How my first Network Automation project failed (and is still in production)

Urs Baumann Swisscom 29.05.2024

Urs Baumann

```
>>> qr = QRCode()
>>> qr.add_data(”https://www.linkedin.com/in/ubaumannch”)
>>> qr.print_ascii()
```

How it began ...

You have automated CCIE Lab deployments.
Could you build a ”Staging Robot”?

Customer A (2015)

A winning team

Software Engineer

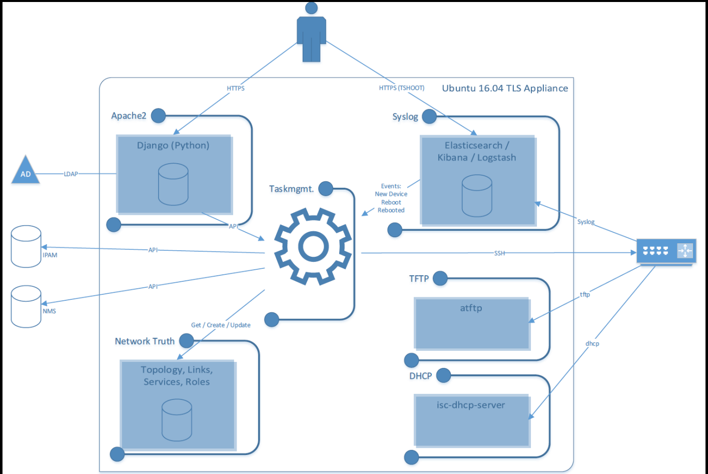
- System engineering background
- ”Hardcore code reviewer”

Network Engineer

- Basic programming skills
- ”It is working, isn’t it?”

[1] System Engineer (BSc student) with a flair for UI joined for UI

First Architecture



Source: SwiNOG #31 Network Automation – Road trip to an automated Network

Event Based

- No need to know in advance:
  - Serial Number
  - MAC Address
  - Model ID

- Support for different staging areas

- Staging directly at the destination

EEM

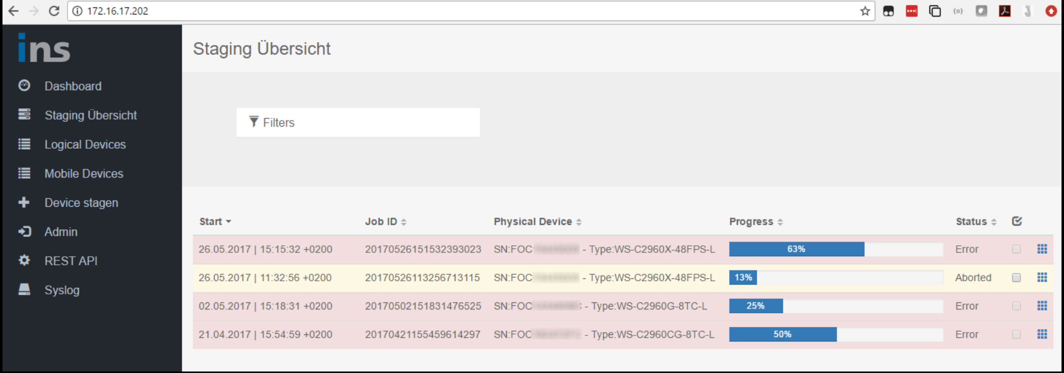
Disclaimer: Needed support for IOS 12 (no Python, no PnP)

- The First idea was to use EEM
- EEM is not supported on L2 devices
- TCL works on all platforms
- TCL has slightly different versions and different libraries

TCL

- More than 900 lines of code
- Around 100 ”if” statements
- Aproxamitly 50 cold showers

How it looked - Job Overview

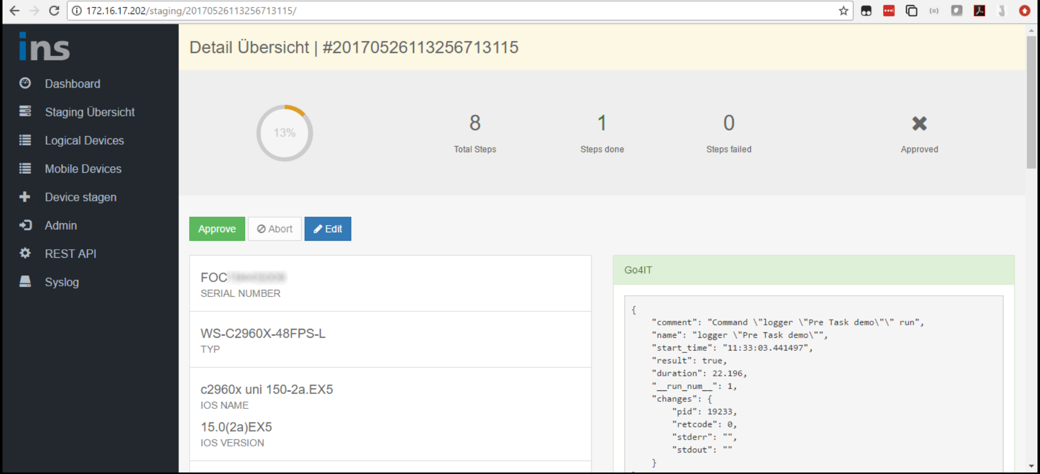


Staging Übersicht

Start	Job ID	Physical Device	Progress	Status	☑	
26.05.2017 | 15:15:32 +0200	20170526151532393023	SN:FOC[redacted] - Type:WS-C2960X-48FPS-L	63%	Error	□	▦
26.05.2017 | 11:32:56 +0200	20170526113256713115	SN:FOC[redacted] - Type:WS-C2960X-48FPS-L	13%	Aborted	□	▦
02.05.2017 | 15:18:31 +0200	20170502151831476525	SN:FOC[redacted] - Type:WS-C2960G-8TC-L	25%	Error	□	▦
21.04.2017 | 15:54:59 +0200	20170421155459614297	SN:FOC[redacted] - Type:WS-C2960CG-8TC-L	50%	Error	□	▦

Source: SwiNOG #31 Network Automation – Road trip to an automated Network

How it looked - Job Details



Detail Übersicht | #20170526113256713115

13%	8	1	0	✖
	Total Steps	Steps done	Steps failed	Approved

FOC[redacted]
SERIAL NUMBER

WS-C2960X-48FPS-L
TYP

c2960x uni 150-2a.EX5
IOS NAME

15.0(2a)EX5
IOS VERSION

Go4IT

```
{
    "comment": "Command \"logger \"Pre Task demo\"\" run",
    "name": "logger \"Pre Task demo\"",
    "start_time": "11:33:03.441497",
    "result": true,
    "duration": 22.196,
    "__run_num__": 1,
    "changes": {
        "pid": 19233,
        "retcode": 0,
        "stderr": "",
        "stdout": ""
    }
```

Source: SwiNOG #31 Network Automation – Road trip to an automated Network

SaltStack

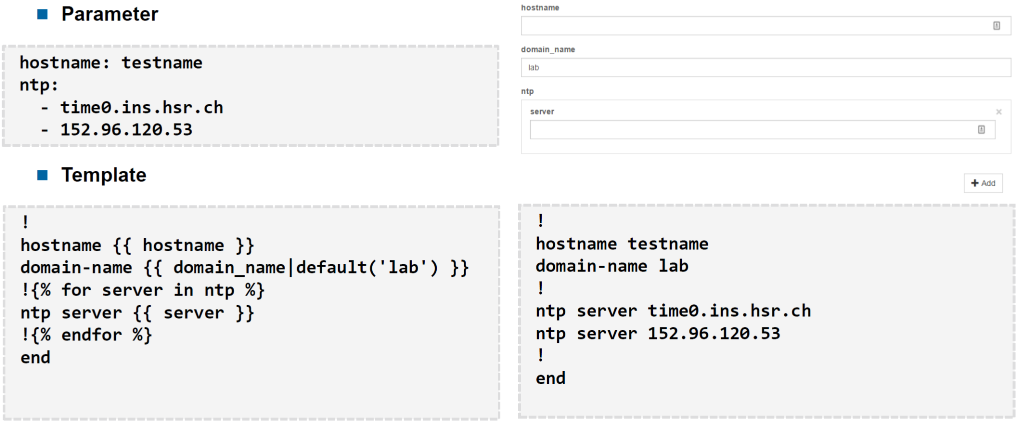
- Using event bus
- Provides API
- Over time way too many workarounds

```
{% set printlabel = salt['pillar.get']('printlabel') %}
{% if printlabel in ['8 mm', '18 mm', '16 mm'] %}
label_print:
  cmd.run:
    - description: Print label
    - name: print_label.py {{ printer_ip }} 1 ”{{ salt['pillar.get']('hostname','') }}”
{% endif %}
```

Awesome Features

- Hierarchical Network-Domain variables
- Generate WebForm from template variables
- Prepare device management with SaltStack
- Templates and template snippets

Generate Form from Template



- **Parameter**

```
hostname: testname
ntp:
  - time0.ins.hsr.ch
  - 152.96.120.53
```

- **Template**

```
!
hostname {{ hostname }}
domain-name {{ domain_name|default('lab') }}
!{% for server in ntp %}
ntp server {{ server }}
!{% endfor %}
end
```

hostname

domain_name

lab

ntp

server

```
!
hostname testname
domain-name lab
!
ntp server time0.ins.hsr.ch
ntp server 152.96.120.53
!
end
```

Source: SwiNOG #31 Network Automation – Road trip to an automated Network

”Emergency” OS upgrade

We hit a dot1x bug and need to upgrade 5000 switches ASAP.
Could the ”Staging Robot” do that?

Customer A (2017)

- Own implementation of Plug&Play
- UI with CSV export/import to select a time window
- Slow start

Redesing UI

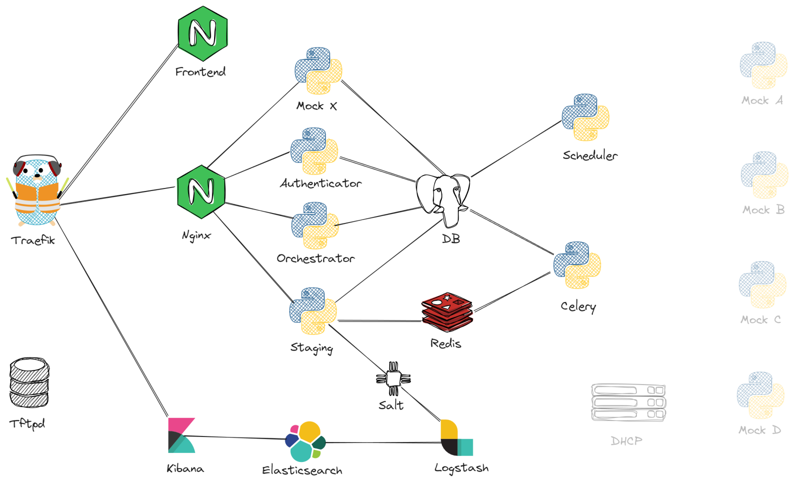
- Use synergies from other internally developed tools
- SinglePage with react
- Integrate multiple backends in the same UI

Customer B

We have a huge rollout upcoming. Could your tool be adapted?

Customer B (2019)

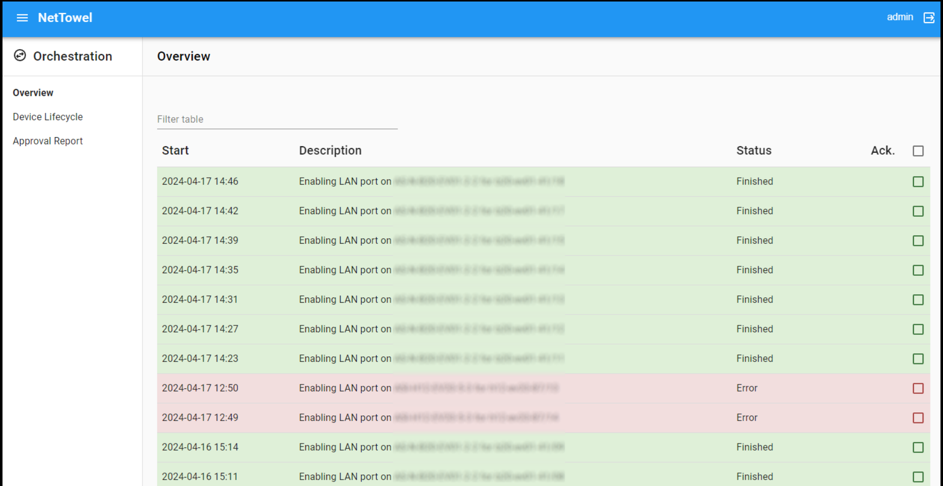
Architecture



Addons

- 1:1 Replace Device
- Replacement with a new device
- Replace with Stack
- Interface rearrangement
- Provision/Deprovison Access port (API triggered from ordering system)

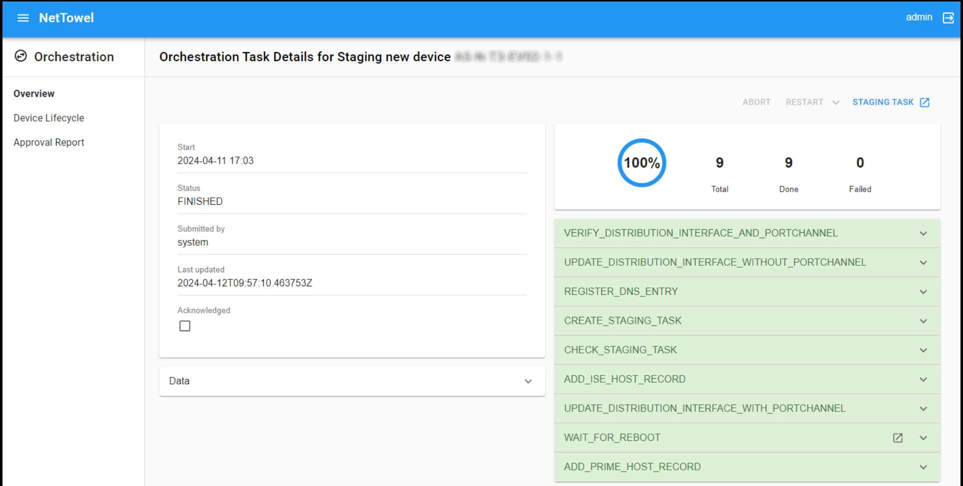
Orchestrator



Overview

Start	Description	Status	Ack. □
2024-04-17 14:46	Enabling LAN port on [redacted]	Finished	□
2024-04-17 14:42	Enabling LAN port on [redacted]	Finished	□
2024-04-17 14:39	Enabling LAN port on [redacted]	Finished	□
2024-04-17 14:35	Enabling LAN port on [redacted]	Finished	□
2024-04-17 14:31	Enabling LAN port on [redacted]	Finished	□
2024-04-17 14:27	Enabling LAN port on [redacted]	Finished	□
2024-04-17 14:23	Enabling LAN port on [redacted]	Finished	□
2024-04-17 12:50	Enabling LAN port on [redacted]	Error	□
2024-04-17 12:49	Enabling LAN port on [redacted]	Error	□
2024-04-16 15:14	Enabling LAN port on [redacted]	Finished	□
2024-04-16 15:11	Enabling LAN port on [redacted]	Finished	□

Orchestrator



Orchestration Task Details for Staging new device [redacted]

Start
2024-04-11 17:03

Status
FINISHED

Submitted by
system

Last updated
2024-04-12T09:57:10.463753Z

Acknowledged
□

Data

100%

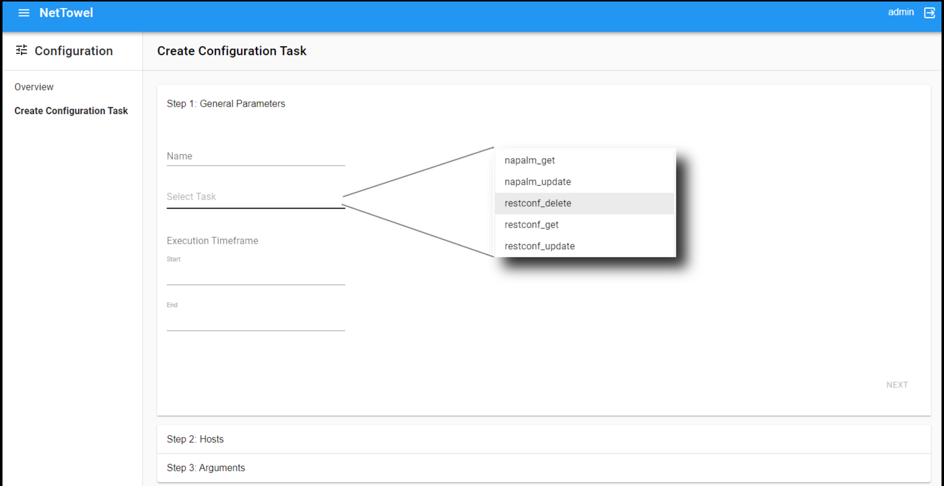
9	9	0
Total	Done	Failed

- VERIFY_DISTRIBUTION_INTERFACE_AND_PORTCHANNEL
- UPDATE_DISTRIBUTION_INTERFACE_WITHOUT_PORTCHANNEL
- REGISTER_DNS_ENTRY
- CREATE_STAGING_TASK
- CHECK_STAGING_TASK
- ADD_ISE_HOST_RECORD
- UPDATE_DISTRIBUTION_INTERFACE_WITH_PORTCHANNEL
- WAIT_FOR_REBOOT
- ADD_PRIME_HOST_RECORD

DIY or not?

- Exactly what you need vs general
- Resource-intensive vs lock-in
- Dependencies
- Integration

Configuration Task



Create Configuration Task

Step 1: General Parameters

Name

Select Task

Execution Timeframe

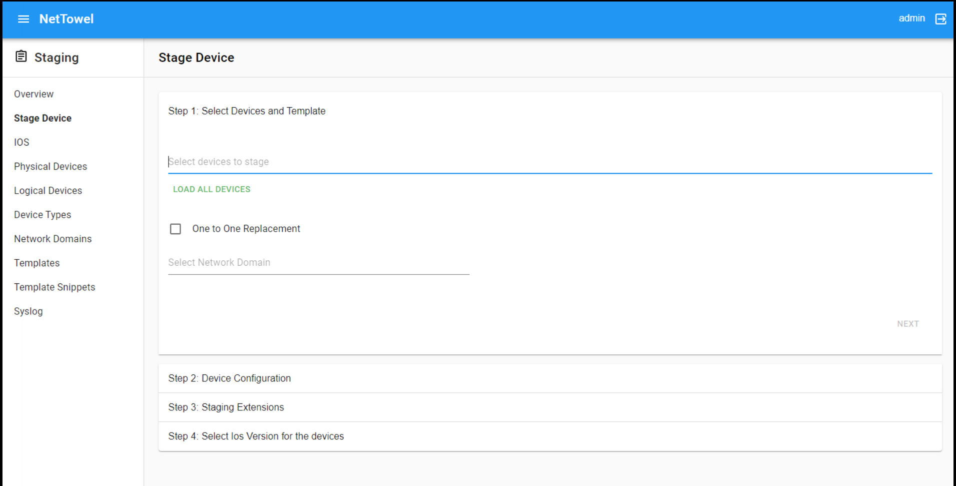
Start

End

Step 2: Hosts

Step 3: Arguments

Staging



Step 1: Select Devices and Template

Select devices to stage

□ One to One Replacement

Select Network Domain

Step 2: Device Configuration

Step 3: Staging Extensions

Step 4: Select Ios Version for the devices

Some numbers

Customer A

- Used the Staging Robot until mid-2023
- Staged around 9’000 L2/L3 devices
- Around 5’000 PnP OS upgrades

Customer B

- In production
- Staged around 700 L3 access switches
- Around 1’500 workflows executed

Using Open Source

- Be prepared to debug the code
- Avoid basing on forks
- Try to be up to date
- Be prepared to overtake small projects
- Version pinning and testing is key

Key Points

- Don’t be afraid of failing
- Do not over-engineer
- Who can maintain this in 5 years?
- Does the customer need this feature or do you want it?
- No shortcuts
- ”Just” maintaining needs time
- Engineer fluctuation

Why do I think the project has failed?

- No direct vendor lock-in but engineer lock-in
- No or outdated documentation
- SaltStack, as a central component, is hard to replace/update
- Settings are in many different locations (because of quick wins)
- Project had multiple contributors, but only one has the global view

Questions?