

Automating Zabbix with Netbox and Ansible

About me



- Working @ AP Hogeschool
- Network and security expert
- Network automation enthusiast

 @jefvantongerloo

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

 github.com/jefvantongerloo/zabbix-automation-demo

Network automation

What, Why & How?

- Use of programmable logic and code to describe the network
 - Intent based networking
 - Predictable state

Network automation

What, Why & How?

- Use of programmable logic and code to describe the network
 - Intent based networking
 - Predictable state
- Automation of network processes and operations
 - Configuration management
 - Device discovery and provisioning
 - Operational tasks

Network automation

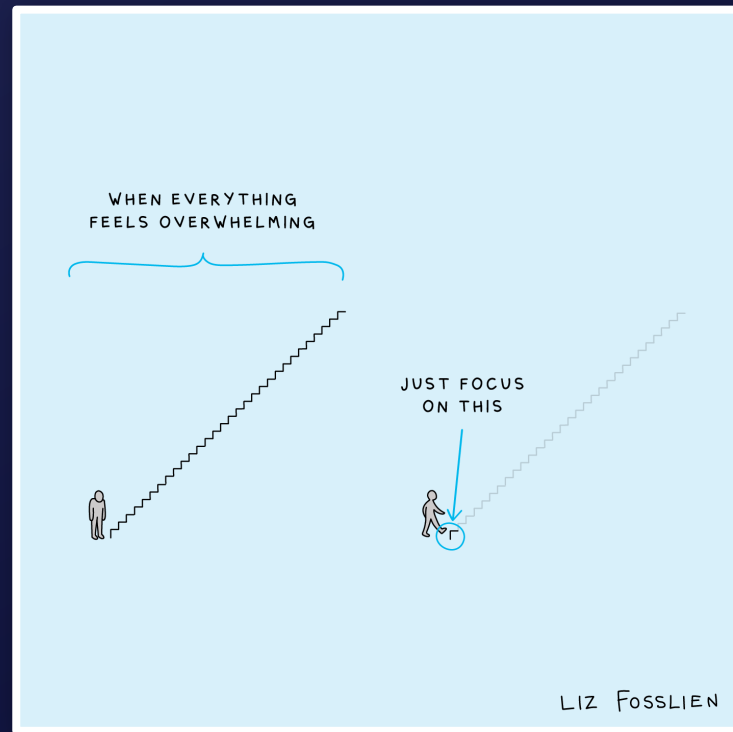
What, Why & How?

- Eliminates manual error prone tasks
- Improves efficiency
- Scales from cow to cattle
- Vendor independent

Network automation

What, Why & How?

- Think big, start small
- Start with read-only operations
- KISS – Keep it simple, stupid
- Complexity lies into the problem, not the solution

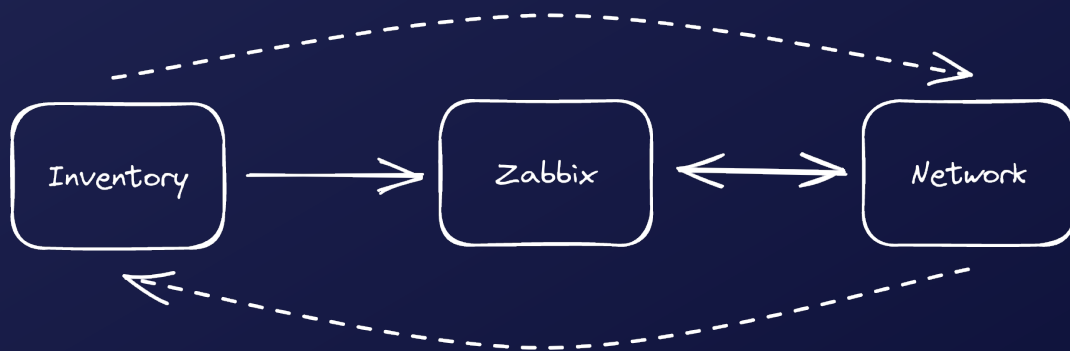


Liz Fosslien, <https://fosslien.com>

Case study

What do we want to achieve?

- An Automated flow for on-boarding, synchronizing and configuring network devices from our source of truth to Zabbix for enabling SNMP monitoring.
- A closed loop and hands-off approach, set and forget.



Case study

Automate all the things!

- Automated Zabbix host and interface creation
- Automated Zabbix templates and groups configuration
- Automated Network device SNMP configuration and validation
- Automated source of truth as inventory
- Automated callback to our inventory journal for logging

Case study

Open-source rules the world

- Infrastructure manager as source of truth
 - Network & device modeling
 - API integration
 - Device journal



Case study

Open-source rules the world

- Infrastructure manager as source of truth
 - Network & device modeling
 - API integration
 - Device journal
- Automating tasks and processes
 - Modular with Ansible collections
 - API interactions through libraries
 - Network CLI interaction capabilities
 - Configuration templating



Case study

Open-source rules the world

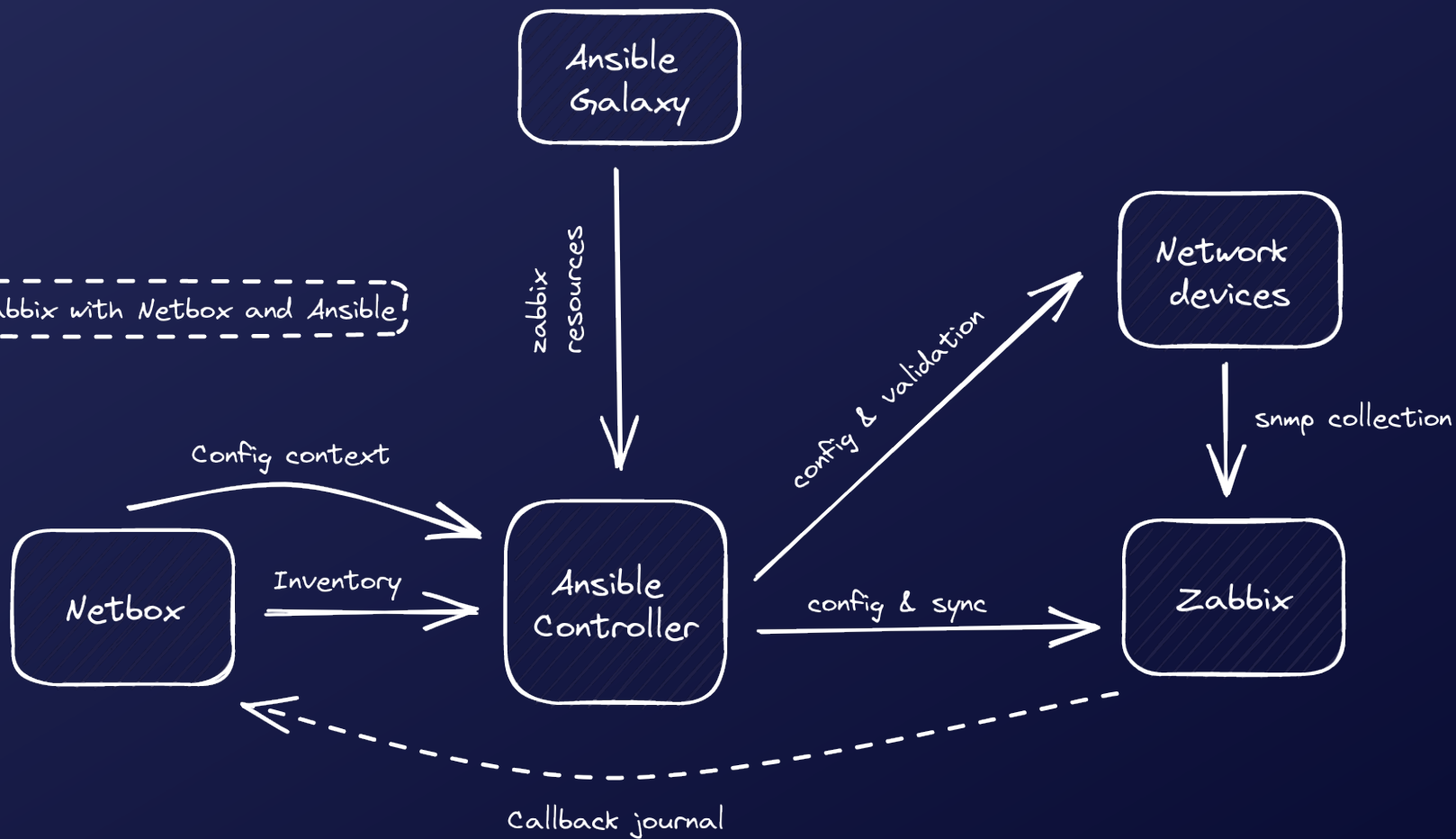
- Infrastructure manager as source of truth
 - Network & device modeling
 - API integration
 - Device journal
- Automating tasks and processes
 - Modular with Ansible collections
 - API interactions through libraries
 - Network CLI interaction capabilities
 - Configuration templating
- Monitoring solution
 - Community Ansible collection
 - API integration



Case study

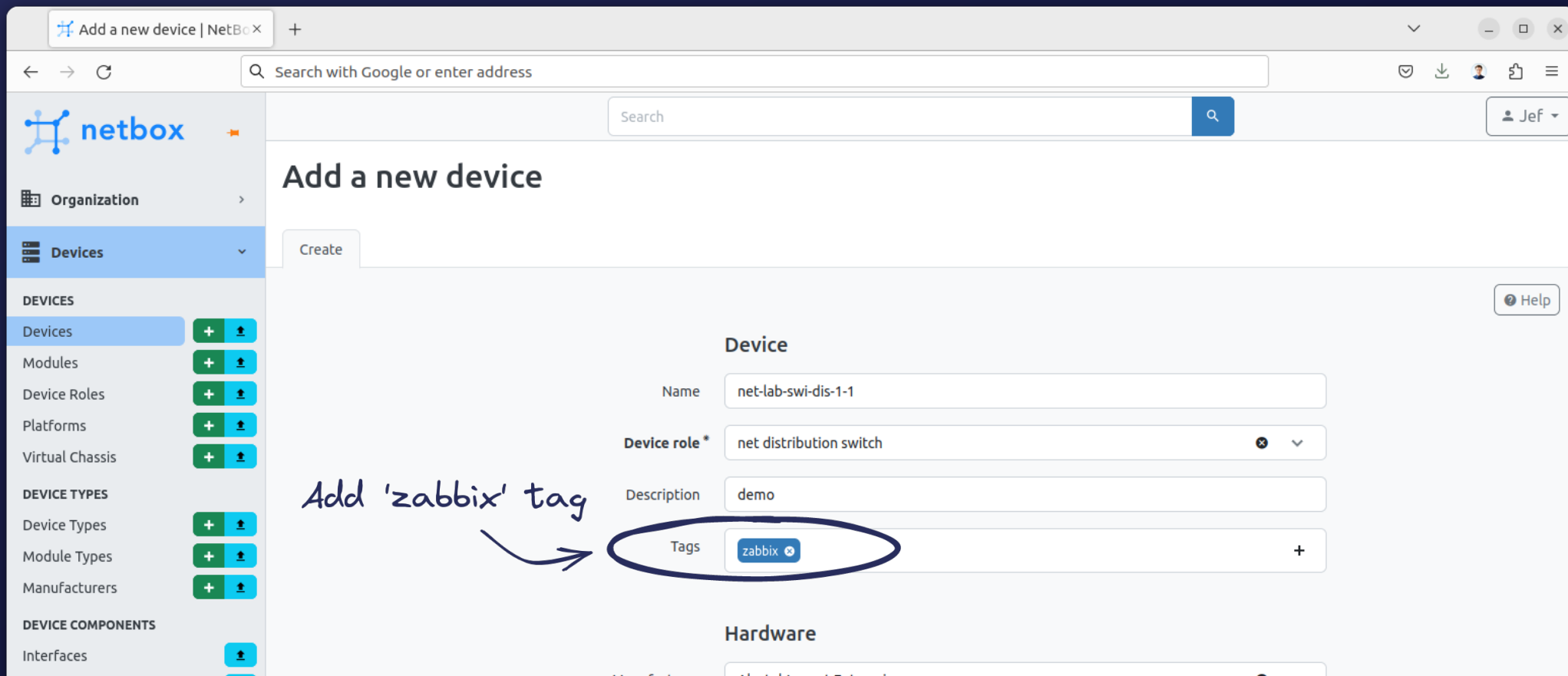
Concept

[Automating Zabbix with Netbox and Ansible]



Demo

Add device to Netbox



The screenshot shows the Netbox web interface for adding a new device. The browser tab is titled 'Add a new device | Netbox'. The left sidebar contains a navigation menu with 'Organization' and 'Devices' (selected). Under 'DEVICES', there are links for 'Devices', 'Modules', 'Device Roles', 'Platforms', and 'Virtual Chassis', each with a green '+' icon and a user icon. Under 'DEVICE TYPES', there are links for 'Device Types', 'Module Types', and 'Manufacturers', each with a green '+' icon and a user icon. Under 'DEVICE COMPONENTS', there is a link for 'Interfaces' with a user icon. The main content area is titled 'Add a new device' and has a 'Create' button. The form fields are as follows:

- Device**
 - Name: net-lab-swi-dis-1-1
 - Device role *: net distribution switch (dropdown menu)
 - Description: demo
 - Tags: zabbix (circled in blue with a handwritten arrow pointing to it from the text 'Add 'zabbix' tag')
- Hardware**
 - Manufacturer: (empty field)

The browser's address bar shows 'Search with Google or enter address'. The top right corner shows a user profile 'Jef' and a 'Help' button.

Demo

Add device to Netbox

net-lab-swi-dist-1-1 | Netbox

Search with Google or enter address

netbox

Organization

Devices

DEVICES

Devices

Modules

Device Roles

Platforms

Virtual Chassis

DEVICE TYPES

Device Types

Module Types

Manufacturers

DEVICE COMPONENTS

Interfaces

net-lab-swi-dist-1-1

Search

Jef

+ Add Components

Clone

Edit

Delete

configuration in gitlab

Device

Interfaces 31

Config Context

Status

LLDP Neighbors

Config

Journal

Changelog

Device

Region	Antwerpen
Site	lab
Location	—
Rack	—
Position	—
Tenant	AP Hogeschool / netwerk
Device Type	Alcatel-Lucent Enterprise OS6560-P24X4 (1U)
Description	—
Airflow	—

Management

Status	Active
Role	net distribution switch
Platform	alcatel_aos
Primary IPv4	10.10.20.11
Primary IPv6	—

Services

None

Select 'config context'

Demo

Add device to Netbox

The screenshot shows the Netbox web interface. The browser tab is 'net-lab-swi-dist-1-1 | Netbox'. The search bar contains 'Search with Google or enter address'. The left sidebar shows the 'netbox' logo and navigation links for 'Organization', 'Devices', 'DEVICES', 'Modules', 'Device Roles', 'Platforms', 'Virtual Chassis', 'DEVICE TYPES', 'Device Types', 'Module Types', 'Manufacturers', 'DEVICE COMPONENTS', and 'Interfaces'. The 'Devices' link is highlighted. The main content area shows the device 'net-lab-swi-dist-1-1' under the 'lab' organization. The 'Config Context' tab is selected, and a handwritten arrow points to it with the text 'Used for switch config'. The 'Rendered Context' tab is also selected, showing a JSON configuration for 'cfg_snmp_stations'. The 'Local Context' tab is also visible, showing a similar JSON configuration. The 'Config Context' tab has a 'configuration in gitlab' button.

net-lab-swi-dist-1-1 | Netbox

Search with Google or enter address

netbox

Organization

Devices

DEVICES

Modules

Device Roles

Platforms

Virtual Chassis

DEVICE TYPES

Device Types

Module Types

Manufacturers

DEVICE COMPONENTS

Interfaces

Devices > lab

net-lab-swi-dist-1-1

+ Add Components Clone Edit Delete

configuration in gitlab

Device Interfaces 31 Config Context Status LLDP Neighbors Config Journal Changelog

Rendered Context

```
{
  "cfg_snmp_stations": [
    {
      "ip_address": "10.200.10.101",
      "protocol": "v3",
      "status": "enable",
      "udp_port": "162",
      "user": "snmpv3"
    }
  ]
}
```

JSON YAML

Local Context

```
{
  "cfg_snmp_stations": [
    {
      "ip_address": "10.200.10.101",
      "protocol": "v3",
      "status": "enable",
      "udp_port": "162",
      "user": "snmpv3"
    }
  ]
}
```


Demo

Ansible inventory

Netbox

netbox.yml

```
plugin: netbox.netbox.nb_inventory
```

```
validate_certs: false
```

```
config_context: true
```

```
flatten_config_context: true
```

```
compose:
```

```
  ansible_network_os: custom_fields.ansible_network_os
```

```
  device_id: id
```

```
  netbox_api: "{{ lookup('env', 'netbox_api') }}"
```

```
  netbox_user_id: '2'
```

```
group_names_raw: true
```

```
groups:
```

```
  netbox: ansible_host != ""
```

```
group_by:
```

```
  - sites
```

```
query_filters:
```

```
  - tag: zabbix
```

Ansible-inventory -i inventory/netbox.yml --list

```
{
  "_meta": {
    "hostvars": {
      "net-lab-swi-dist-1-1": {
        "ansible_host": "10.10.20.11",
        "cfg_snmp_stations": [
          {
            "ip_address": "10.200.10.101",
            "protocol": "v3",
            "status": "enable",
            "udp_port": "162",
            "user": "snmpv3"
          }
        ]
      }
    }
  },
  "lab": {
    "hosts": [
      "net-lab-swi-dist-1-1"
    ]
  }
}
```

Demo

Switch configuration

```
switch-config.yml

---
- name: Get >>> snmp stations
  ansible.utils.cli_parse:
    command: show snmp station
    parser:
      name: ansible.utils.textfsm
      set_fact: pre_snmp_stations
- name: Configure >>> snmp stations
  when: pre_snmp_stations != cfg_snmp_stations
  notify:
    - "Zabbix-sync : save configuration"
    - "Zabbix-sync : callback netbox journal - config diff"
  block:
    - name: Push >> no snmp stations
      ansible.netcommon.cli_command:
        command: "{{ lookup('template', 'no_snmp_stations.j2') }}"
    - name: Push >> snmp stations
      ansible.netcommon.cli_command:
        command: "{{ lookup('template', 'snmp_stations.j2') }}"
    - name: Info >> snmp configuration changes
      ansible.utils.fact_diff:
        before: "{{ pre_snmp_stations }}"
        after: "{{ cfg_snmp_stations }}"
      register: cfg_snmp_stations_diff
```

parse

```
aos_show_snmp_station.textfsm

Value ip_address ((?:[0-9]{1,3}\.){3}[0-9]{1,3}/(?:[a-f0-9]{1,4}:){7}[a-f0-9]{1,4})
Value udp_port (\d{1,5})
Value status (enable/disable)
Value protocol (v1/v2/v3)
Value user (.* )

Start
^ipAddress/port                status    protocol user$$
^[-+\|+]+\s*$$ → Station

Station
^${ip_address}\/${udp_port}\s+${status}\s+${protocol}\s+${user}$$ → Record
^.\s → Error

parsed:
- ip_address: 10.200.10.11
  protocol: v3
  status: enable
  udp_port: '162'
  user: snmpv3
```

Demo

Switch configuration

```
switch-config.yml

---
- name: Get >>> snmp stations
  ansible.utils.cli_parse:
    command: show snmp station
    parser:
      name: ansible.utils.textfsm
    set_fact: pre_snmp_stations

- name: Configure >>> snmp stations
  when: pre_snmp_stations != cfg_snmp_stations
  notify:
    - "Zabbix-sync : save configuration"
    - "Zabbix-sync : callback netbox journal - config diff"
  block:
    - name: Push >> no snmp stations
      ansible.netcommon.cli_command:
        command: "{{ lookup('template', 'no_snmp_stations.j2') }}"

    - name: Push >> snmp stations
      ansible.netcommon.cli_command:
        command: "{{ lookup('template', 'snmp_stations.j2') }}"

    - name: Info >> snmp configuration changes
      ansible.utils.fact_diff:
        before: "{{ pre_snmp_stations }}"
        after: "{{ cfg_snmp_stations }}"
      register: cfg_snmp_stations_diff
```

Source of truth

```
parsed:
- ip_address: 10.200.10.101
  protocol: v3
  status: enable
  udp_port: '162'
  user: snmpv3
```

≠

Device state

```
parsed:
- ip_address: 10.200.10.11
  protocol: v3
  status: enable
  udp_port: '162'
  user: snmpv3
```

Demo

Switch configuration

```
switch-config.yml

---
- name: Get >>> snmp stations
  ansible.utils.cli_parse:
    command: show snmp station
    parser:
      name: ansible.utils.textfsm
    set_fact: pre_snmp_stations

- name: Configure >>> snmp stations
  when: pre_snmp_stations != cfg_snmp_stations
  notify:
    - "Zabbix-sync : save configuration"
    - "Zabbix-sync : callback netbox journal - config diff"
  block:
    - name: Push >> no snmp stations
      ansible.netcommon.cli_command:
        command: "{{ lookup('template', 'no_snmp_stations.j2') }}"
    - name: Push >> snmp stations
      ansible.netcommon.cli_command:
        command: "{{ lookup('template', 'snmp_stations.j2') }}"
    - name: Info >> snmp configuration changes
      ansible.utils.fact_diff:
        before: "{{ pre_snmp_stations }}"
        after: "{{ cfg_snmp_stations }}"
      register: cfg_snmp_stations_diff
```

3
template

```
snmp_stations.j2

{% for snmp_station in cfg_snmp_stations %}
  snmp station {{ snmp_station.ip_address }}
  {{ snmp_station.udp_port }}
  {{ snmp_station.user }}
  {{ snmp_station.protocol }}
  {{ snmp_station.status }}
{% endfor %}
```



```
! SNMP:
snmp station 10.200.10.101 162 "snmpv3" v3 enable
```

Demo

Zabbix configuration

```
netbox.yml

- name: Get >>> sites from netbox
  run_once: true
  block:
    - name: Get >>> netbox sites
      ansible.builtin.set_fact:
        netbox_sites: |
          "{{ query('netbox.netbox.nb_lookup',
            'sites',
            api_endpoint=netbox_api,
            token=netbox_token) }}"

- name: Add/update/remove >>> groups from netbox
  delegate_to: "{{ zabbix_api }}"
  community.zabbix.zabbix_group:
    state: "{{ netbox_state_map[item.value.status.value] }}"
    host_groups:
      - "net/{{ item.value.slug }}"
  loop: "{{ netbox_sites }}"
```

GET - HTTP 200 OK

Netbox:

```
Response body:
{
  "count": 1,
  "next": null,
  "previous": null,
  "results": [
    {
      "id": 1,
      "url": "api/dcim/sites/1/",
      "display": "lab",
      "name": "lab",
      "slug": "lab",
      "status": {
        "value": "active",
        "label": "Active"
      }
    }
  ]
}
```

Demo

Zabbix configuration

AP Zabbix Server: Config

+

← → ↺

Search with Google or enter address

🔒

⬇

👤

📌

☰

ZABBIX

AP Zabbix Server

🔍

👁 Monitoring

⌵

🕒 Services

⌵

☰ Inventory

⌵

📊 Reports

⌵

🔧 Configuration

⌶

Host groups

Templates

Hosts

Maintenance

Actions

Event correlation

Discovery

⚙ Administration

⌵

Host groups

Create host group

Filter

🔍

Name

lab

Apply

Reset

<input type="checkbox"/>	Name ▲	Hosts	Templates	Members	Info
<input type="checkbox"/>	net/lab	Hosts	Templates		

Displaying 1 of 1 found

0 selected

Enable hosts

Disable hosts

Delete

Demo

Zabbix configuration

```
netbox.yml

- name: Add/update/delete >> templates
  run_once: true
  block:
    - name: Add/update >>> templates
      delegate_to: "{{ zabbix_api }}"
      community.zabbix.zabbix_template:
        - template_json: "{{ lookup('file', item.template) | from_yaml | to_json }}"
          state: "{{ item.state }}"
        loop: "{{ zabbix_templates }}"
        when: item.state == "present"

    - name: Remove >>> templates
      delegate_to: "{{ zabbix_api }}"
      community.zabbix.zabbix_template:
        template_name: "{{ item.name }}"
        state: absent
        loop: "{{ zabbix_templates }}"
        when: item.state == "absent"
```

3

Ansible variable:

```
zabbix_templates:
  - template: template_alcatel-lucent...
    name: Alcatel-Lucent Enterprise...
    platform: aos8
    state: present
```

Demo

Zabbix configuration

AP Zabbix Server: Config

+

Search with Google or enter address

Search

AP Zabbix Server

Monitoring

Services

Inventory

Reports

Configuration

Host groups

Templates

Hosts

Maintenance

Actions

Event correlation

Discovery

Administration

Templates

Create template

Import

Filter

Host groups

type here to search

Select

Linked templates

type here to search

Select

Name

aos

Tags

And/Or

Or

tag

Contains

value

Remove

Add

Apply

Reset

<input type="checkbox"/>	Name ▲	Hosts	Items	Triggers	Graphs	Dashboards	Discovery	Web	Linked templates	Linked to templates	Tags
<input type="checkbox"/>	Alcatel-Lucent Enterprise OmniSwitch AOS 6.x	Hosts	Items 5	Triggers 1	Graphs	Dashboards	Discovery 4	Web			
<input type="checkbox"/>	Alcatel-Lucent Enterprise OmniSwitch AOS 8.x	Hosts	Items 5	Triggers 1	Graphs	Dashboards	Discovery 3	Web			

0 selected

Export

Mass update

Delete

Delete and clear

Displaying 2 of 2 found

Demo

Zabbix hosts

```
zabbix-hosts.yml

- name: Add/update >>> hosts to zabbix
  when: status.value in ["active", "offline", "planned", "staged"]
  notify: 'Zabbix-sync : callback netbox journal - added'
  block:
    - name: Add/update >>> hosts to zabbix
      delegate_to: "{{ zabbix_api }}"
      community.zabbix.zabbix_host:
        state: present
        host_name: "{{ inventory_hostname }}"
        visible_name: "{{ inventory_hostname }}"
        interfaces:
          - type: 2
            main: 1
            useip: 1
            ip: "{{ primary_ip4 }}"
            details:
              authphrase: "{{ cfg_snmp_passphrase }}"
              authprotocol: 1
              securityname: snmpv3
              privphrase: "{{ cfg_snmp_passphrase }}"
              privprotocol: 1
              securitylevel: 2
              version: 3
        host_groups:
          - "net/{{ sites[0] }}"
    ...
```

```
zabbix-hosts.yml

...
- name: Add/update >>> linked templates
  delegate_to: "{{ zabbix_api }}"
  community.zabbix.zabbix_host:
    host_name: "{{ inventory_hostname }}"
    link_templates:
      - Alcatel-Lucent Enterprise OmniSwitch AOS 8.x
    when: platforms[0] == "alcatel_aos"

- name: Add/update >>> host status
  notify: 'Zabbix-sync : callback netbox journal - status changed'
  delegate_to: "{{ zabbix_api }}"
  community.zabbix.zabbix_host:
    host_name: "{{ inventory_hostname }}"
    status: "{{ zabbix_status_map[status.value] }}"
    when: status.value in ["offline", "planned", "staged"]

name: Delete >>> hosts
notify: 'Zabbix-sync : callback netbox journal - deleted'
delegate_to: "{{ zabbix_api }}"
community.zabbix.zabbix_host:
  state: absent
  host_name: "{{ inventory_hostname }}"
  when: status.value in ["inventory", "decommissioning"]
```

Demo

Zabbix configuration

AP Zabbix Server: Config

+

← → ↺

Search with Google or enter address

🔒

⬇

👤

📌

☰

ZABBIX

AP Zabbix Server

🔍

👁 Monitoring

⌵

🕒 Services

⌵

☰ Inventory

⌵

📊 Reports

⌵

🔧 Configuration

⌶

Host groups

Templates

Hosts

Maintenance

Actions

Event correlation

Discovery

⚙ Administration

⌵

Hosts

Create host

Import

Host groups

type here to search

Select

Templates

type here to search

Select

Name

lab

DNS

IP

Port

Monitored by

Any

Server

Proxy

Proxy

Select

Tags

And/Or

Or

tag

Contains

▼

value

Remove

Add

Apply

Reset

☐

Name ▲

Items

Triggers

Graphs

Discovery

Web

Interface

Proxy

Templates

Status

Availability

Agent encryption

Info

Tags

☐

net-lab-swi-dist-1-1

Items 5

Triggers 1

Graphs

Discovery 3

Web

10.10.20.11:161

Alcatel-Lucent Enterprise OmniSwitch AOS 8.x

Enabled

SNMP

None

0 selected

Enable

Disable

Export ▼

Mass update

Delete

Displaying 1 of 1 found

Demo

Zabbix configuration

The screenshot displays the Zabbix web interface for configuring a new host. The browser window title is "AP Zabbix Server: Config". The left sidebar shows the navigation menu with "Configuration" expanded, highlighting "Host groups", "Templates", "Hosts", "Maintenance", "Actions", "Event correlation", and "Discovery". The main content area is titled "Host" and includes tabs for "Host", "IPMI", "Tags", "Macros", "Inventory", "Encryption", and "Value mapping". The "Host" tab is active, showing the following configuration fields:

- * Host name:**
- Visible name:**
- Templates:** A table with columns "Name" and "Action". It lists "Alcatel-Lucent Enterprise OmniSwitch AOS 8.x" with actions "Unlink" and "Unlink and clear". Below the table is a search input "type here to search" and a "Select" button.
- * Groups:** A dropdown menu showing "net/lab" with a close button (X). Below it is a search input "type here to search" and a "Select" button.
- Interfaces:** A table with columns "Type", "IP address", "DNS name", "Connect to", "Port", and "Default". It contains one entry: "SNMP" with IP address "10.10.20.11", "Connect to" set to "IP" and "DNS", and "Port" set to "161". A "Remove" button is next to the entry.
- * SNMP version:** A dropdown menu set to "SNMPv3".
- Context name:**
- Security name:**
- Security level:** A dropdown menu set to "authPriv".
- Authentication protocol:** A dropdown menu set to "SHA1".
- Authentication passphrase:**

On the right side of the interface, there are buttons for "Create host" and "Import", and a "Filter" dropdown. At the bottom right, it says "Displaying 1 of 1 found".

Demo

Ansible handlers

```
handlers.yml

- name: 'Zabbix-sync : save configuration'
  vars:
    ansible_connection: ansible.netcommon.network_cli
    ansible_network_os: jefvantongerloo.alcatel.aos
    ansible_netcommon_cli_command:
    command: "write memory flash-synchro"

- name: 'Zabbix-sync : callback netbox journal - added'
  ansible.builtin.uri:
    url: "{{ netbox_api }}/api/extras/journal-entries/"
    method: POST
    headers:
      Accept: application/json
      Authorization: "Token {{ netbox_token }}"
    status_code: 201
    body_format: json
    body:
      assigned_object_type: dcim.device
      assigned_object_id: '{{ device_id }}'
      created_by: '{{ netbox_user_id }}'
      kind: info
      tags:
        - name: zabbix
      comments: /
        zabbix - device added
```

On task 'changed':

```
notify:
  - "Zabbix-sync : save configuration"
```

On task 'changed':

```
notify:
  - 'Zabbix-sync : callback netbox journal - added'
```

Demo

Netbox callback

net-lab-swi-dist-1-1 | Netbox

Search with Google or enter address

netbox

Organization

Devices

DEVICES

Devices

Modules

Device Roles

Platforms

Virtual Chassis

DEVICE TYPES

Device Types

Module Types

Manufacturers

DEVICE COMPONENTS

Interfaces

Search

Jef

Devices > lab

net-lab-swi-dist-1-1

+ Add Components Clone Edit Delete

configuration in gitlab

Device Interfaces 31 Config Context Status LLDP Neighbors Config Journal 2 Changelog

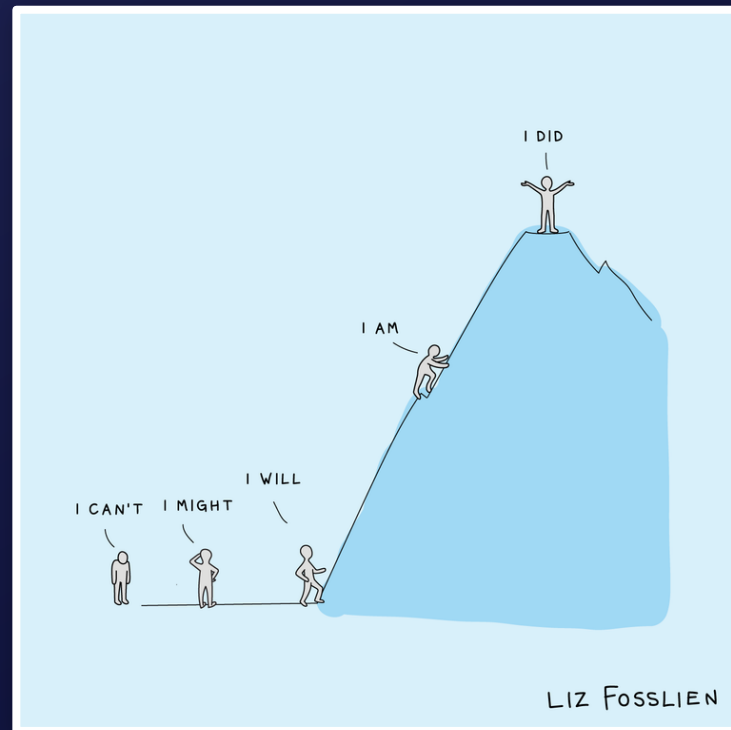
Created	Created by	Kind	Tags	Comments (Short)
2023-03-26 14:26	p064033	Info	config	<div>zabbix - snmp config changed</div> <div>--- before</div> <div>+++ after</div> <div>@@ -1 +1 @@</div> <div>-{'user': 'snmpv3', 'status': 'enable', 'protocol': 'v3', 'udp_port': '162', 'ip_address': '10.200.10.11'}</div> <div>+{'user': 'snmpv3', 'status': 'enable', 'protocol': 'v3', 'udp_port': '162', 'ip_address': '10.200.10.101'}</div>
2023-03-26 14:26	p064033	Info	zabbix	zabbix - device added

Per Page 1-2 of 2

What's next?

Integration

- Integrate in CI/CD pipeline services
 - Github, GitLab, Drone CI, ...
- Integrate into task manager
 - AWX, Jenkins, ...
- Sit back and relax



Liz Fosslien, <https://fosslien.com>

Questions?

 @jefvantongerloo

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

 github.com/jefvantongerloo/zabbix-automation-demo