

# **Cumulus Linux NOS installation with Ansible**

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Version:

Draft 1



# Introduction

The process to remotely configure a switch with Cumulus Linux NOS with Ansible will be covered in this document. The following configuration tasks will be covered:

- 1. Installing Cumulus Linux NOS on a switch running ONIE
- 2. Installing Cumulus license on a switch running Cumulus Linux NOS
- 3. Re-installing or upgrading a switch with Cumulus Linux NOS

The following items and access will be required:

- 1. Binary installation file for Cumulus
- 2. Valid license file for Cumulus
- 3. Control server: Linux Ubuntu system with Ansible installed (Ubuntu 16.04.04 verified)
- 4. HTTP server: Server accessible via http:// URL for installation of binary and license files (can be run on control server)
- 5. Target Switch: Agema AG7648
- 6. Console access to the switch will be helpful to see changes as they are run
- 7. Switch, control system, and http server must be on same network

# **Pre-install connectivity and Setup**

# Network and Systems required

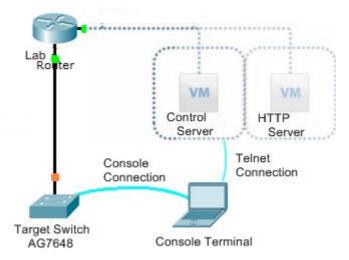
The basic systems required for building and running Ansible playbooks consist of the following:

Control Server – Linux server that runs Ansible and contains playbooks.

Target Switch – Switch that is to be configured running ONIE and may be many.

Web Server – HTTP location where update, license, and install files are located.

Console Terminal – PC with console connection to switch and telnet to control server.



Network Diagram

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Note: Please reference <u>Getting Started with Ansible</u> for additional details on system, switch, and server setups.

### Configure Ansible on Control server:

You can configure Ansible (Ubuntu) via the PPA with the following commands:

```
$ sudo apt-get update
$ sudo apt-get install software-properties-common
$ sudo apt-add-repository ppa:ansible/ansible
$ sudo apt-get update
$ sudo apt-get install ansible
```

Verify Ansible is installed with:

\$ ansible -version

Configuration should look something like this

```
root@DPR-LABVM-01:/etc/ansible# ansible --version
ansible 2.5.0
config file = /etc/ansible/ansible.cfg
configured module search path = [u'/root/.ansible/plugins/modules', u'/usr/share/ansible/plugins/modules']
ansible python module location = /usr/lib/python2.7/dist-packages/ansible
executable location = /usr/bin/ansible
python version = 2.7.12 (default, Dec 4 2017, 14:50:18) [GCC 5.4.0 20160609]
root@DPR-LABVM-01:/etc/ansible#

Connected to 10.62.10.22

aes128-ctr - hmac-shal - not 108x42
```

# Switch ready state:

The target switch should be installed with the management port on the back of the switch connected to the local network and an IP assigned to the switch. A console connection should also be defined so that switch status can be monitored (see below). The console terminal should have the following prompt if ONIE is installed correctly:

```
ONIE:#
```

Note: ONIE release verified for this installation is 20170416-onie-recovery-x86\_64-delta\_ag7648-r0.iso

If ONIE is in discovery mode it will try to look for NOS installers in predefined locations. To stop this you can use the command:

```
ONIE: # onie-dicovery-stop
```



#### Create HTTP server:

HTTP server can be a stand-alone web server that you can place files on or you can create a simple http server on your control server. To do this execute the following in a directory to keep binary, config, and license files such as "install" directory:

```
$ mkdir /root/cumulus
$ cd /root/cumulus
$ python2 -m SimpleHTTPServer 80 &
```

Place your Cumulus binary installation file and license file via ftp/sftp/tftp/scp/etc in the working directory. It should be visible by a browser on the local network at URL:

```
http://[control server IP/Name]/
```

You should see similar files when connected to this URL with a browser:

```
cumulus-linux-3.5.0-bcm-amd64.bin
cumulus license.txt
```

### Console terminal:

Configure the console terminal connection to the switch as follows:

- 1. Connect the console port of the switch to a PC. Most switches come with a RJ45 console port. Use a RJ45-to-serial cable or an RJ45-to- USB cable to connect to a PC.
- 2. Use a terminal application; such as "Tera Term" to terminal connect. Configure the console port with these settings:
  - 115200 baud
  - No flow control
  - stop bit
  - No parity bits
  - 8 data bits
- 3. Connect MGMT port of the switch to the same sub-net as terminal station

# **Ansible and Playbooks**

Ansible is configured to work within a defined structure with dependencies on configuration file, hosts file, playbooks, and scripts. These are defined on the control server. For this guide the following network configurations are being used:

Control server assigned IP: 10.62.10.22 (hostname: DPR-LABVM-01)

HTTP server assigned IP: 10.62.10.22 (SimpleHTTPServer defined on control server)

Target switch assigned IP: 10.62.10.34

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The ansible directory to work from can be created in any location on the control server. For this guide we are using the /etc/ansible directory and running as root. Non root accounts can be used as well but should have sudo access in order to run most commands.

## Reguried files and execution:

```
ansible.cfg
```

definition and configuration file - using default config file for these playbooks

hosts

definition and configuration file - target switch and other systems defined in hosts file

roi.cfg

variable definition file - used for dependencies in roi.sh script

roi.sh

script for ssh command - called from Ansible for remote-onie-install.yml playbook

remote-onie-install.yml

YAML playbook executed by Ansible for install on switch running ONIE only

cumulus-install.yml

YAML playbook executed by Ansible for re-installing/upgrade of cumulus NOS

cumulus-lic-install.yml

YAML playbook executed by Ansible to install cumulus license file on switch

# Directory structure, root user, cumulus user, and permissions:

```
root@DPR-LABVM-01:/etc/ansible# ls -al
total 64
drwxr-xr-x  3 root root  4096 Apr 15 23:45 .
drwxr-xr-x 99 root root  4096 Apr  7 12:29 ..
-rw-r--r--  1 root root  19342 Apr 15 23:23 ansible.cfg
-rw-r--r--  1 root root  646 Apr 15 23:23 cumulus-install.yml
-rw-r--r--  1 root root  477 Apr 15 23:23 cumulus-lic-install.yml
-rw-r--r--  1 root root  431 Apr 15 23:23 hosts
-rw-r--r--  1 root root  4284 Apr 15 23:45 Readme.md
-rw-r--r--  1 root root  126 Apr 15 23:23 remote-onie-install.yml
-rw-r--r--  1 root root  395 Apr 15 23:23 roi.cfg
-rwxr-xr-x  1 root root  708 Apr 15 23:23 roi.sh
root@DPR-LABVM-01:/etc/ansible#
```



# Ansible commands to execute playbooks:

1. Install Cumulus NOS on switch running ONIE:

```
ansible-playbook remote-onie-install.yml --ask-pass
```

Playbook contains the following:

```
- hosts: localhost
  become: yes
  tasks:
  - name: Execute script
  command: '/bin/bash /etc/ansible/roi.sh'
```

The roi.sh script contains the following:

```
#!/bin/bash
  Copyright (C) 2018 Ron Wilhelmson <ron.wilhelmson@deltaww.com>
#
##
## remote-onie-install
## History: 12APR2018 Ron.Wilhelmson Initial Creation
# Dependencies: roi.cfg in same directory
# Set environment variables from roi.cfg for switch and server names/IPs
source ./roi.cfg
echo ""
echo "Target switch set to: $target_switch"
echo "HTTP server set to: $http_server"
echo ""
echo "Sending install command to switch"
/usr/bin/ssh -a -l root $target_switch /bin/onie-nos-install
http://"$http_server"/cumulus-linux-3.5.0-bcm-amd64.bin
echo "Waiting for onie to download and install"
```



```
sleep 60
echo "Rebooting switch"
/usr/bin/ssh -l root $target switch /sbin/reboot
The roi.cfg file contains the following:
  Copyright (C) 2018 Ron Wilhelmson <ron.wilhelmson@deltaww.com>
#
## remote-onie-install variable definitions
## History: 12APR2018 Ron.Wilhelmson Initial Creation
# Reliancies: roi.sh
# target_switch is the switch that NOS is being installed on
target switch=10.62.10.37
# http_server is the URL server where the NOS bin and license files are
located
http server=10.62.10.22
Playbook execution and output:
root@DPR-LABVM-01:/etc/ansible# ansible-playbook remote-onie-install.yml --
ask-pass
SSH password:
PLAY [localhost]
***********************************
************
TASK [Gathering Facts]
**************************
***********
ok: [localhost]
TASK [Execute script]
*************************
***********
```





```
The authenticity of host '10.62.10.34 (10.62.10.34)' can't be established.
RSA key fingerprint is SHA256:gqcwYNeppYieB0SnoypbqyW9i5dNfNakWxZEndHLY3o.
Are you sure you want to continue connecting (yes/no)? yes
10.62.10.34 - - [16/Apr/2018 00:36:02] "GET /cumulus-linux-3.5.0-bcm-
amd64.bin HTTP/1.1" 200 -
10.62.10.34 - - [16/Apr/2018 00:36:13] code 404, message File not found
10.62.10.34 - - [16/Apr/2018 00:36:13] "GET /cumulus-linux-3.5.0-bcm-
amd64.bin.preseed HTTP/1.1" 404 -
10.62.10.34 - - [16/Apr/2018 00:36:13] code 404, message File not found
10.62.10.34 - - [16/Apr/2018 00:36:13] "GET /cumulus-linux-3.5.0-bcm-
amd64.bin.ztp HTTP/1.1" 404 -
changed: [localhost]
PLAY RECAP
***********************************
localhost
                                   changed=1 unreachable=0
                                                               failed=0
                         : ok=2
```

root@DPR-LABVM-01:/etc/ansible#

The nos-install utility attempts to download .preseed and .ztp files with the .bin image but in this case they are not being used and therefore get a "code 404, message File not found" which is normal in this case.

The switch console will display the following output:

```
COM4 - Tera Term VT
                                                                                                                                                                                                                              _ - X
File Edit Setup Control Window Help
   opping: discover... done.

IE: Executing installer: <a href="http://10.62.10.22/cumulus-linux-3.5.0-bcm-amd64.bin">http://10.62.10.22/cumulus-linux-3.5.0-bcm-amd64.bin</a>

Prifying inage checksum ... OK.

Prifying inage archive ... OK.

Prifying system ram ... OK.

Prifying system ram ... OK.

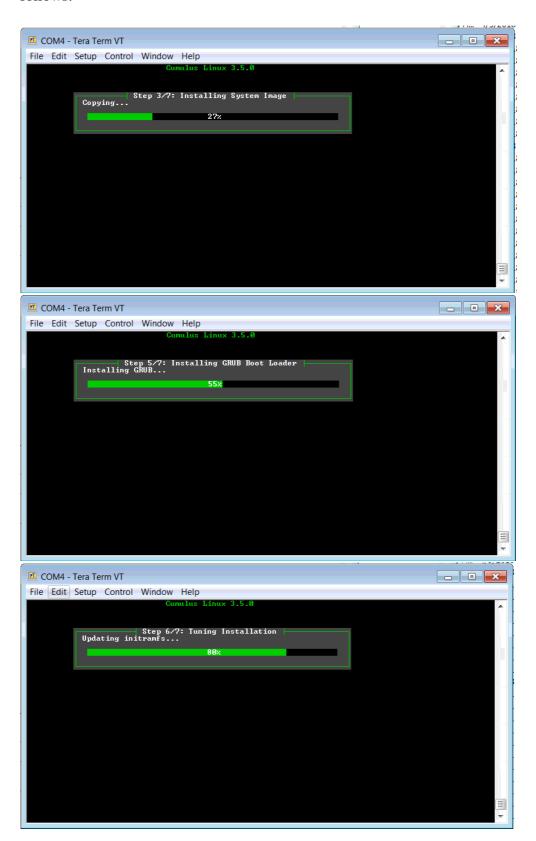
Prifying up installer ... Info: The full install log is located at /tmp/ei_runlog.XXCUptkS

NK.
        ase reboot to start installing OS.
```



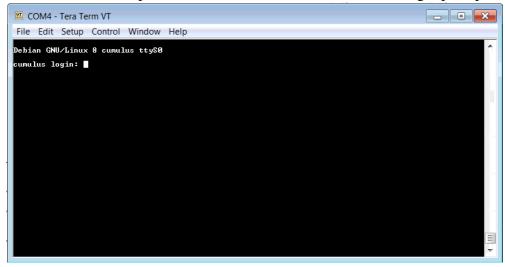


The switch will automatically reboot and install update screens will be displayed as follows:





Once the install completes the console will show the cumulus login prompt:



2. Re-install/Upgrade Cumulus NOS on switch running Cumulus NOS:

```
ansible-playbook cumulus-install.yml -k -K
cumulus-install.yml contains the following:
- hosts: switches
  connection: ssh
  remote_user: cumulus
  become: yes
  gather_facts: yes
  vars:
    http_server: 10.62.10.22
    install_file: http://{{ http_server }}/cumulus-linux-3.5.0-bcm-
amd64.bin
  tasks:
    - name: onie-nos-install Cumulus Linux NOS
      become-method: sudo
      shell: 'onie-install -f -a -i {{ install_file }}'
      tags: onie_nos_install
      notify:
        - snooze
    - name: reboot switch
      become-method: sudo
      command: 'reboot -f'
      notify:
        - wait for switch to come back up
```



#### handlers:

- name: snooze

```
local action:
  module: wait_for
    host=switches
    port=22
    delay=20
    timeout=300
    state=started
- name: wait for switch to come back up
 local_action: wait_for host=switches port=22 delay=20
           state=started
 become: false
 Playbook execution and output:
 root@DPR-LABVM-01:/etc/ansible# ansible-playbook cumulus-install.yml
 -k -K
 SSH password:
 SUDO password[defaults to SSH password]:
  [WARNING]: Ignoring invalid attribute: become-method
 PLAY [switches]
 **************************
 ***************
 TASK [Gathering Facts]
 **********************
 ************
 ok: [10.62.10.34]
 TASK [onie-nos-install Cumulus Linux NOS]
 ***********************
 *********
 10.62.10.34 - - [16/Apr/2018 04:19:39] "GET /cumulus-linux-3.5.0-
 bcm-amd64.bin HTTP/1.1" 200 -
 changed: [10.62.10.34]
 TASK [reboot switch]
 *************
 ***********************
 ****************
 localhost
                     : ok=2
                             changed=1
                                      unreachable=0
 failed=0
 root@DPR-LABVM-01:/etc/ansible#
```



#### Console screen output:

```
COM4 - Tera Term VT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 - - X
  File Edit Setup Control Window Help
Loading Linux 4.1.8-cl-6-amd64 ...
Loading initial randisk ...
[ 0.0702911 PCI: MMCONFIG has no entries [ 0.0859531 PCI: MMCONFIG has no entries [ 2.3261651 i8042: No controller found Loading, please wait... Scanning for Btrfs filesystems
                                           Expecting device dev-tty80.device...
Reached target Remote File Systems (Pre).
Set up automount Arbitrary Executable File Formats F...utomount Point.
Reached target Swap.
Expecting device dev-disk-by\x2duuid-1599d898\x2d079...fcead.device...
Created slice Root Slice.
Created slice User and Session Slice.
Listening on /dev/initcl Compatibility Named Pipe.
Listening on Delayed Shutdown Socket.
Listening on Journal Socket (/dev/log).
Listening on LUI2 metadata daemon socket.
Listening on Device-mapper event daemon FIFOs.
Listening on udev Control Socket.
Listening on udev Kernel Socket.
Listening on Journal Socket.
Created slice System Slice.
Starting Increase datagram queue length...
Mounting Huge Pages File System...
Starting Create list of required static device nodes..rrent kernel...
Created slice system-serial\x2dgetty.slice.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             - - X
  COM4 - Tera Term VT
                                                                     tup Control Window Help

ted /etc/rc.local Compatibility.

ted Permit User Sessions.

ted Initialize hardware monitoring sensors.

ted System Logging Service.

ted was dead of the service.

ted Machine Check Exception Logging Daemon.

ted Machine Check Exception Logging Daemon.

ted Machine Check Exception Logging Daemon.

ted Gunulus Linux System Monitoring Daemon.

ted Cumulus Linux System Monitoring Daemon.

ted Cumulus Linux LED Manager Daemon.

ted Cumulus Linux LED Manager Daemon.

ted Cumulus Linux EAD Monager Daemon.

ted Cumulus Linux Fan Control Daemon.

ting Cumulus Linux Fan Control Daemon.

ting MSTP Daemon.

ted MSTP Daemon.

ted MSTP Daemon.

ting MSTP bridge configuration..

ting Cumulus Linux ZTP init and state capture

ting Cumulus Linux switch port setup...

ted A high performance web server and a rever

ted Login Sawwice
  File Edit Setup Control Window Help
COM4 - Tera Term VT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 _ D X
File Edit Setup Control Window Help
                                                   Setup Control Window Help

Reached target Network is Online.

starting NIP - Network Time Protocol daemon...

starting NIP - Network Time Protocol daemon...

starting NIP - Network Time Protocol daemon...

starting Prescriptive Topology Manager (PIM) Daemon...

starting Prescriptive Topology Manager (PIM) Daemon...

starting LSB: start and stop ptpd...

starting (null)...

starting Sumulus Linux Multi-Chassis LACP Bonding Daemon...

starting Cumulus Linux ZIP...

starting Cumulus Linux ZIP...

starting OpenBSD Secure Shell server...

starting Serial Getty on ttySB...

starting Serial Getty on ttySB...

started LDP daemon.
                                                                                                                    daemon.
start and stop ptpd.
Launch atftpd server.
Lus Linux Multi-Chassis LACP Bonding Daemon.
                                           Started (null).
Reached target Multi-User System.
Starting Bootlog Service...
Starting Update UTMP about System Runlevel Changes...
Started Update UTMP about System Runlevel Changes...
Started Bootlog Service.
      ebian GNU/Linux 8 cumulus ttySØ
```



#### 3. Install Cumulus license file:

ansible-playbook cumulus-lic-install.yml --ask-sudo-pass cumulus-lic-install.yml contains the following:

```
- hosts: switches
 connection: ssh
 remote_user: cumulus
 become: yes
 gather_facts: yes
 vars:
    http_server: 10.62.10.22
    license_file: http://{{ http_server }}/cumulus-linux-3.5.0-bcm-
amd64.bin
 tasks:
  - name: Download and install license for Cumulus Linux NOS
    become-method: sudo
    shell: 'cl-license -i {{ license_file }}'
    tags: cl-install
  - name: restart switchd service
    become-method: sudo
    shell: 'systemctl restart switchd.service'
    tags: restart-switchd
        Note 1: sudo password for default cumulus user on cumulus NOS is:
CumulusLinux!
        Note 2: ONIE root user password is: <none> enter return
        Note 3: -vvv and -vvvv are sometimes useful as they extend the
level of verbose reporting through execution
```



# SSH Host Keys – Issues and Updates

The following shows how to copy ssh host keys from the control server to the switch if required. The first time the control server tries to connect to the switch may generate an error message in the playbook output containing a message similar to the following:

#### First try to copy the host keys from the control server to the switch as follows:

```
root@DPR-LABVM-01:/etc/ansible# ssh-copy-id cumulus@10.62.10.34
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed:
"/root/.ssh/id rsa.pub"
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to
filter out any that are already installed
/usr/bin/ssh-copy-id: ERROR:
ERROR: @ WARNING: REMOTE HOST IDENTIFICATION HAS CHANGED!
ERROR: IT IS POSSIBLE THAT SOMEONE IS DOING SOMETHING NASTY!
ERROR: Someone could be eavesdropping on you right now (man-in-the-middle
attack)!
ERROR: It is also possible that a host key has just been changed.
ERROR: The fingerprint for the ECDSA key sent by the remote host is
ERROR: SHA256:jxfw26hjERJ0NxURlRfj70redK/tQTSdq90gp2bXDjc.
ERROR: Please contact your system administrator.
ERROR: Add correct host key in /root/.ssh/known hosts to get rid of this
ERROR: Offending ECDSA key in /root/.ssh/known hosts:4
ERROR: remove with:
ERROR: ssh-keygen -f "/root/.ssh/known hosts" -R 10.62.10.34
ERROR: ECDSA host key for 10.62.10.34 has changed and you have requested
strict checking.
ERROR: Host key verification failed.
```

### If the above error occurs you need to generate new ssh keys for the new ID as follows:

```
root@DPR-LABVM-01:/etc/ansible# ssh-keygen -f "/root/.ssh/known_hosts" -R
10.62.10.34
# Host 10.62.10.34 found: line 4
/root/.ssh/known_hosts updated.
Original contents retained as /root/.ssh/known hosts.old
```





#### Then the ssh-copy-id should be executed again to update the key entry:

root@DPR-LABVM-01:/etc/ansible# ssh-copy-id cumulus@10.62.10.34
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed:
"/root/.ssh/id\_rsa.pub"
The authenticity of host '10.62.10.34 (10.62.10.34)' can't be established.
ECDSA key fingerprint is
SHA256:jxfw26hjERJ0NxURlRfj70redK/tQTSdq90gp2bXDjc.
Are you sure you want to continue connecting (yes/no)? yes
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to
filter out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are
prompted now it is to install the new keys
cumulus@10.62.10.34's password:

Number of key(s) added: 1

Now try logging into the machine, with: "ssh 'cumulus@10.62.10.34'" and check to make sure that only the key(s) you wanted were added.

root@DPR-LABVM-01:/etc/ansible#



## **Example Playbooks and Projects:**

The following git repository has example playbooks created for this guide and other applications that may be useful:

https://github.com/DeltaProducts/Getting-Started-with-Ansible

#### **References:**

Ansible User Guide

http://docs.ansible.com/ansible/devel/user\_guide/intro\_getting\_started.html

Ansible Installation Guide

http://docs.ansible.com/ansible/latest/installation\_guide/intro\_installation.html

Ansible ansible-playbook Guide:

https://docs.ansible.com/ansible/2.4/ansible-playbook.html

**Ansible Commands** 

http://docs.ansible.com/ansible/latest/modules/list of commands modules.html

**Ansible Modules** 

http://docs.ansible.com/ansible/latest/modules/list of all modules.html

Tera Term Guide

https://ttssh2.osdn.jp/index.html.en

Open Network Install Environment (ONIE) Installation Guide

 $\frac{https://github.com/DeltaProducts/SolutionCenter/blob/master/ONIE\%20recovery\%20}{from\%20bootable\%20USB.pdf}$ 

Apache Web Server Setup Guide

https://www.digitalocean.com/community/tutorials/how-to-install-the-apache-web-server-on-ubuntu-16-04