

The background features a large, stylized graphic composed of four overlapping diagonal bands of color: light blue, medium blue, dark blue, and navy blue. These bands create a sense of depth and motion across the slide.

# APNIC

# Network Monitoring and Management Module : Network Documentation



# Objectives

**Participants will have a clear understanding of the followings:**

- a) What is Source of Truth?
- b) What does Network Documentation (ND) mean ?
- c) How a ND can be fruitful in any Operational process ?
- d) How an IP address management (IPAM) system works ?
- e) Inventory Management (IM) workflow!
- f) Features of NetBox
- g) Netbox Application architecture
- h) Workflow of Netbox



# What is Source of Truth?

*“The **Source of Truth** can be defined as a conceptual practice that help an organization to control and manage the necessary data and assets from a specific place in an efficient way.*

*Some people would like to call it **System of Record**. ”*

## Let's have an example

A scenario of an enterprise company, where –

- It has several branch offices.
- Assets information is kept by the IT team; for non-IT domain assets as well.
- Non-IT domain information is required by different teams.
  - Like - quantity of online UPS, and its connectivity.
  - Concerned team is Power-Team; but required by NOC, IT and Procurement as well.



# What is Source of Truth?

## Questions to think about?

- Should they store information separately?
  - *assuming procurement and power team maintain it individually.*
- Or manage it from a single place?
  - *more of a library, where books are arranged categorically based on the genre!*

## Focal Point!

- This is where **Single Source of Truth** takes place, which ensures:
  - Reuse of content or data
  - Eliminate information duplicity

“The **Single Source of Truth** is the authorized component of *Network Documentation* service where necessary information is categorized and managed to help automate network infrastructure.”

# Network Documentation in Operational Process



Traditional Approach	SoT for Automation
Hosts/devices are configured in each NoC tools separately. – probability of missing a device to configure.	Host/device related information are coming only from SoT. – You get to know the missing point.
Data being imported from one tool to another depending information availability.	All tools are being populated from SoT by push/pull method.
<b>Example</b> CPU utilization and NIC bandwidth of a router are monitored by two monitoring systems. e.g - LibreNMS and Nagios.	<b>Example</b> With SoT, it can be defined based on the policy that Nagios will monitor the <i>uptime</i> , and LibreNMS will monitoring utilization of CPU and Interface.

\* SoT – Source of Truth  
\* CPU - Central Processing Unit  
\* NIC - Network Interface Card

# Network Documentation in Operational Process



Benefits of maintaining Network Documentation!

- Can have a clear understanding, how the network is being operated!
- Get to know, how the data center is being managed!
- One can have a historical overview of what has been done a few months ago.
- In case of any senior or teammate's absence, other team members can troubleshoot the issue as required.

# Network Documentation in Operational Process



A multinational company wants to deploy a media service for its employee.

- IT admin has placed a requisition to purchase 2 server hardware, 1 NAS (*Network-attached storage*).
- The **IT Manager** got the request and followed a predefined **checklist** to validate.

## Checklist?

Adequate rack space to host new server hardware.

Free socket ports of power strip.

Network cable capacity specifications. like - 1.00 GbE or 10.00 GbE?

Network cable types. Like - ethernet or fiber optics?

Availability of IP address.

Power consumption availability from online UPS.

Length of network cable.

**“What could happen, to evaluate the requisition paper, if there is no Network Documentation in place?”**



# Network Documentation Policy

A documentation policy has to be defined –

- What are the responsibilities of each team and teammates? *Who will take care of which part?*
- Does the network topology diagram have up-to-date details? *Like a server's connectivity as a whole.*
- Process to check task integrity! *Did the network admin followed every step to upgrade a router OS?*
- What should be the methodology for the naming pattern, to identify devices, cables, connectivity, etc?



# Network Documentation Policy

Everything should be labeled in a comprehensive manner.

- Devices – servers, routers, switches, servers, KVM, power strips, etc.
- Cabling of power cord and network connectivity.
- Racks; which data center or region it belongs.



# Network Documentation Policy

Labeling format	Device Naming Format
<p><b>Device Tag:</b> <b>Format:</b> Rack_Number/Device_Number <b>Example:</b> R-06/SRV05</p>	<ul style="list-style-type: none"><li>• Router -&gt; RTR</li><li>• Switch -&gt; SWC</li><li>• Server -&gt; SRV</li><li>• Appliance -&gt; APL</li><li>• Modem -&gt; MDM</li><li>• SAN Storage -&gt; SAN</li><li>• NAS Storage -&gt; NAS</li><li>• WL Access Point -&gt; AP</li><li>• Temperature Meter -&gt; TMP</li><li>• KVM -&gt; KVM</li><li>• Cable Manager -&gt; CM</li><li>• IP Phone -&gt; IPP</li></ul>
<p><b>Cable Tag :</b> <b>Format:</b> Source_Device_ID/Destination_Device_ID-Port_Number/Name <b>Example:</b> R-01/RTR02/R-13/SWC03-1/1/1</p>	

# NetBox – The Network Documentation Application



## What is NetBox?

- NetBox is an Open-Source Network Documentation application.
- Written in python with Django web-framework
- Provide integration with API, webhooks, plugins, custom python scripts, etc.
- Developed by **Jeremy Stretch** of *Digital Ocean* at late 2015.
- Serve at Django web framework with PostgreSQL.

# NetBox – The Network Documentation Application



## Features of NetBox

- **IP address management (IPAM)** - IP networks and addresses, AS numbers, VLANs
- **Physical Infrastructure**
  - **Racks** – Arranged by specific sites
  - **Devices** - Types of devices and where they are installed
  - **Connections** – KVM console, network and power connections among devices.
- **Virtualization** – Specifications of virtual machines.

# NetBox – The Network Documentation Application



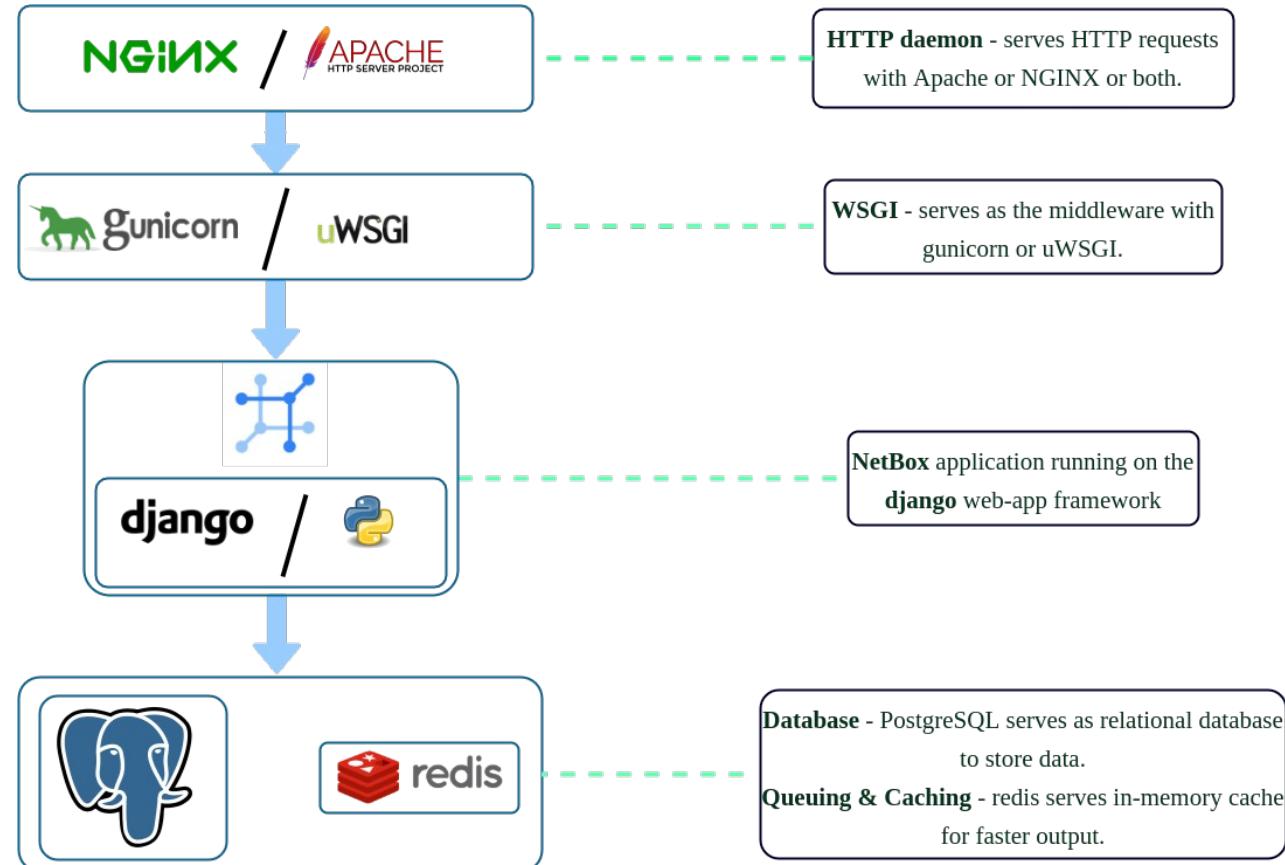
Few things that NetBox **doesn't do** –

- It does not do network monitoring.
- It doesn't have the mechanism to serve as a DNS server.
- Doesn't have AAA mechanism to support RADIUS server. (*AAA = Authentication, Authorization and Accounting*)
- Configuration management
- Facilities management

# NetBox – The Network Documentation Application



## Application Architecture



# NetBox – The Network Documentation Application



## Application Integration

- JSON format data is being transmitted through **REST API**.
- In response to an event, **Webhook** is used to send the HTTP request.
- Custom scripts are used with python from the **Netbox UI/API**.

# NetBox – The Network Documentation Application



## Application Integration – REST API

When a developer creates an API, they used to follow a set of rules, which is called REST. (*Representational State Transfer*), *The main advantage of REST API is its human friendly.*

*To work with the API, here are the standard **HTTP verbs** to know–*

- **GET:** Use to retrieve a list of objects or an object
- **POST:** Use to create an object
- **PUT / PATCH:** Use to modify an existing object.
- **DELETE:** Use to delete an existing object

# NetBox – The Network Documentation Application



## Application Integration – REST API

NetBox apnic

API Root / IPAM / IP Address

### IP Address

GET /api/ipam/ip-addresses/

GET /api/ipam/ip-addresses/1/

HTTP 200 OK

Allow: GET, POST, PUT, PATCH, DELETE, HEAD, OPTIONS

Content-Type: application/json

Vary: Accept

```
{ "count": 1, "next": null, "previous": null, "results": [ { "id": 1, "url": "http://192.168.68.108/api/ipam/ip-addresses/1/", "family": { "value": 4, "label": "IPv4" }, "address": "192.168.1.0/24", "vrf": null, "tenant": null, "status": { "value": "active", "label": "Active" } } ] }
```

# NetBox – The Network Documentation Application



## Application Integration – *Webhook*

- **Webhook** is used to send/respond to an external receiver regarding an event, and it is basically an HTTP request.
- Webhook can be configured for specific devices or object type.
- It can be limit to administrative options, like – create, delete, or modify.

### Example –

- A server admin has added a new application server to the **NetBox**.
- It will then generate an event and let the LibreNMS know when new hardware has been added to the system.

# NetBox – The Network Documentation Application



Organization	
Sites	
Geographic locations	
Tenants	
Customers or departments	

DCIM	
Racks	
Equipment racks, optionally organized by group	
Device Types	
Physical hardware models by manufacturer	
Devices	
Rack-mounted network equipment, servers, and other devices	
Connections	
Cables	
Interfaces	
Console	
Power	

IPAM	
VRFs	
Virtual routing and forwarding tables	
Aggregates	
Top-level IP allocations	
Prefixes	
IPv4 and IPv6 network assignments	
IP Addresses	
Individual IPv4 and IPv6 addresses	
VLANs	
Layer two domains, identified by VLAN ID	

Circuits	
Providers	
Organizations which provide circuit connectivity	
Circuits	
Communication links for Internet transit, peering, and other services	

Power	
Power Feeds	
Electrical circuits delivering power from panels	
Power Panels	
Electrical panels receiving utility power	

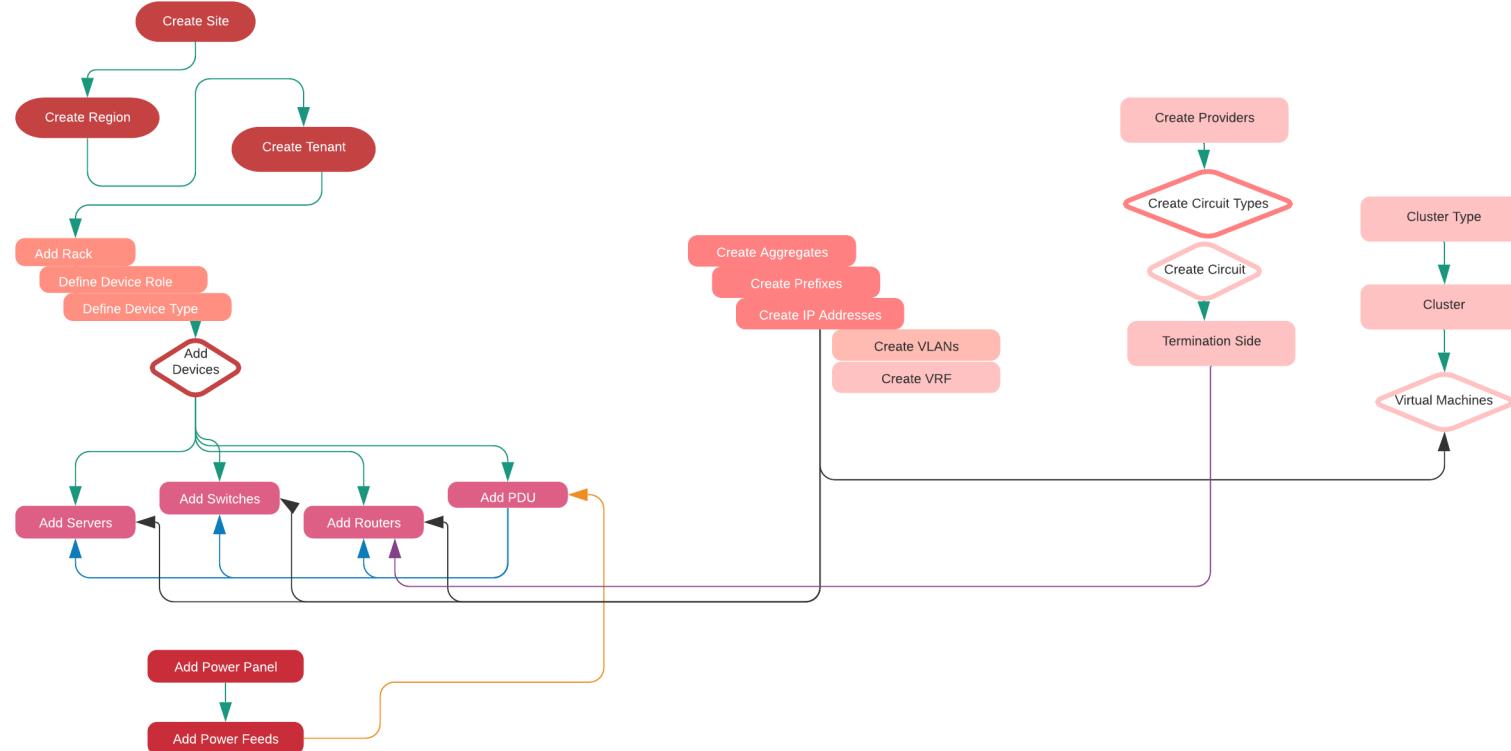
Virtualization	
Clusters	
Clusters of physical hosts in which VMs reside	
Virtual Machines	
Virtual compute instances running inside clusters	

## Major Modules of NetBox

# NetBox – The Network Documentation Application



## NetBox Workflow



# Thank You!

