

Mastering Network Operations

The Power of Abstraction



AI generated - freepik.com



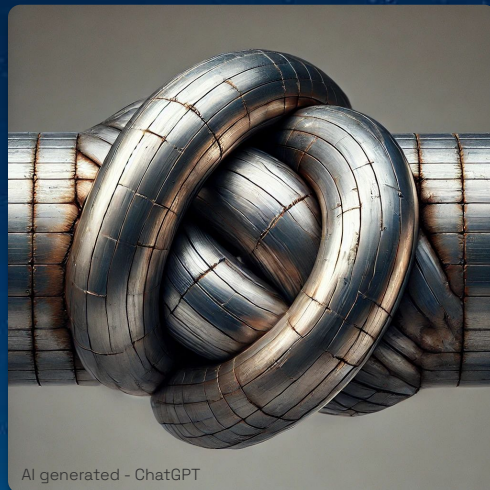
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Problems to solve

Playing with too many details daily

```
!  
interface GigabitEthernet0/0/0/1  
description acme-bb-rtr3 / GigabitEthernet0/0/0/1  
mtu 9000  
ipv4 mtu 1514  
ipv4 address 10.0.240.2 255.255.255.254  
load-interval 30  
!  
interface GigabitEthernet0/0/0/10  
description Acme-site-1 / site1-dsw1 / GigabitEthernet0/0/0/  
load-interval 30  
!  
interface GigabitEthernet0/0/0/10.1101  
description acme-site-1 / ACME-VN-1  
vrf ACME-VN-1  
ipv4 address 10.2.1.1 255.255.255.254  
load-interval 30  
encapsulation dot1q 1101  
ipv4 access-group ACME-VN-1-ACME-SITE-1-ALLOWED ingress  
!  
prefix-set ACME-VRF-ROUTES-IN  
end-set  
!  
prefix-set ACME-VN-1-ACME-SITE-1-PREFIX-SET  
10.2.1.0/31,  
10.2.1.2/31,  
10.2.2.0/31  
end-set  
!
```

Complex Config Pipeline



AI generated - ChatGPT

How to Scale?

IN: Abstractions

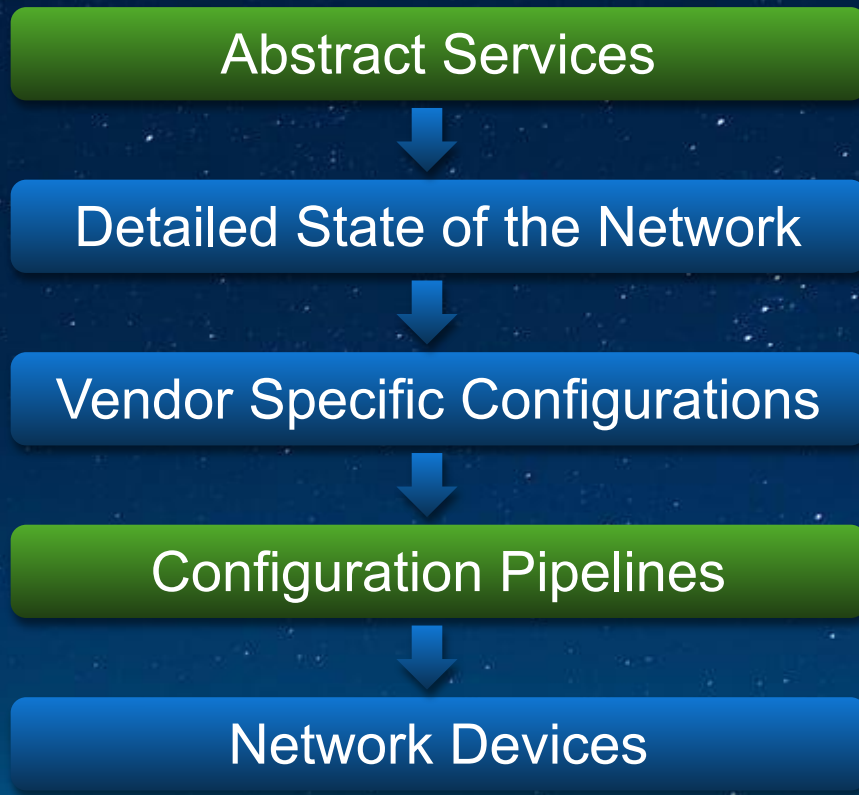


netbox

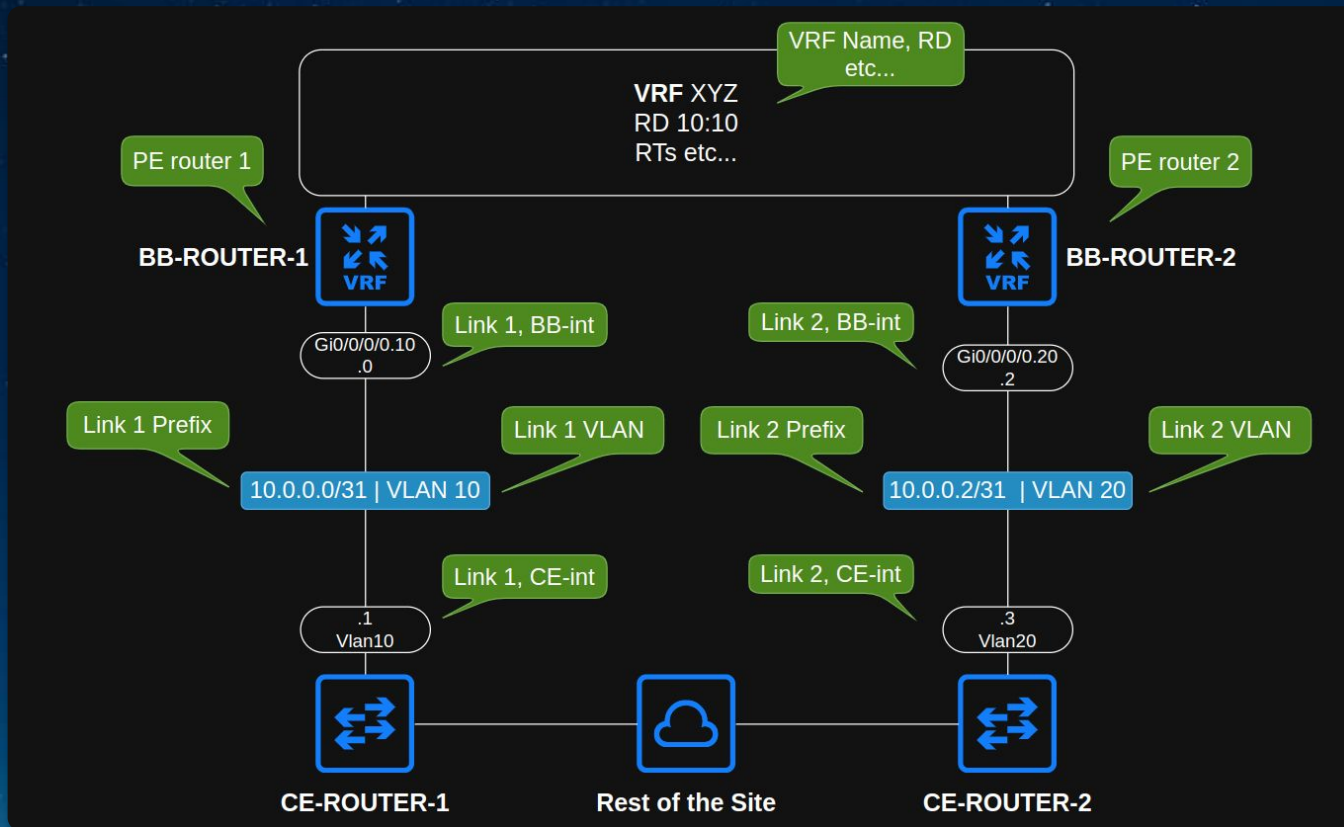
OUT: Straight pipe



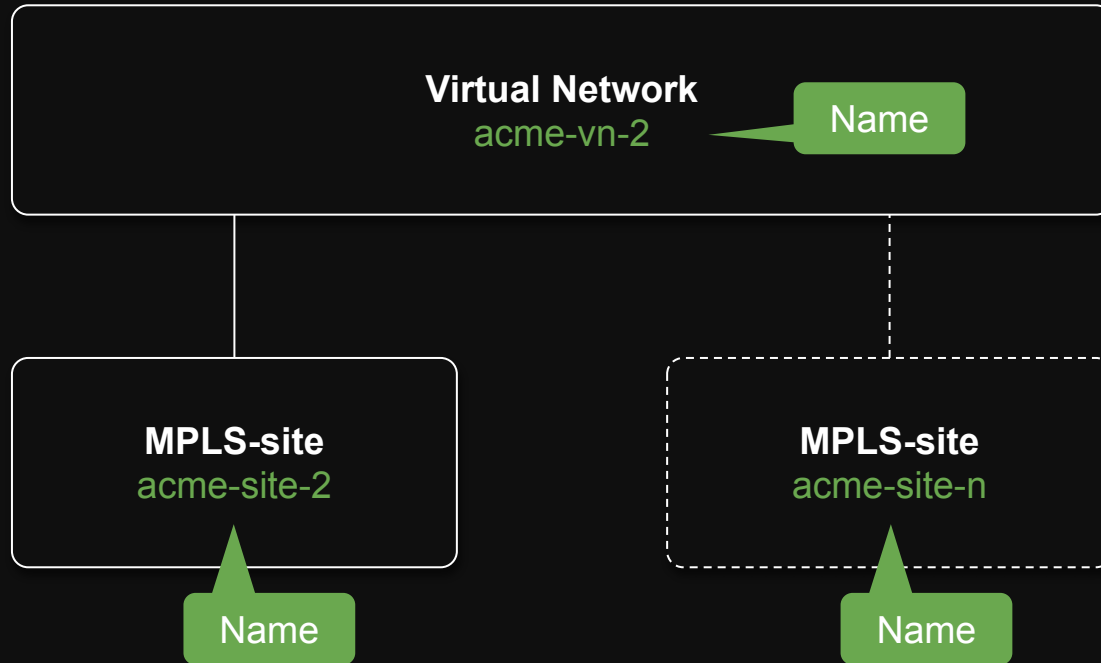
Our Automation Stack



Virtual Network - Detailed model



Virtual Network - Abstract model



Add a new virtual network

 Help

Create

Virtual network

Name* acme-vn-2

Template* ACME Virtual Networks

☒ Enable multicast

MPLS sites acme-site-2 | x

MPLS sites connected to this virtual network

Firewall connection

Primary firewall site -----

Cancel

Create

Create & Add Another



acme-vn-2

Created 2025-03-29 08:36 · Updated 2025-03-29 08:36

[Bookmark](#) [Edit](#) [Delete](#)

Virtual Network

Virtual network	
Name	acme-vn-2
Template	ACME Virtual Networks
Use multicast	✓
MPLS sites	acme-site-2
ASN	AS65012
VRF	acme-vn-2
SNMP access list name	SNMP-ACL
Object group name suffix	-NETS
Custom data	
No custom data	{}
Firewall connections	
No connections	

MPLS connections	
Site	acme-site-2
VLANs	acme-site-2 / acme-vn-2 (1101)
...	acme-site-2 / acme-vn-2 (1201)
...	acme-site-2 / acme-vn-2 (1301)
Prefixes	10.2.1.16/31
...	10.2.1.18/31
...	10.2.2.16/31
Loopback interfaces	acme-bb-rtr3 / Loopback65012
...	acme-bb-rtr4 / Loopback65012
VLAN interfaces	site2-dsw11 / Vlan1101
...	site2-dsw11 / Vlan1301
...	site2-dsw12 / Vlan1201
...	site2-dsw12 / Vlan1301
Subinterfaces	acme-bb-rtr3 / GigabitEthernet0/0/0/10.1101
...	acme-bb-rtr4 / GigabitEthernet0/0/0/10.1201

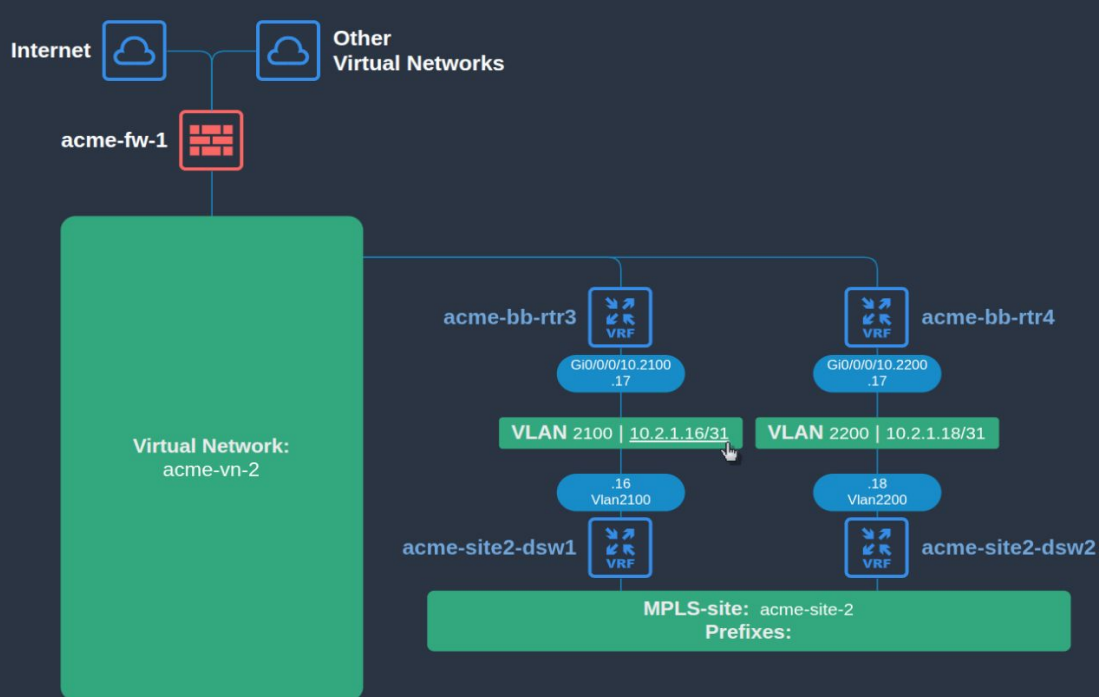


Virtual Network

Ninja

Changelog

NAME	OUTPUT TYPE	FULL SCREEN
Virtual Network L3 Diagram	drawio	Open
RENDERED		



Ninja Plugin
for Netbox



ACME Backbone

Created 2025-03-17 10:30 · Updated 2025-03-17 16:34

Manage configurations

Bookmark

Edit

Delete

Config Control

DEVICE	LINES ADDED	LINES REMOVED	LAST UPDATED	LAST FETCHED	
acme-bb-rtr1	0	0	2025-03-29 08:40:19	2025-03-29 08:40:19	 
acme-bb-rtr3	224	1	2025-03-29 08:40:19	2025-03-29 08:40:19	 
acme-bb-rtr2	0	0	2025-03-29 08:40:19	2025-03-29 08:40:19	 
acme-bb-rtr4	224	1	2025-03-29 08:40:19	2025-03-29 08:40:19	 
Showing 1-4 of 4					Per Page 

acme-bb-rtr3

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[Refresh Configuration](#)[Bookmark](#)[Clone](#)[Edit](#)[Delete](#)[Device](#)[Interfaces](#) 8[Config Context](#)[Render Config](#)[Diff](#)[Contacts](#)[Journal](#)[Changelog](#)

Last updated 0 minutes ago

[Show changes only](#)[Show config](#)

@@ -48,6 +48,14 @@

address:

address: 192.168.255.3

netmask: 255.255.255.255

+ - Cisco-IOS-XR-um-if-vrf-cfg:vrf: acme-vn-2

+ description: acme-vn-2

+ interface-name: Loopback65012

+ ipv4:

+ Cisco-IOS-XR-um-if-ip-address-cfg:addresses:

+ address:

+ address: 172.16.0.3

+ netmask: 255.255.255.255

- Cisco-IOS-XR-um-statistics-cfg:load-interval: 30

description: No description

interface-name: MgmtEth0/RP0/CPU0/0

@@ -82,6 +90,22 @@

- Cisco-IOS-XR-um-statistics-cfg:load-interval: 30

description: Acme-site-1 / site2-dsw11 / GigabitEthernet0/0/0/10

interface-name: GigabitEthernet0/0/0/10

+ - Cisco-IOS-XR-um-if-vrf-cfg:vrf: acme-vn-2

ACME Backbone

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[Manage configurations](#) ▾[Bookmark](#)[Edit](#)[Delete](#)

Config Control

DEVICE	LINES ADDED	LINES REMOVED	LAST UPDATED	LAST FETCHED	
acme-bb-rtr1	0	0	2025-03-29 08:40:19	2025-03-29 08:40:19	Edit ▾
acme-bb-rtr3	224	1			Edit ▾
acme-bb-rtr2	0	0			Edit ▾
acme-bb-rtr4	224	1			Edit ▾
Showing 1-4 of 4					
					Per Page ▾

Confirm configuration push

Are you sure you want to push configurations to routers controlled via **ACME Backbone**?

[Cancel](#)[Push](#)

Design Process

Split

Split service into suitable **parts**.

Decide how parts relate to each other.

Top to Bottom

Model

Design data model for each part:

Fields, their **types** and **references** to other data models.

Logic for create, edit and delete.

Bottom to Top

Implement & Test

Implement as Netbox Plugin. This is **Python** code.

Write tests to validate and make it easy to handle Netbox updates.

Deploy

Deploy into production. Take care of possible data migrations.

Lessons learned

1

Get rid of arbitrary rules

2

Follow declarative model

3

Make models Generic

Thank you for your time



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