2: public color (+NAT).

Estabelecendo Túneis!



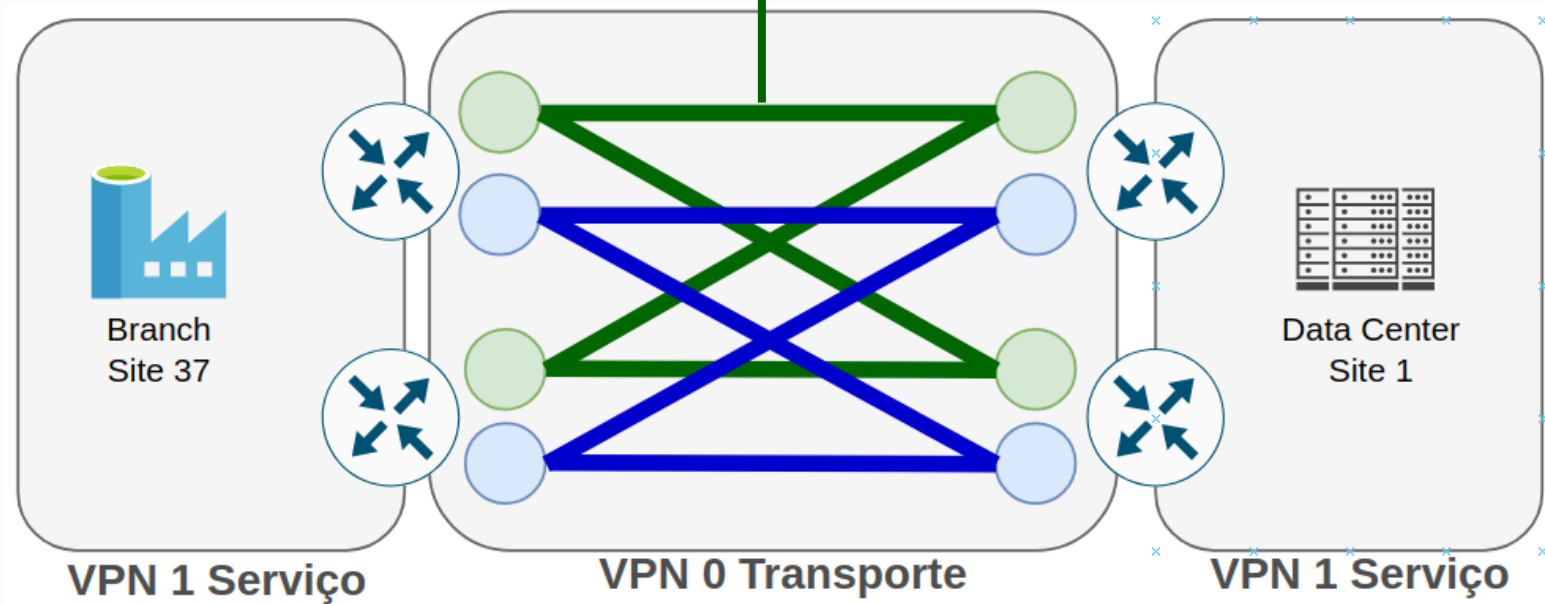
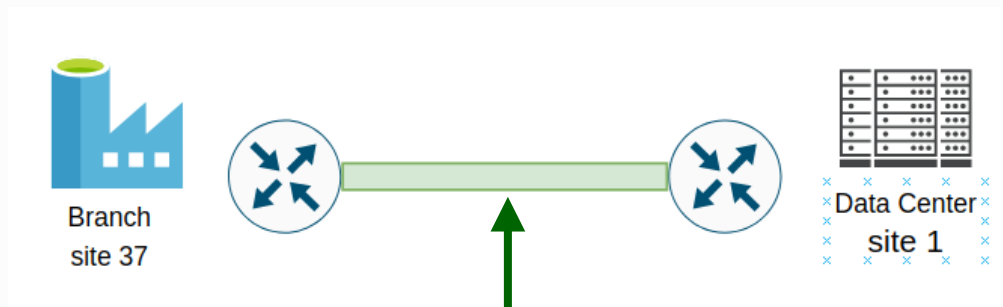
Obs1: cada TLOC permite um Túnel end-point. Obs2: GRE ou IPSec.

Túneis + Color Restrict

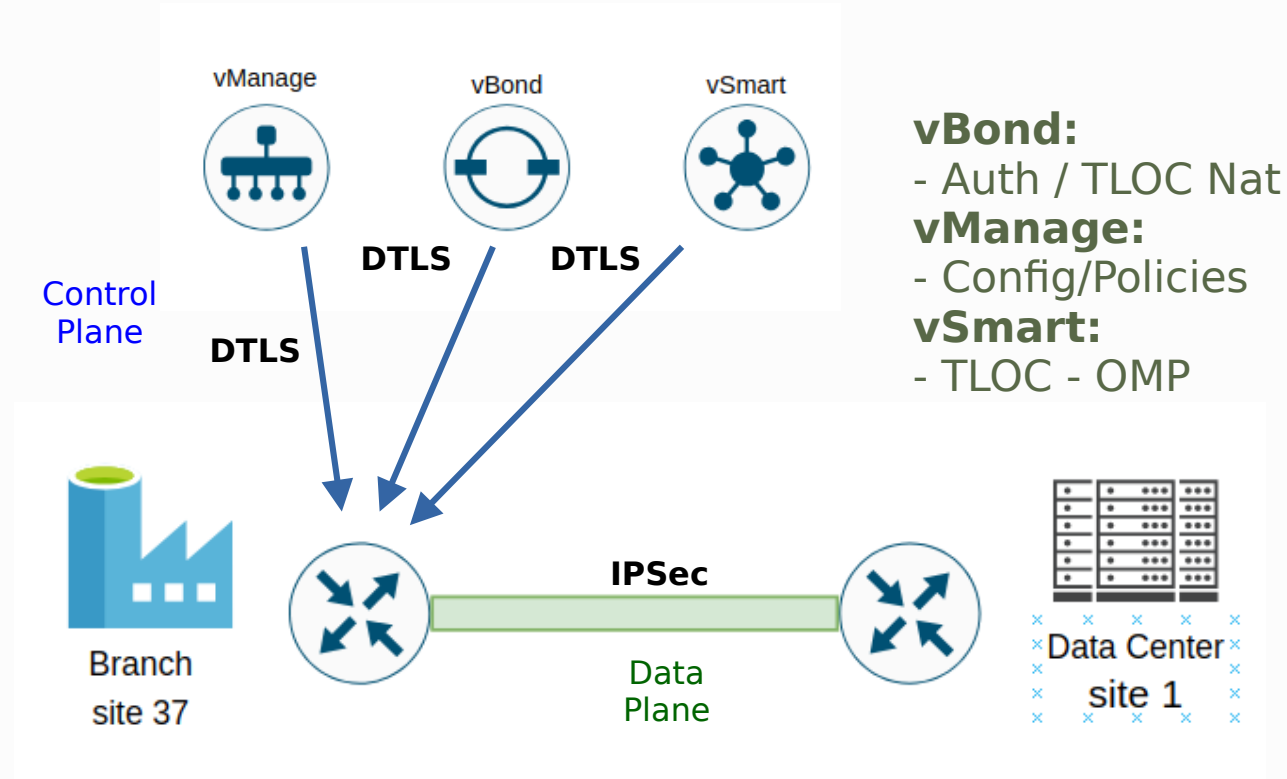


Segmentação dos túneis, usar color restrict ou tunnels group.

Detalhando ...



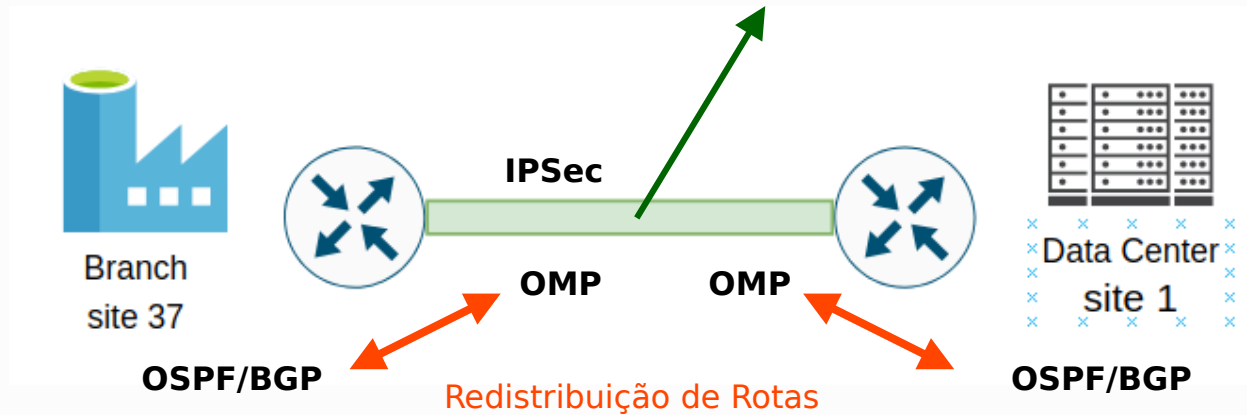
Detalhamento



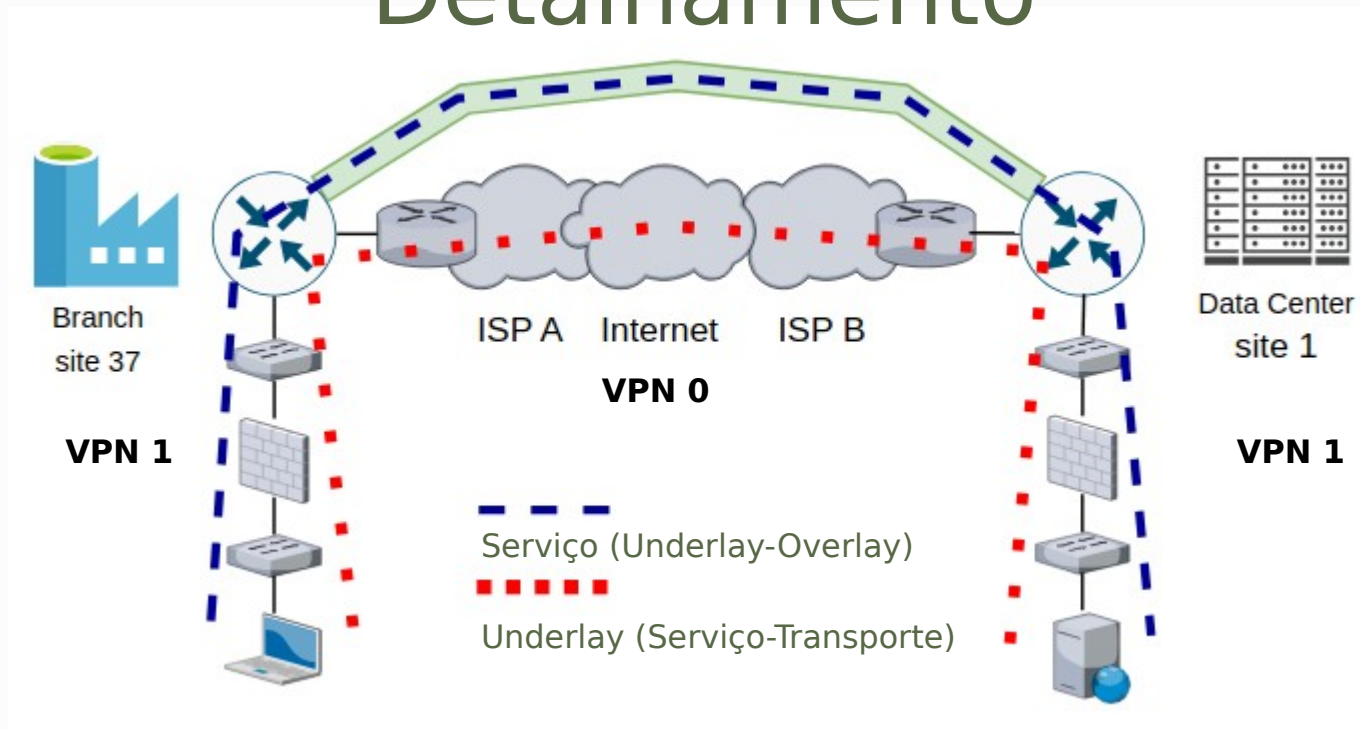
Detalhamento

IPSec:

- Túnel Seguro
- Marcação VPN
- BFD

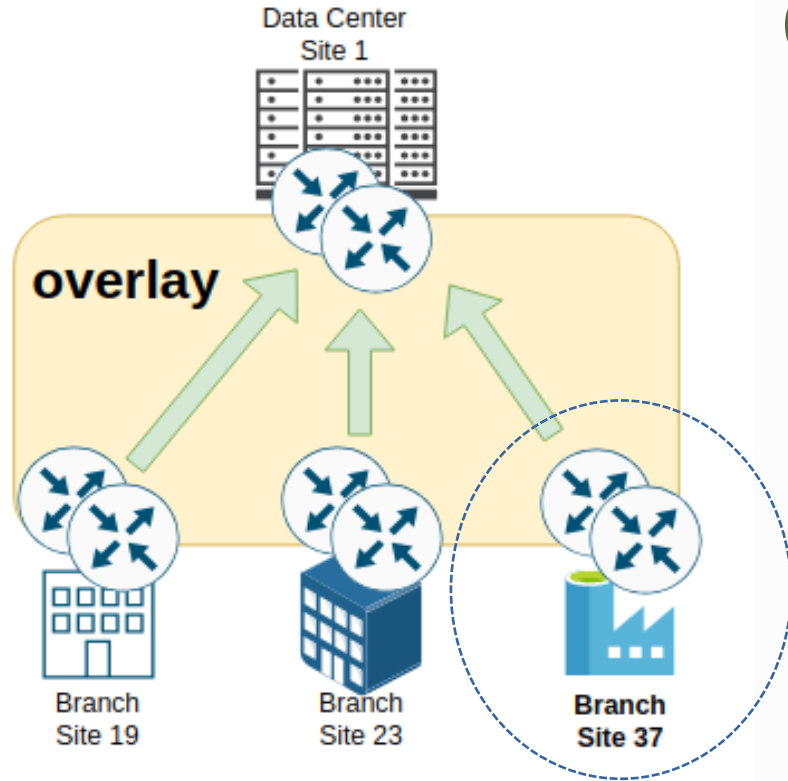


Detalhamento



Obs: Rede Overlay somente VPN 1 (serviço).

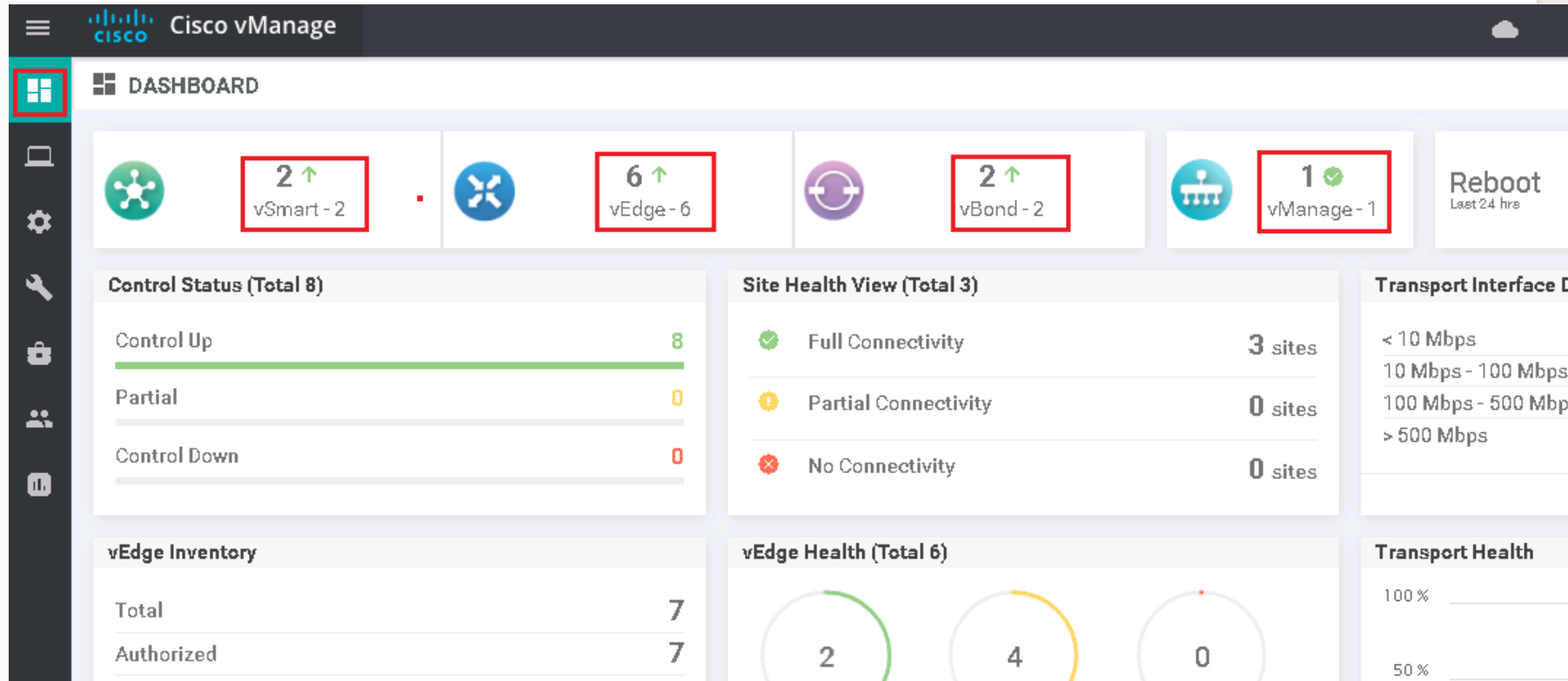
O Básico está Ok!



Topologias Overlay:

- Hub-n-Spoke
- Full Mesh (default)
- Partial Mesh

Exemplo: vManage Dashboard



Exemplo: vManage Dashboard

DASHBOARD

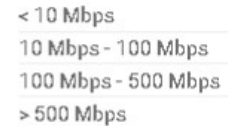
Control Status (Total 8)



Site Health View (Total 3)



Transport Interface Distribution

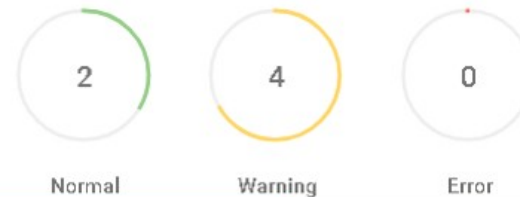


[View Percent Utilization](#)

vEdge Inventory



vEdge Health (Total 6)



Transport Health



Top Applications



Application-Aware Routing

| | Tunnel Endpoints | Avg. Latency (ms) | Avg. Loss (%) | Avg. Jitter (ms) |
|---|---|-------------------|---------------|------------------|
| ↗ | DC1-VEDGE1:biz-internet-BR1-VEDGE2:biz-i... | 1.114 | 3.634 | 0.185 |
| ↗ | BR1-VEDGE1:biz-internet-DC2-VEDGE2:biz-i... | 1.065 | 1.497 | 0.141 |
| ↗ | BR1-VEDGE1:biz-internet-DC2-VEDGE1:biz-i... | 1.046 | 1.459 | 0.118 |



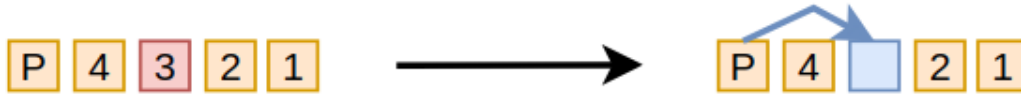
05

Avançando com SD-WAN!

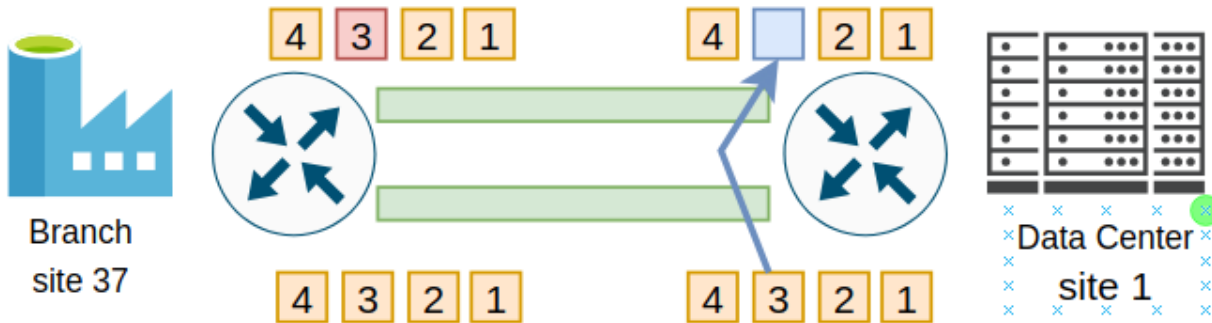
Vamos nos aprofundar um pouco mais.
Customizando a SD-WAN.

Qualidade do Serviço / Circuitos

FEC



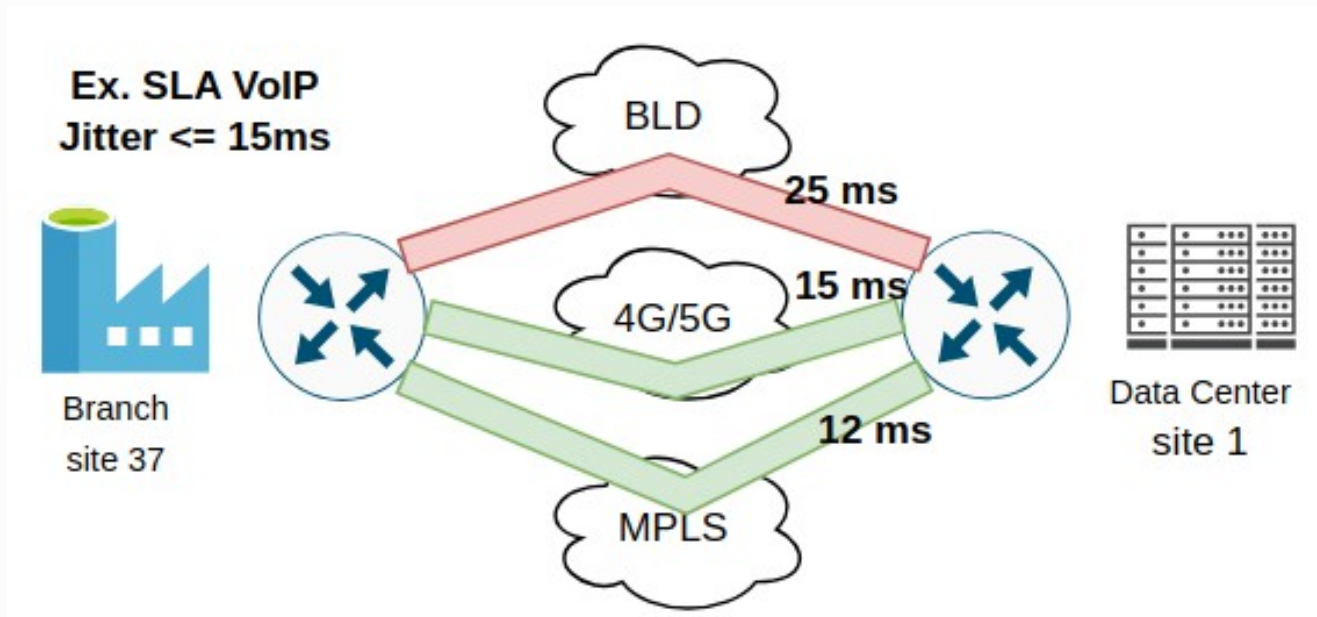
Packet Dup



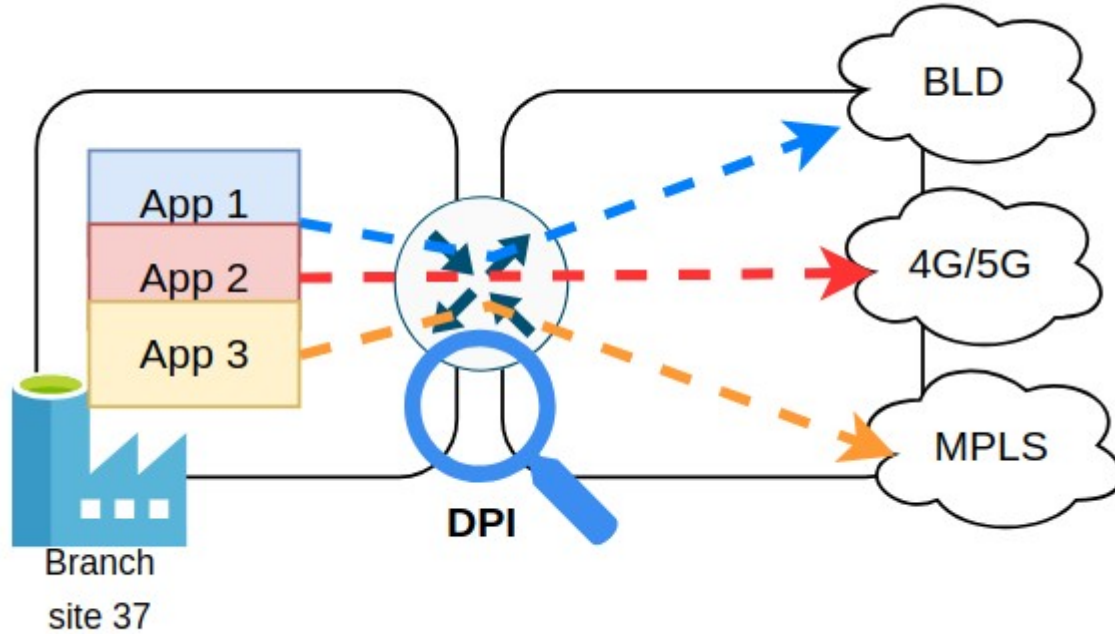
WAN

- + BFD
- + PMTU discovery
- + DSCP
- + TCP SACK

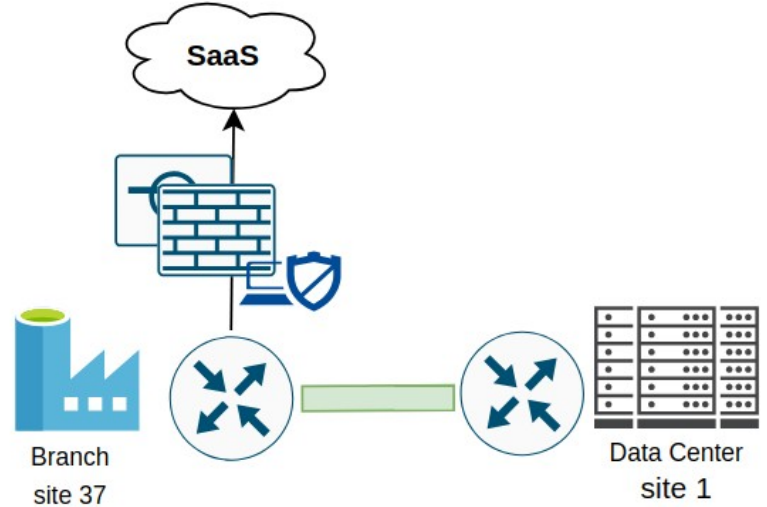
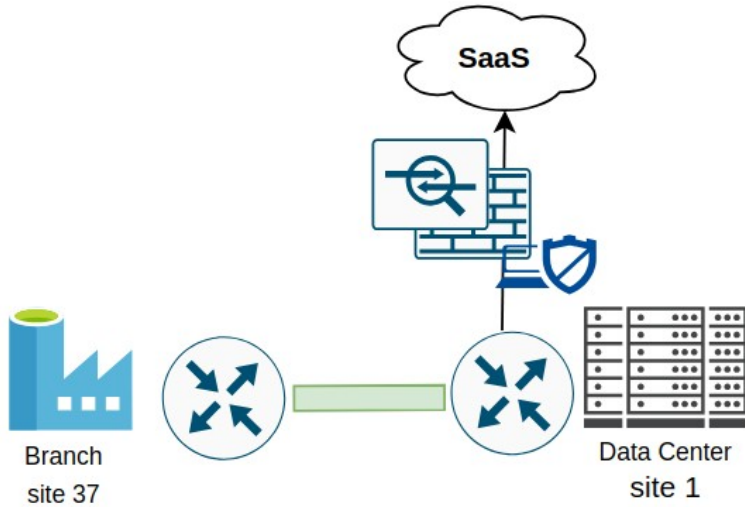
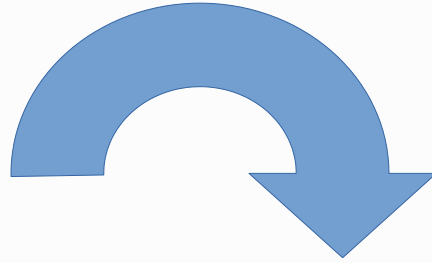
Application Aware Routing



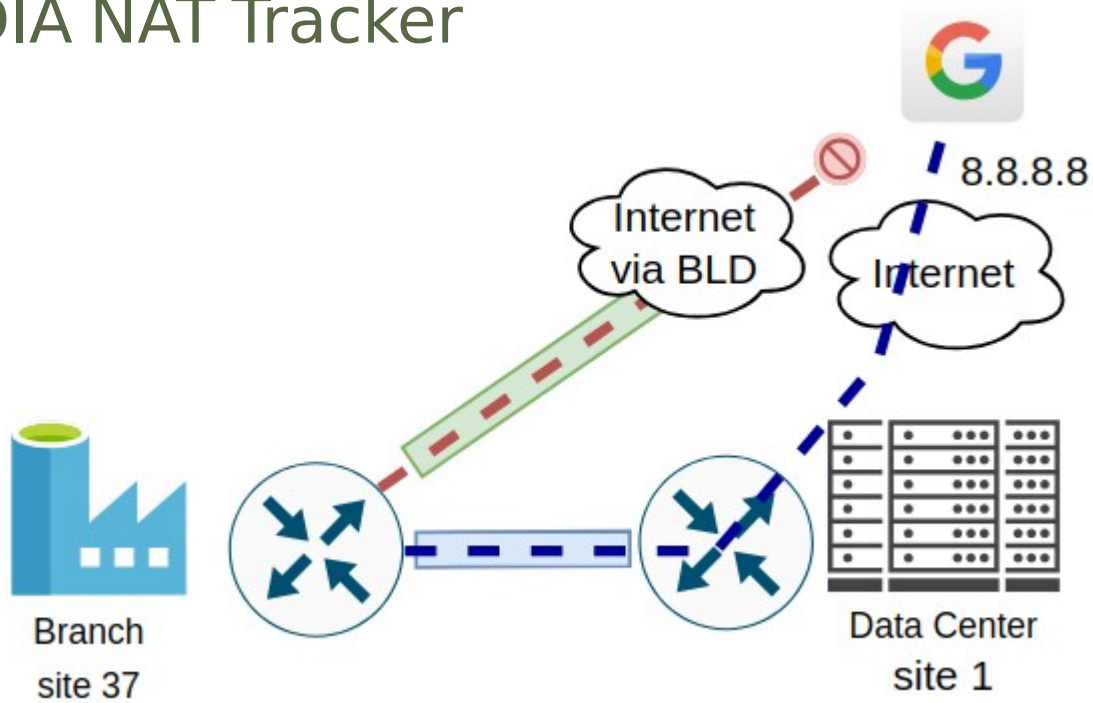
SD Application Visibility and Control



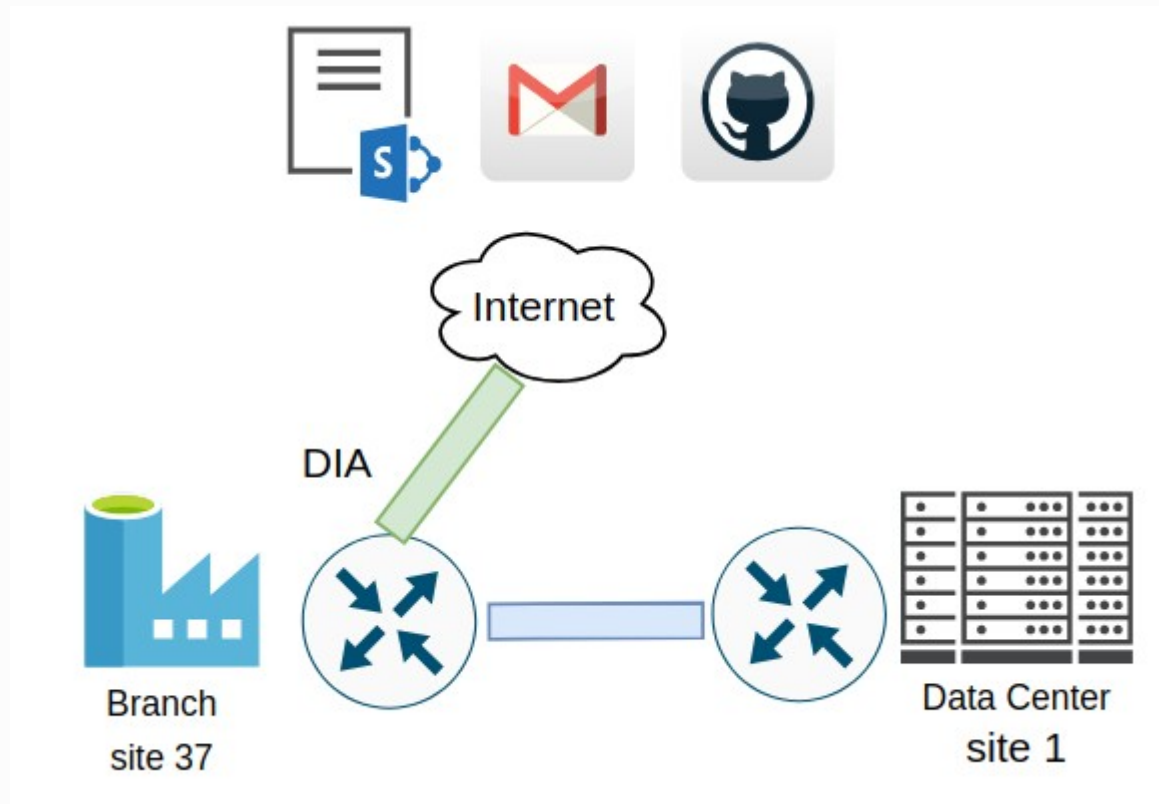
Direct Internet Access



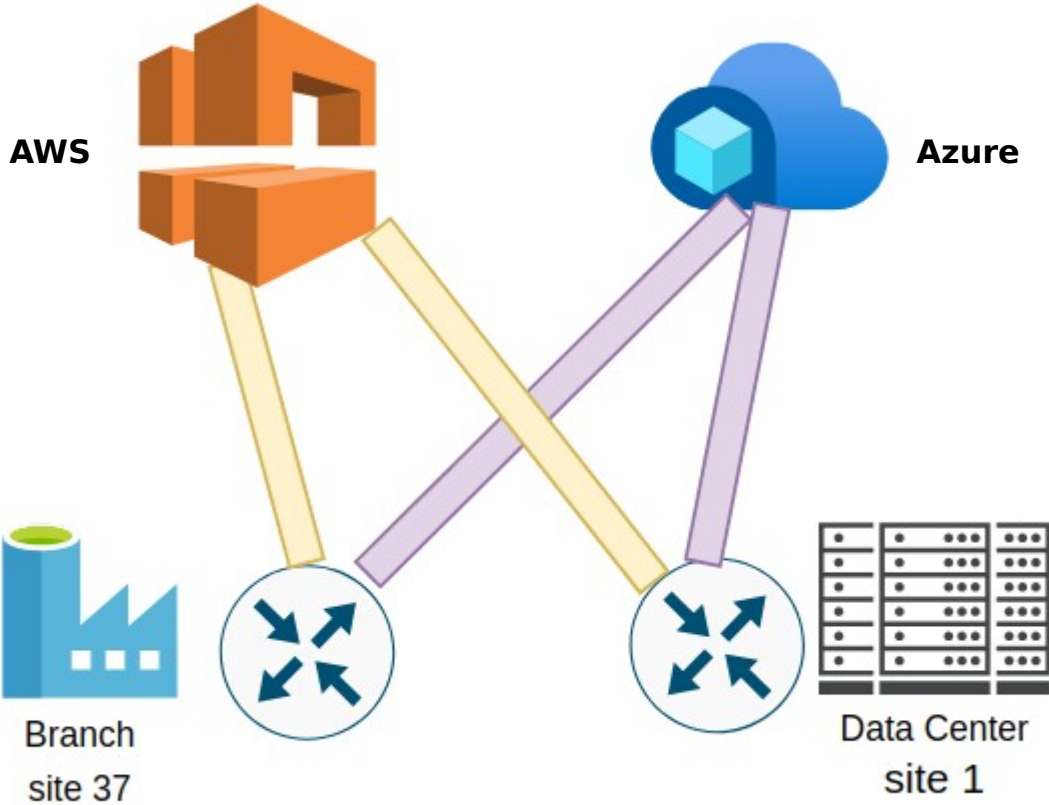
DIA NAT Tracker



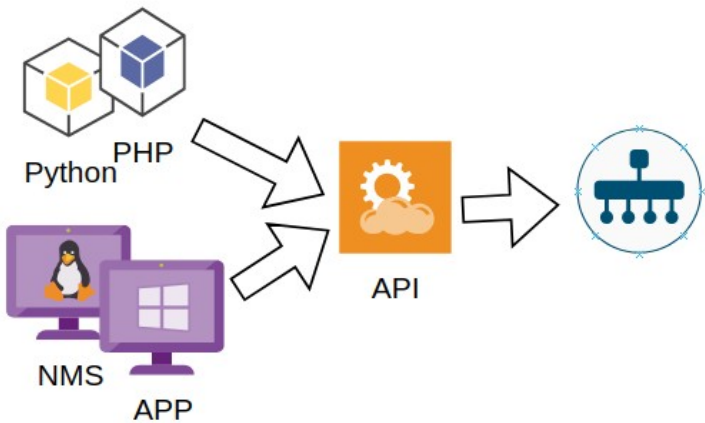
Cloud onRamp for SaaS




Cloud onRamp for IaaS



RESTFuI APIs



 api_key

Capacity Show/Hide | List

- GET** /capacity

Utility - Logging Show/Hide | List

- POST** /util/logging/level
- POST** /util/logging/debuglog
- GET** /util/logging/loggers

Alarms - Notifications Show/Hide | List

- GET** /notifications/rules Specific
- DELETE** /notifications/rules
- POST** /notifications/rule
- PUT** /notifications/rule

Diagnostics Show/Hide | List

- GET** /diagnostics/dbschema

06

Considerações!

Prós/Contras

Perguntas?

Obrigado :)

hermanopereira@gmail.com



Referências:

<https://onlinelibrary.wiley.com/doi/epdf/10.1002/sec.1737>

<https://www.cisco.com/c/en/us/td/docs/solutions/CVD/SDWAN/cisco-sdwan-design-guide.html>

<https://www.networkacademy.io/ccie-enterprise/sdwan>

<https://www.dclessons.com/sd-wan-dashboard-basic-walk-through>

<https://www.computerworld.com.pt/2021/11/22/cisco-fortinet-hpe-aruba-e-vmware-lideram-o-crescente-mercado-sd-wan/>

<https://newsroom.cisco.com/c/r/newsroom/en/us/a/y2017/m08/cisco-completes-acquisition-of-viptela.html>

<https://blog.telegeography.com/unpacking-sd-wan-prices>

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