Cumulus Linux NOS installation with Ansible

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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

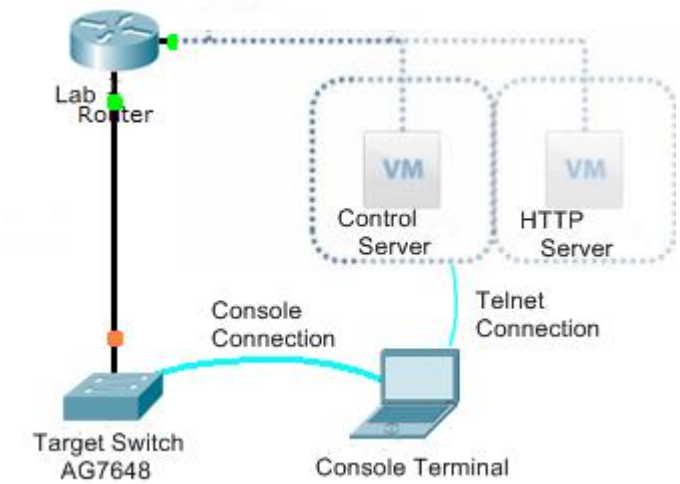
The basic systems required for building and running Ansible playbooks consist of the following:

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

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

Configure Ansible on Control server:

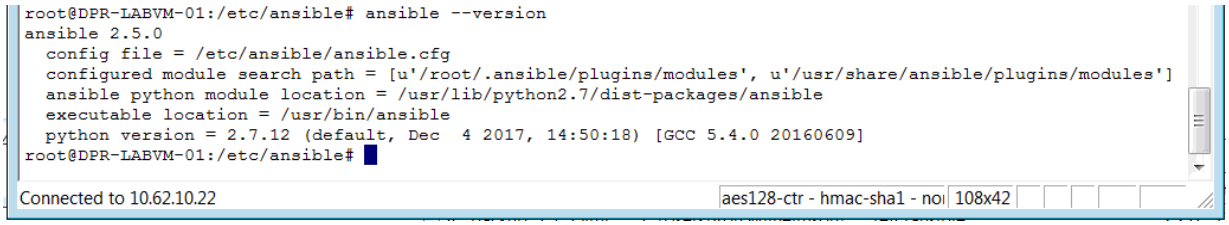
You can configure Ansible (Ubuntu) via the PPA with the following commands:

```
$ 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



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

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 ""
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
```

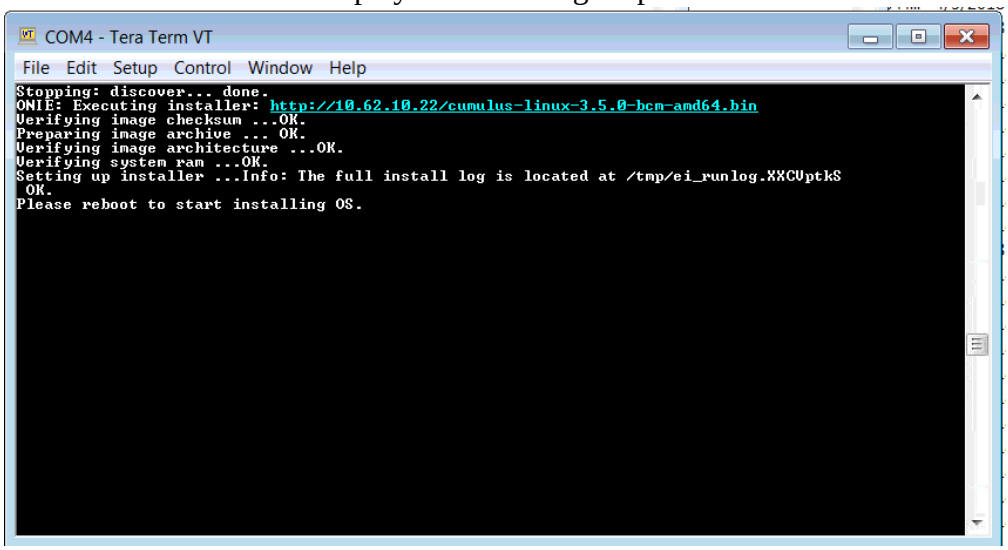
Playbook execution and output:

```
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]
*********************************************************************
**********************************
```

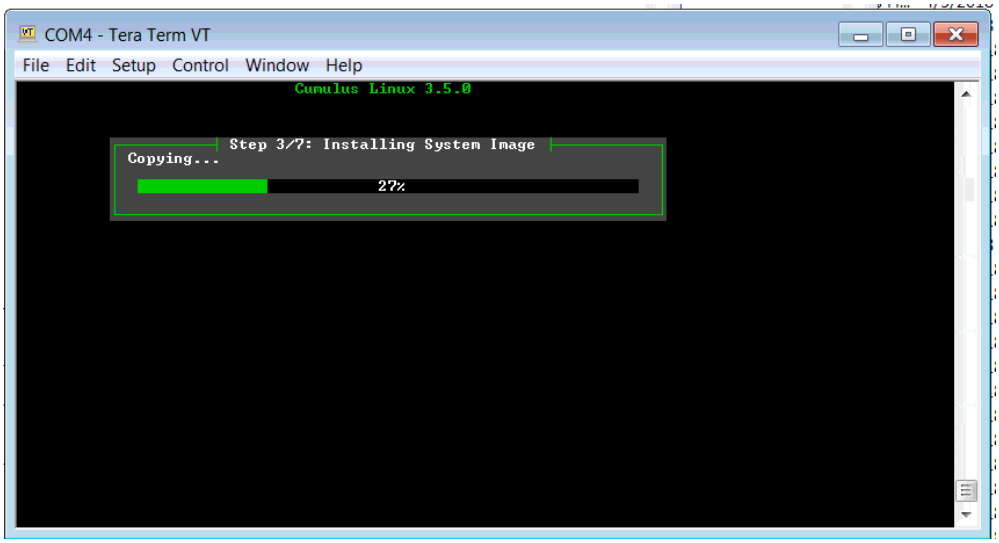
```
The authenticity of host '10.62.10.34 (10.62.10.34)' can't be established.
RSA key fingerprint is SHA256:gqcwYNeppYieB0SnoypbqyW9i5dNfNakWxZEndHLY3o.
Are you sure you want to continue connecting (yes/no)? yes
10.62.10.34 - - [16/Apr/2018 00:36:02] "GET /cumulus-linux-3.5.0-bcm-
amd64.bin HTTP/1.1" 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                  : ok=2    changed=1    unreachable=0    failed=0

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

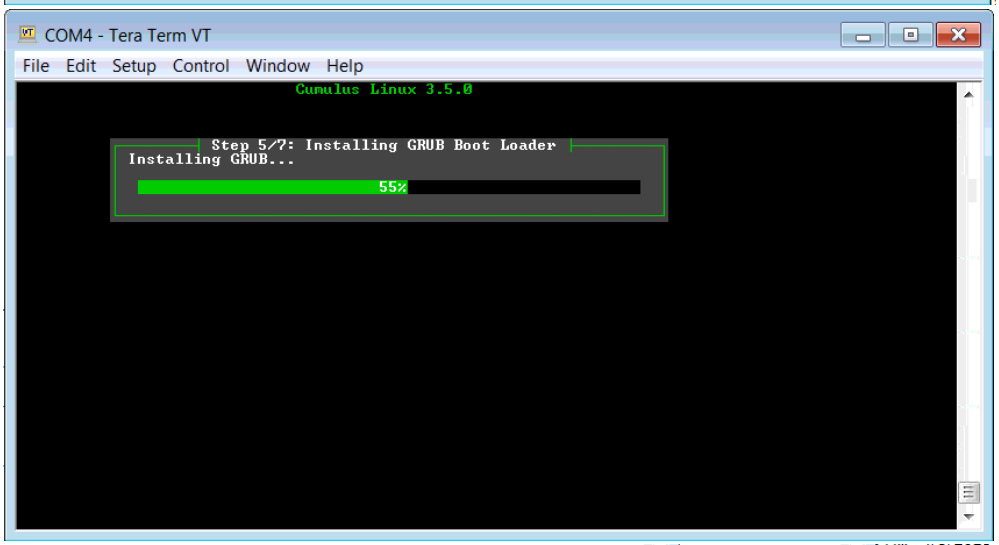
The nos-install utility attempts to download .preseed and .ztp files with the .bin image but in this case they are not being used and therefore get a “code 404, message File not found” which is normal in this case.

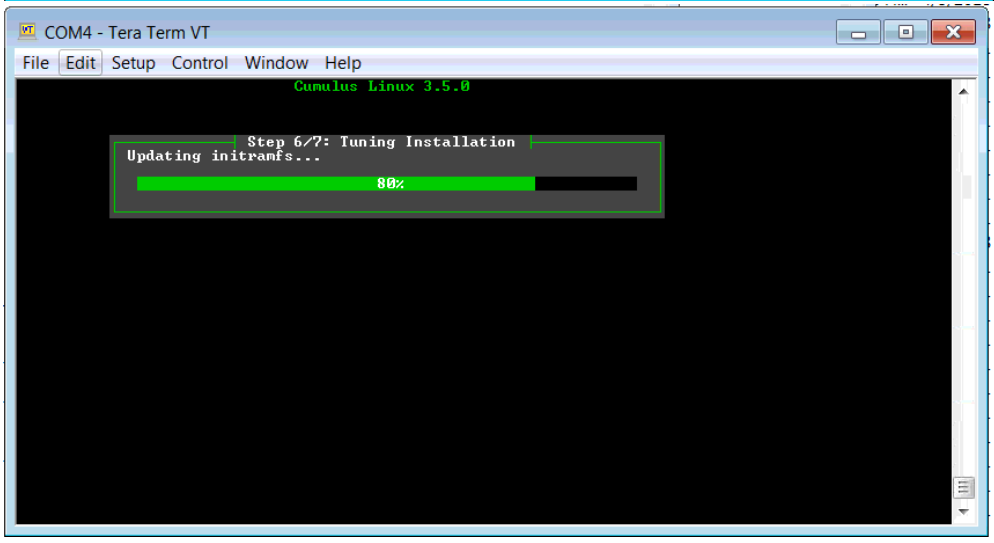
The switch console will display the following output:



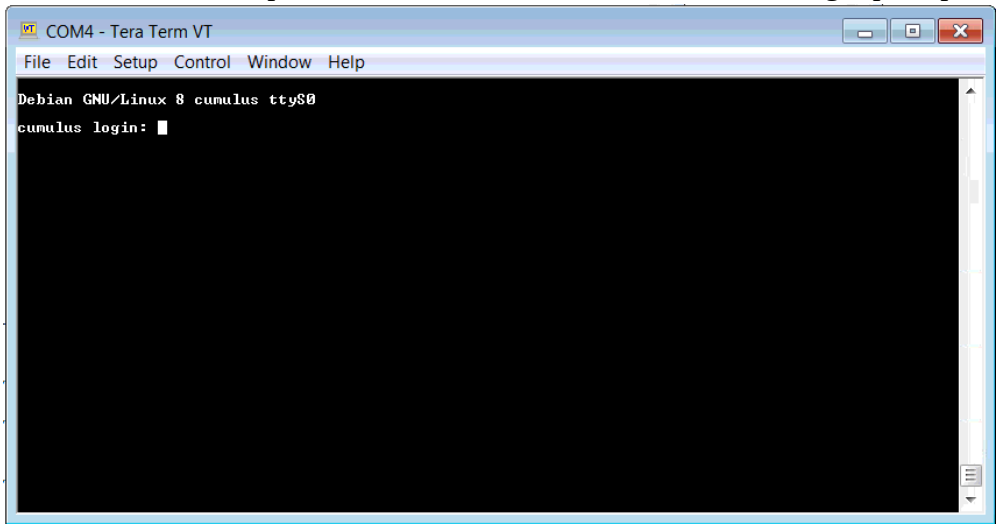
The switch will automatically reboot and install update screens will be displayed as follows:







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:

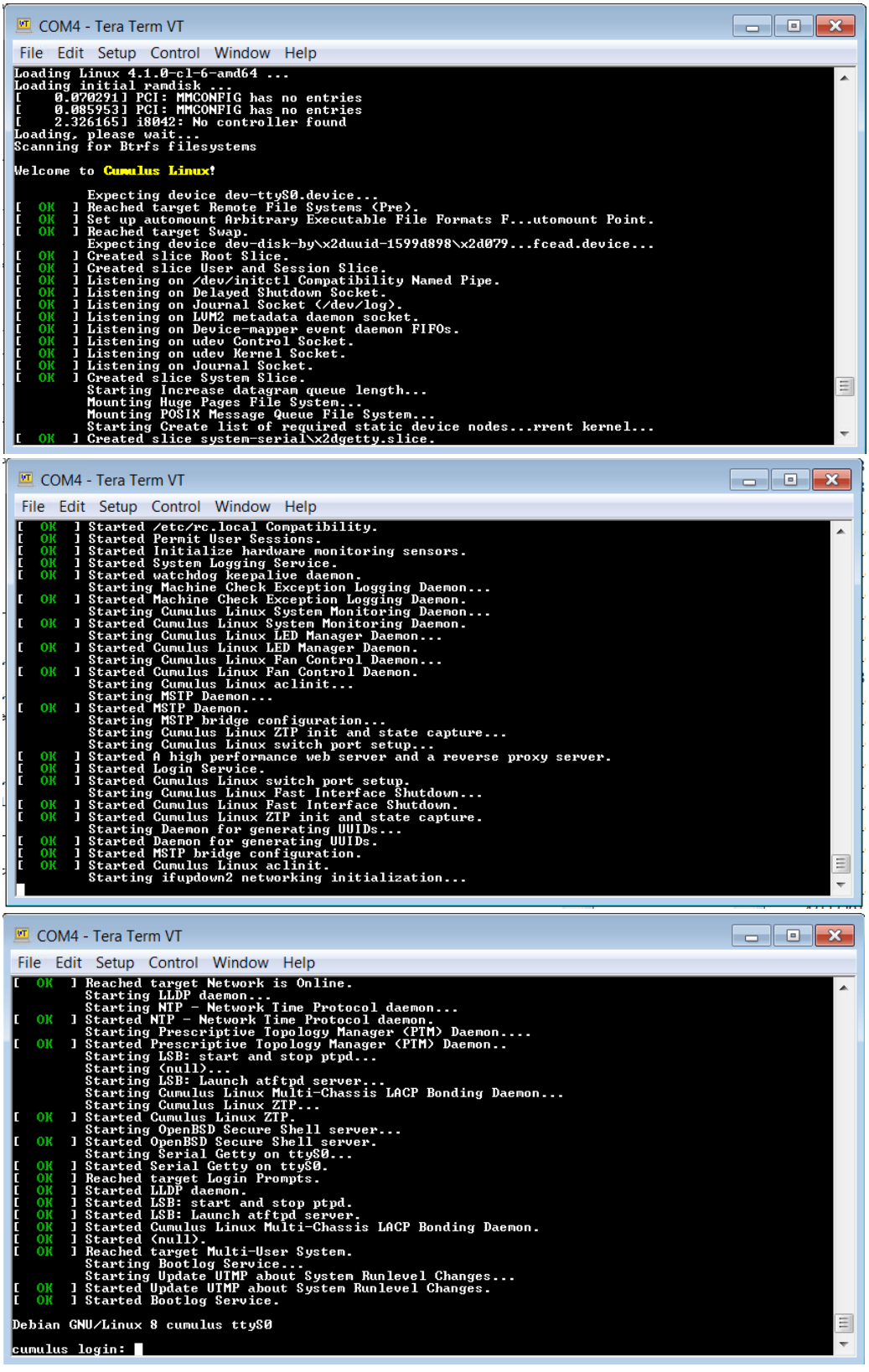
```
---

- 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]
*********************************************************************
*****************************************
PLAY RECAP
*********************************************************************
*************************************************
localhost                  : ok=2    changed=1    unreachable=0
failed=0

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

Console screen output:



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:

```
"Failed to connect to the host via ssh:
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@\r\n@
WARNING: REMOTE HOST IDENTIFICATION HAS CHANGED!
@\r\n@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@\r\n
```

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: @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
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
message.
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

https://github.com/DeltaProducts/SolutionCenter/blob/master/ONIE%20recovery%20from%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