

Multi-Vendor Zero-Touch Provisioning with ATOM

Plug it, Power it & Relax

Key Capabilities

- [Vendor Agnostic Provisioning](#)

Ability to trigger ZTP for 45+ vendors and 150+ platforms

- [Reduction in truck rolls](#)

Plug in the device, power on, and relax. ATOM offers dramatic savings for your supply chain

- [Ensure golden config standards](#)

Ability to ensure new devices comply with golden config templates during onboarding

- [Ensure Software compliance](#)

Image server support to push software updates during the ZTP process

- [Massively scalable workflows](#)

Microservices based architecture spans the breadth of your network.

- [Provision from Private & Public Cloud](#)

Private or Public cloud, ATOM deployments ensures smooth provisioning of resources

Traditionally, introducing a new set of devices into the network has been a manual multi-step process. The user connects to the hardware and configures the parameters. With networks expanding exponentially, such existing procedures do not scale. To address this concern, Zero-Touch Provisioning (ZTP) has seen wide adoption and is a term that appears increasingly on the feature list of networking vendors. However, ZTP implementations differ significantly between vendors, posing operational challenges to organizations managing multi-vendor networks.

Why Zero-Touch Provisioning?

Zero-Touch Provisioning (ZTP) is a feature that allows the devices to be configured and upgraded automatically, thus eliminating all the manual efforts. The five main reasons why ZTP is highly imperative in modern networks are as follows:

1. Majority of the network downtimes are attributed to human errors
2. Manual configuration is slow and error-prone
3. Lack of skilled staff at remote locations, and increased travel costs
4. Multi-vendor network
5. Non-compliance to golden configuration standards

While there are several “zero-touch” provisioning systems in the market today, there are not many that bring flexibility and customizability options that organizations crave for to establish their intent-driven process. Today’s ZTP solutions are also siloed and do not fit into the broader network automation and monitoring ecosystem. In today’s modern network infrastructure, network managers must centralize provisioning and configuration roles to improve reliability, minimize bring-up costs, and contain the expenses of creating and delivering next-generation services.

How is ATOM ZTP different from traditional ZTP

Anuta Networks ATOM offers a true multi-vendor Zero-Touch Provisioning solution that transforms how network teams onboard the devices to their network. It utilizes a DHCP based approach that automates steps such as deploying Day-0 configuration templates, updating software images, deploying patches, and bug fixes.

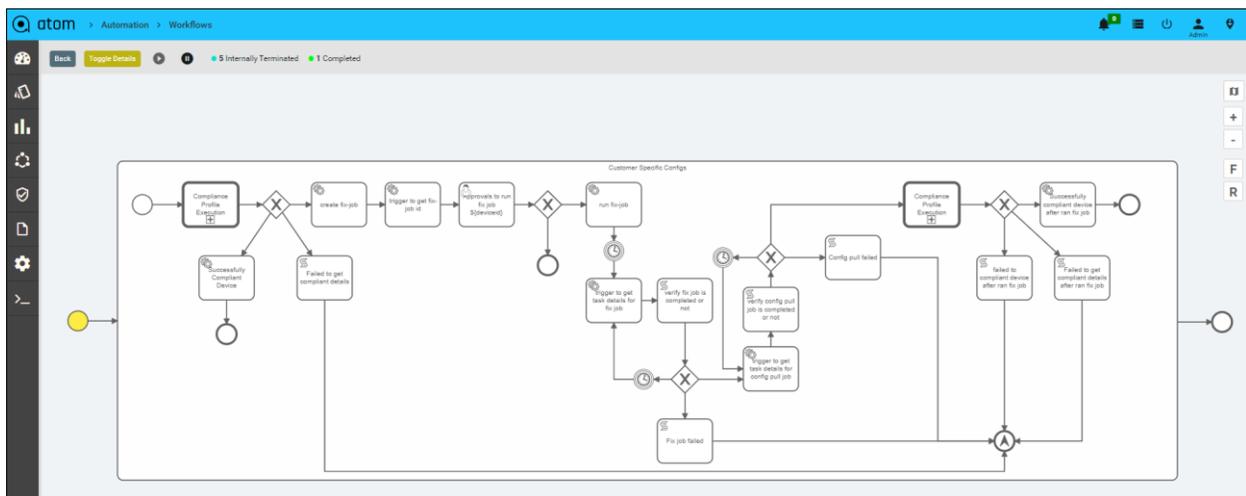
ATOM ZTP addresses several fundamental design principles that positions it as a unique zero-touch solution.

Equips to build a business process around ZTP

ZTP is process-driven automation. The best approach to achieving it is by using workflows. ATOM's workflow based ZTP solution enables an organization to build its business process. It simplifies the existing manual and half-baked processes into simple visual steps. ATOM's workflow automation empowers NetOps teams to integrate the current out-of-box workflow into IPAM/ITSM/OSS/BSS tools to address the process gaps, or if the existing ZTP workflow in ATOM does not suit the requirements, NetOps teams are enabled to use ATOM's built-in workflow designer to customize it to meet their needs.

Ensure compliance with golden standards

Every organization expects a set of standard configurations to be available on the devices being onboarded. ATOM's configuration compliance enables organizations to create golden profiles comprising configuration templates that cater to Day-0 configurations. These profiles could include policies on NTP, domain name, name servers, mandatory VLAN configurations, and much more. The compliance workflow, a sub-process to the ZTP workflow, renders and applies the golden standard configuration to newly onboarded devices. In a context where ad-hoc configurations need to be part of Day-0 profiles, the ATOM ZTP workflow supports it all!



Compliance Workflow as a sub-process

Handle negative scenarios

ATOM ZTP is tuned to handle corner cases that crop up during a ZTP process.

1. In situations where the device is at fault and is forced into multiple reboots, ATOM handles the additional workflows triggered by the circumstances.
2. In another common scenario, if the DHCP server configuration lacks an IP to MAC binding, the chances of a rogue device reaching out to ATOM cannot be ruled out. In such cases, ATOM offers an in-built IPAM where a white list range of IPs can be configured. The ZTP workflow, in its transit, will look up the IPAM range of allowed IPs and decide against onboarding the device if found out-of-range. Define additional handling of such cases by modifying the existing ZTP flows in ATOM.

Utilize ATOM's Config Manager & Image server

ZTP is about pushing the intended configuration and software image to the devices with no user interaction. ATOM's ZTP workflow utilizes ATOM's existing capabilities such as Configuration Management and built-in Image server. The image and configuration files can be uploaded through ATOM's native UI. ATOM supports multiple file transfer methods such as FTP, SFTP, and TFTP to fetch configuration files and images.

Provision from Anywhere

Most organizations have a cloud strategy in place. Anuta ATOM has a cloud native microservices-based architecture. It can be deployed and managed in private or public clouds such as AWS, GCP, or Azure. The devices in line for ZTP will reach out to ATOM deployed on a private or public cloud for golden Day-0 profiles and image updates.

Highly Scalable ZTP Solution

Organizations, large or small, need to invest in future proof and scalable automation solutions. Owing to the cloud native architecture, every aspect of the ATOM is independently scalable. The workflow component of the ATOM that forms the foundation of ATOM ZTP is horizontally scalable to meet the scale requirements of any large organization. ATOM can execute multiple ZTP and compliance workflows at the same time to cater to vast and demanding ZTP workloads.

Customize based on requirements

ATOM ZTP is the best practice adopted by various organizations to onboard devices into their network. But it is a well-known fact that every organization has its own procedures and processes to follow. Keeping this in mind Anuta ATOM is built for customization. While it offers out-of-box solutions, the same can be customized as well. The ZTP workflow can be remodeled according to network requirements of an organization. For example, if the existing ZTP workflow needs to address more negative scenarios, open up the workflow in ATOM's workflow designer, append or delete tasks to meet the requirements and deploy it.

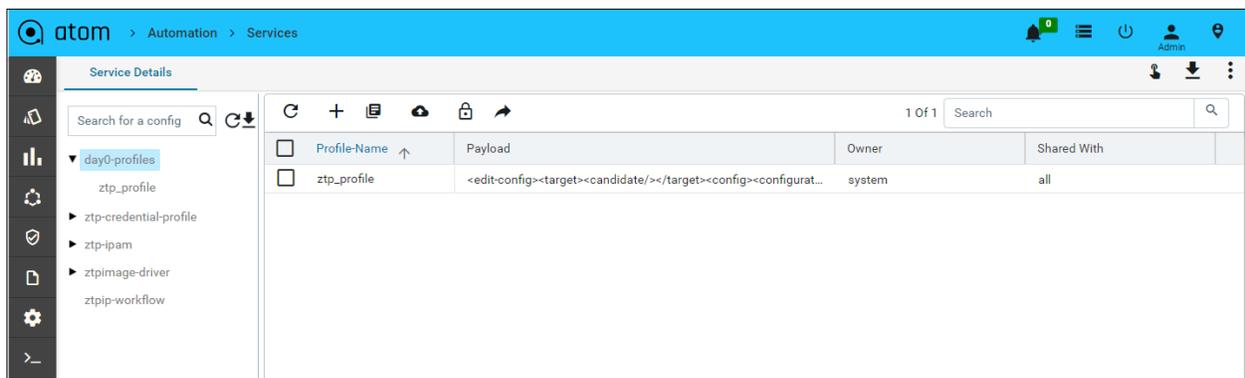
ATOM Multi-Vendor Zero-Touch Provisioning

In the below section, take a closer look at the nuts and bolts of ATOM ZTP. ATOM ZTP uses a workflow-based approach to cater to custom requirements on ZTP from various organizations.

Pre-Requisites

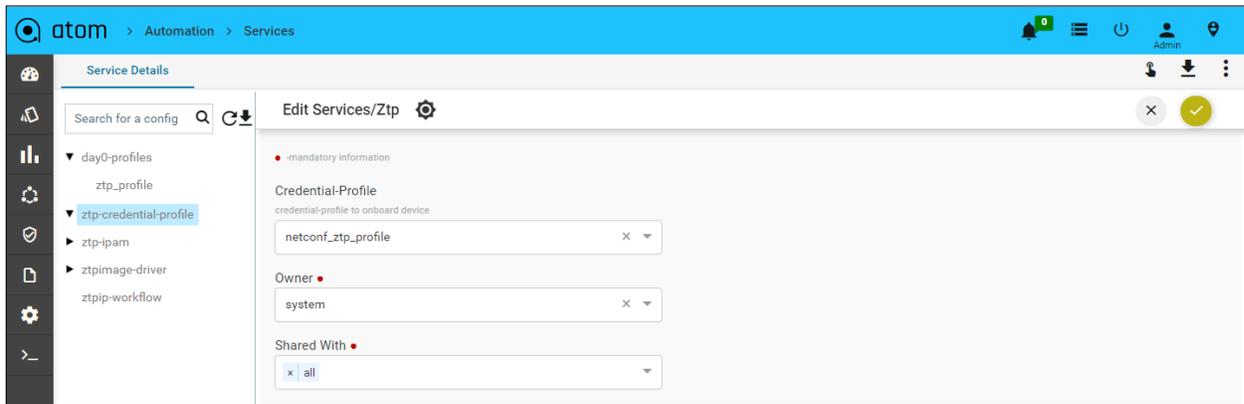
The below steps in ATOM is considered a one-time effort to satisfy all the requirements to start a ZTP process in the network.

1. **Day-0 Profiles** - The profile chosen will be pushed to the device after the onboarding is completed. Choose the Golden compliance profile or add the ad-hoc NETCONF payload intended to be part of the ZTP configurations.



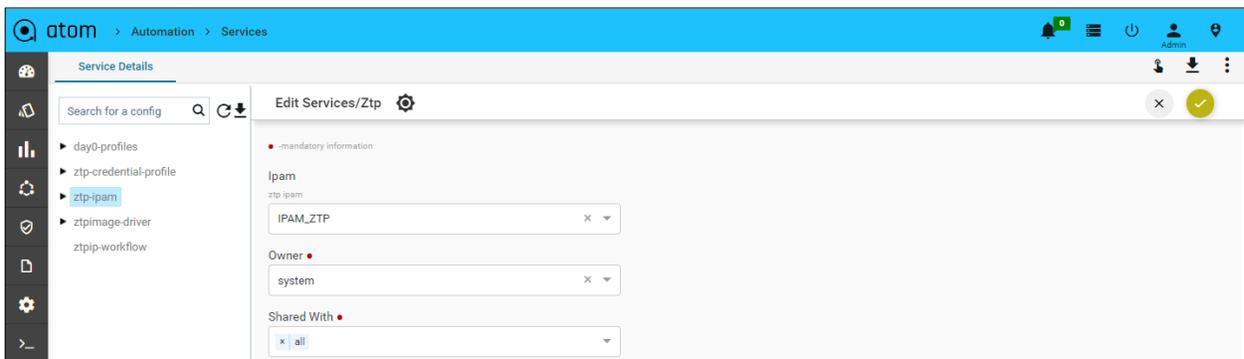
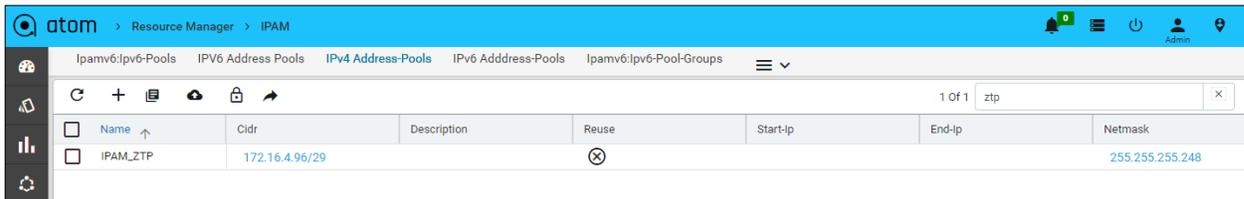
Templatized Day-0 config profiles

2. **ZTP-Credential-Profile** - The workflow uses the credential profile to communicate to the devices with the appropriate device drivers. Choose the credential profile relevant to devices being onboarded. The devices involved could be YANG based or a CLI based.



Credential profiles for SSH/NETCONF

3. **ZTP-IPAM** - An allowed range of IPs can be created on ATOM IPAM. Choose the range of white list IPs defined in ATOM IPAM. The workflow has steps to validate the DHCP offered device IP to the white list range and decide on the state of the workflow.



Internal IPAM for DHCP offered IP validation

4. **Upload Golden Image & Configuration file** - ATOM offers a file server where the relevant software images and configuration files are uploaded. The configuration file contains details such as User profiles, FTP, SSH, and NETCONF configuration to ensure seamless connectivity from ATOM.

The device uses information configured on a Dynamic Host Control Protocol (DHCP) server to determine the location of the software image and configuration files on the network. The DHCP server is configured with the appropriate options for the file server path on ATOM for both software image and configuration files. The DHCP server configuration snippet is shown below.

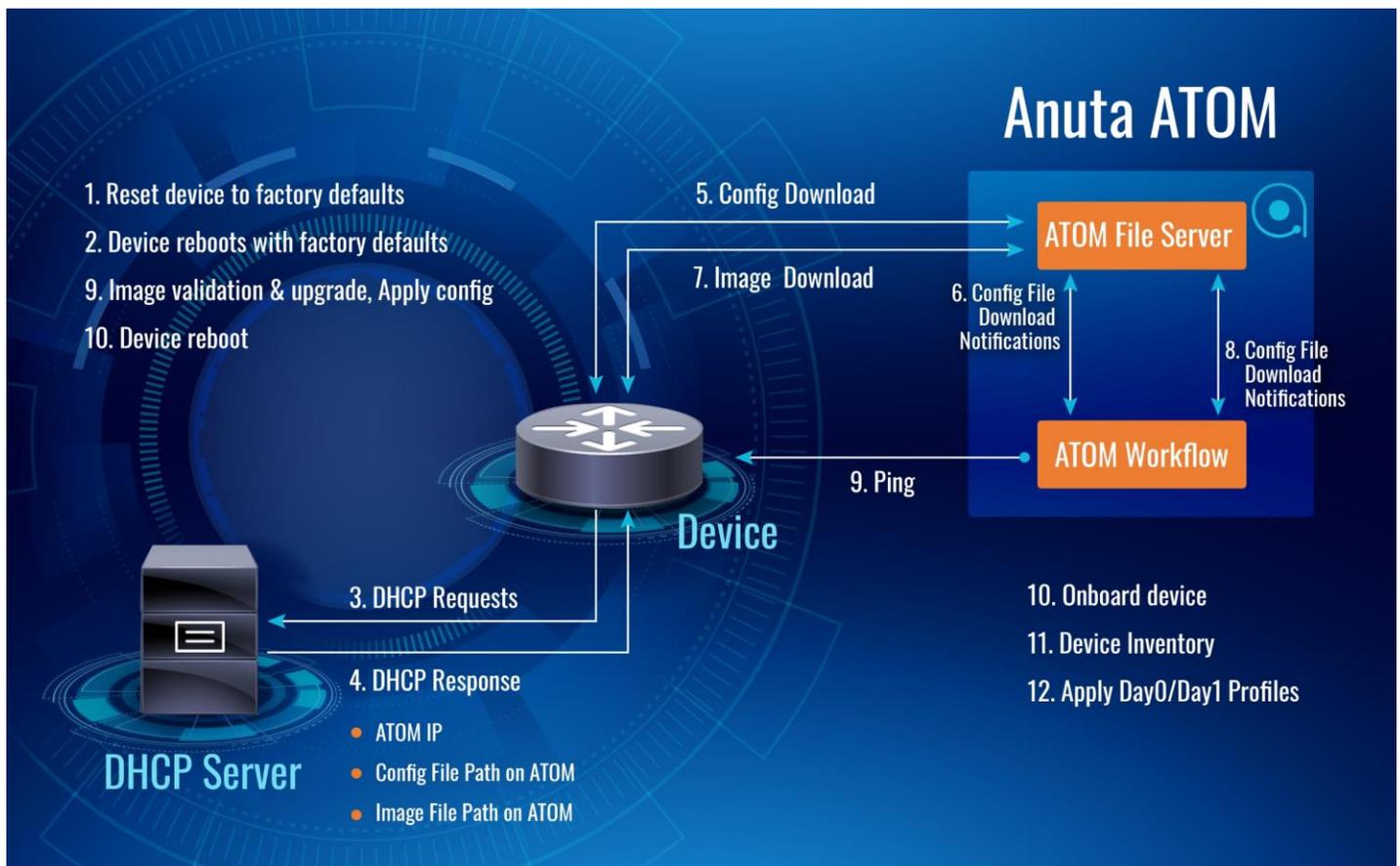
```

host gre01-vmX-4.99 {
  hardware ethernet cc:e1:94:6f:89:92;
  fixed-address 172.16.4.99;
  option host-name "GRE-vmX-4.99";
  option routers 172.16.4.1;
  option vendor-class-identifier "Juniper-mx10001-BR158";
  option option-150 172.16.22.136;
  option NEW_OP.image-file-name "/images/mx/junos-vmhost-install-mx-x86-64-19.4R1.10-limited.tgz";
  option NEW_OP.transfer-mode "ftp";
  option NEW_OP.config-file-name "/configs/run4_99.conf";
}

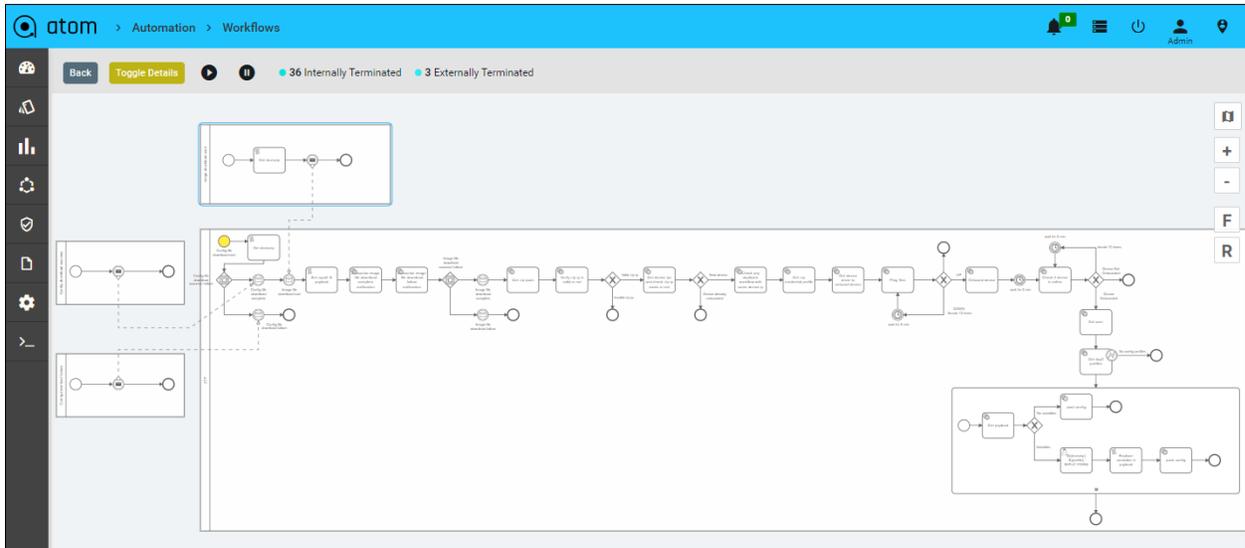
```

DHCP host file configurations

Steps in ATOM ZTP Process & Workflow

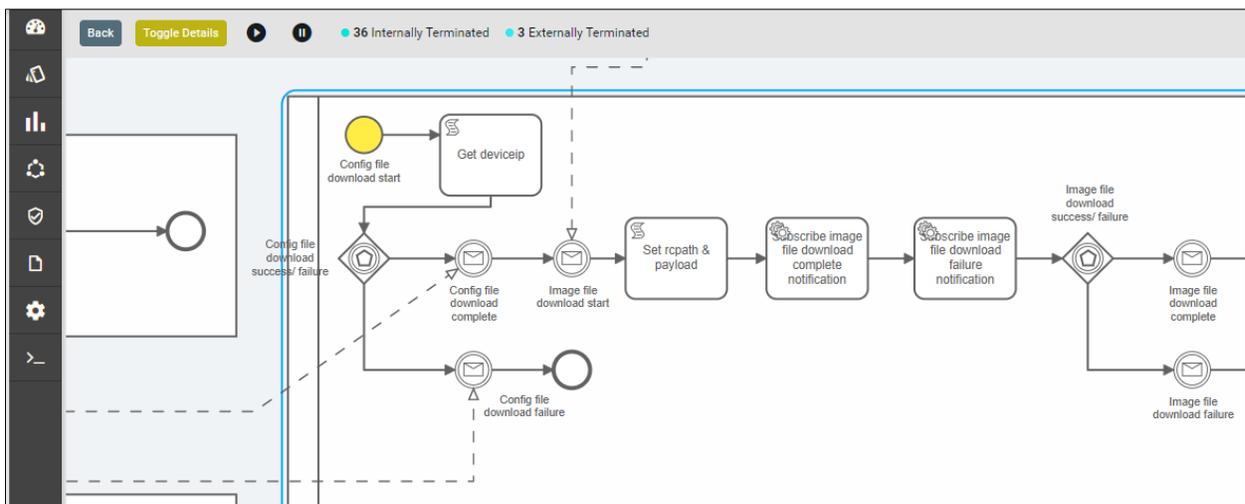


ATOM ZTP Process



ATOM ZTP Workflow

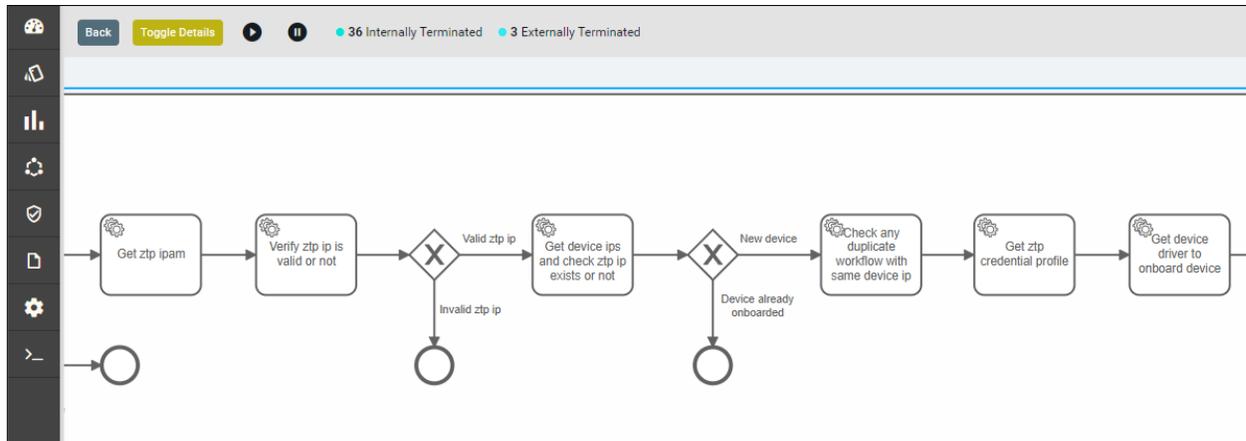
1. Restore the device to factory defaults using the respective vendor commands or by pressing the reset button to trigger the ZTP process from the device side.
2. The device reboots with factory defaults and starts the DHCP discovery process to identify the DHCP server on the network segment. In the request stage, the device sends out the DHCP request to the server to obtain a leased IP address and ATOM fileserver IP and path for software image and configuration files.
3. The device reaches out to ATOM file server for the initial configuration file containing User profiles, FTP, SSH, and NETCONF configuration.



Config file/Image file download

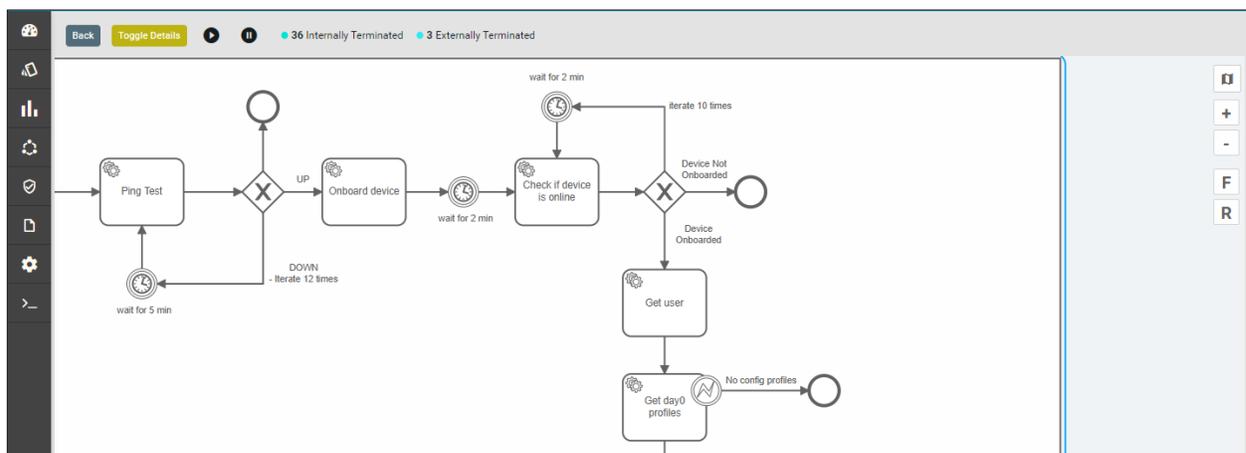
4. The configuration file download triggers the ATOM ZTP workflow highlighted in yellow in the screenshot below. ATOM fetches the device details such as the IP address offered by the DHCP server and begins to track the status of configuration file download.

- Once the configuration file download is completed, the device initiates a software image file download from ATOM. The download is tracked closely by ATOM's ZTP workflow. Any failure to download a file is immediately notified to the user via service ticket or ATOM's notifications.
- The device updates the image and applies the configuration downloaded from ATOM file server. This step on the device is likely to take some time due to the reboot process involved.
- Meanwhile, ATOM ZTP workflow validates the device against the allowed range of IPs configured on ATOM IPAM. Unidentified devices are dropped, and corresponding workflows are terminated.



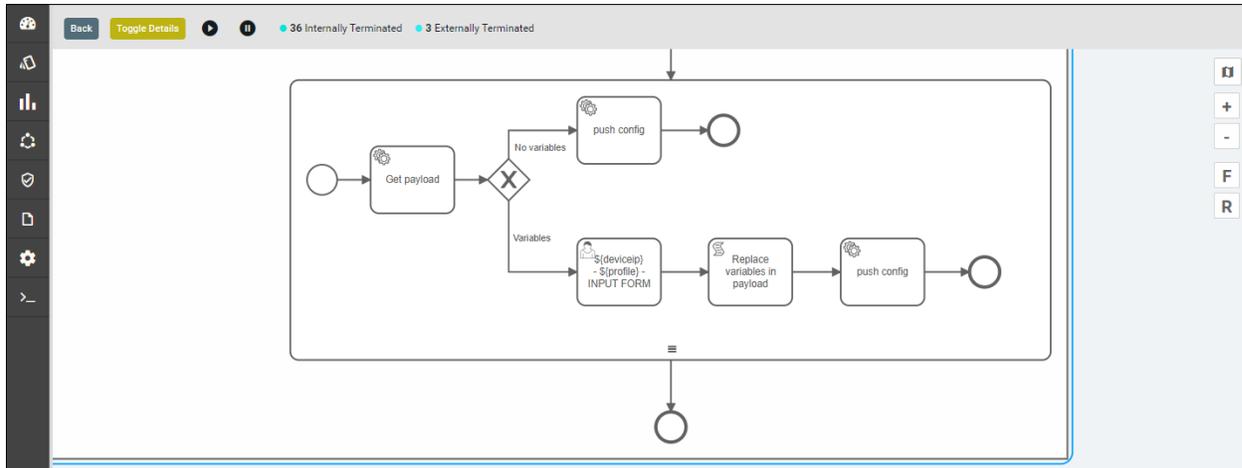
DHCP offered ZTP IP validation

- Valid devices go through an onboarding process with pre-checks such as reachability checks via ping. ATOM performs diagnostics on device reachability via SNMP, NETCONF, etc., followed by inventory collection to complete the onboarding process as shown in the below screenshot.



Device Onboarding

- Once the new device is successfully onboarded, the Day-0 profiles are applied to ensure that the device is compliant with the golden configuration standards. If the choice is to deploy ad-hoc configuration, ATOM ZTP workflow allows templating the same by including variables. This specific flow in the workflow generates a User Form where variables can be populated. The below screenshot shows the day-0 config in the rpc-payload.



Applying Day-0 standard config

Workflow Instance 101144 - push config

Task ID Oex1_7nBpkQAKgQmxC9_TDbA

Time Taken 03/09/2020, 14:53:04 - 03/09/2020, 14:53:08 (3 seconds)

Sep 3, 2020, 2:53:04 PM RPC Operation developerutils:invoke-netconf-driver-rpc started.

Sep 3, 2020, 2:53:04 PM Request

```

{"input": {
  "password": "1YRS50MH4i7NcNssbADnCATfPpb08lkk",
  "port": 830,
  "rpc-payload": "<edit-config><target><candidate/></target><config><configuration><system><host-
name>MX</host-name></system></configuration></config></edit-config>",
  "run-commit-on-config-change": true,
  "log-response": true,
  "device-id": "172.16.4.99",
  "timeout": 300000,
  "username": "admin"
}}
  
```

Sep 3, 2020, 2:53:08 PM Response

```

<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<nc:ok xmlns:nc="urn:ietf:params:xml:ns:netconf:base:1.0"
xmlns:junos="http://xml.juniper.net/junos/19.4R0/junos"/>
  
```

Applying Day-0 standard config

10. The set of commands pushed via ATOM ZTP can be seen on the device as shown below

```
Using username "admin".
Keyboard-interactive authentication prompts from server:
End of keyboard-interactive prompts from server
--- JUNOS 19.4R1.10 Kernel 64-bit JUNPR-11.0-20191115.14c2ad5_buil
admin@MX> show configuration | display set
set version 20191212.201431_builder.r1074901
set system host-name MX
set system root-authentication encrypted-password "$6$g13.H.er$bJgS72B7VPzUt7q0H0rJD/1oiGSdQ87B.I6hN3kSZ4vj3IQY8b/PXBz
D9DBb69vQHreOfAMSQTgCyPXM5ivdV0"
set system scripts language python
set system login user admin uid 2000
set system login user admin class super-user
set system login user admin authentication encrypted-password "$6$ojCOPLsf$FHWf5ScsNHdyVQDoRjXkVXERR5nrhf3.gaEFi2.62Bb
PuCn0vRKuBpdScWwzVuq30/7SnTbWWGAvCGDqzduN0"
set system services ftp
set system services ssh root-login allow
set system services ssh max-sessions-per-connection 50
set system services telnet
set system services extension-service request-response grpc clear-text port 50051
set system services extension-service request-response grpc skip-authentication
set system services extension-service notification allow-clients address 0.0.0/0
set system services extension-service notification allow-clients address 172.16.11.1/24
set system services netconf ssh
set system services netconf unified unhide
set system services netconf rfc-compliant
set system services netconf yang-compliant
set system services netconf yang-modules device-specific
set system services netconf yang-modules emit-extensions
set system services netconf traceoptions file netconf.log
set system services netconf traceoptions on-demand
set system domain-name anutacorp.com
```

Day-0 config & standard image applied on device through ATOM ZTP

With the world going through a crisis like never, remote management of networks is the new normal. Anuta ATOM's ZTP solution by combining the power of Workflow automation with Compliance & Service orchestration, gives the much-needed cushion to network teams involved in daily operations. But what also sets it apart from other similar solutions is the customizability factor that Anuta ATOM offers. Anuta ATOM is developed, keeping in mind the varied requirements of different organizations.

Additional Resources

[Video-on-demand](#) on ATOM Workflow Automation

To learn how Anuta Network's ATOM Zero-Touch Provisioning contact us at <https://www.anutanetworks.com>