Abstract

The main motivation of this project is to research a better way to approach the problem of configuring multiple routers and switches at the same time and improve the management of network devices. The requirement was reached by creating a script using python that automates the configuration of routers, switches, and AP. The automation of networks simplifies the work of a Network Engineer. Although such script has some security issues due to the use of an excel sheet that includes all the sensitive information all of the routers, switches, and AP that the network engineer wants to automate.

Design: The design of the script in python was possible with the use of a library named Netmiko/Paramiko which makes possible an SSH/Telnet connection to the network devices such as the router used for this project (Cisco Catalyst 3500)

Netmiko/Paramiko: Paramiko is a Python (2.6+, 3.3+) implementation of the SSHv2 protocol, providing both client and server functionality. While it leverages a Python C extension for low level cryptography (PyCrypto), Paramiko itself is a pure Python interface around SSH networking concepts. Netmiko is a Multi-vendor library to simplify Paramiko SSH connections to network devices.

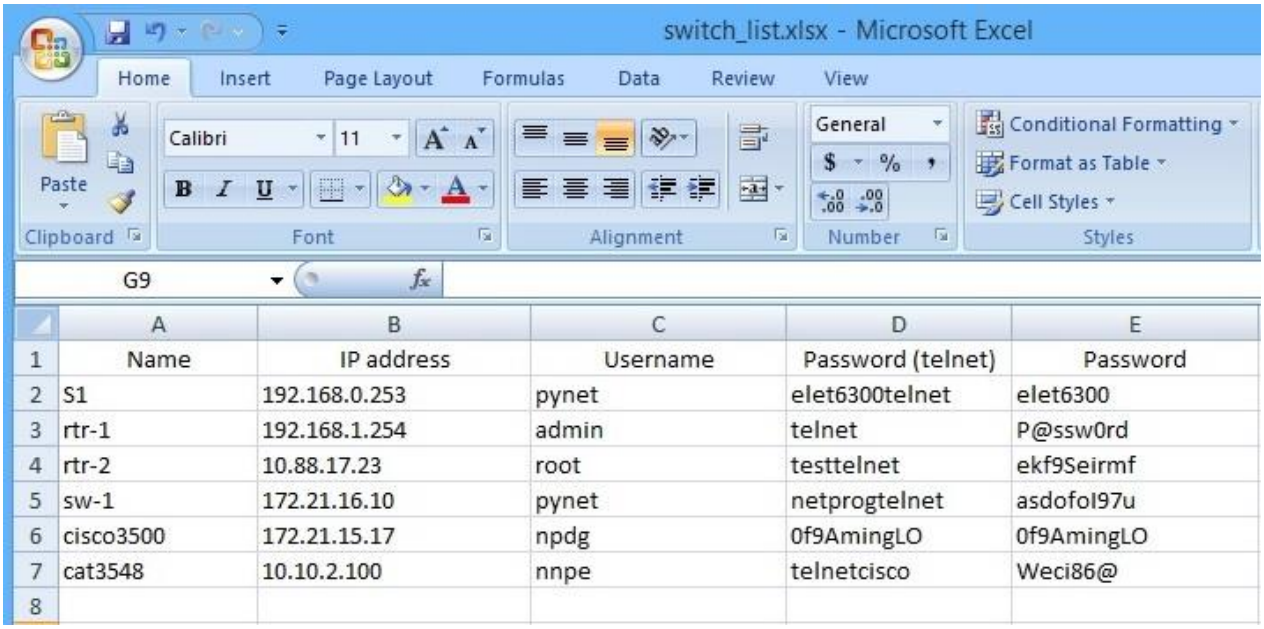
Router
The router used, Catalyst 3500 series is a scalable line of stackable 10/100 and Gigabit Ethernet switches that delivers premium performance, manageability, and flexibility.
Features:

- Ports Qty - 48 x Ethernet 10Base-T, Ethernet 100Base-TX
- Data Transfer Rate- 100 Mbps
- Data Link Protocol- Ethernet, Fast Ethernet, Gigabit Ethernet
- Remote Management Protocol- SNMP, RMON
- Connectivity Technology- Wired
- Communication Mode- Half-duplex, full-duplex
- Switching Protocol- Ethernet

XLRD Module: A python module to provide library for developers for extracting data from Microsoft Excel spreadsheet files. It is not an end-user tool. The package itself is pure python with no dependencies on modules or packages outside the standard Python distribution. xlrd is a package for reading data and formatting information from older Excel files (.xls). openpyxl and xlsxwriter are the altervative packages for newer version of Excel (.xlsx)

Once when the main program starts, it automatically loads all switches information from a Microsoft Excel file including Name, IP address, Username and Password. The users can choose either to send configurations to or to retrieve data from a specific switch/router using a telnet connection. Users do not have to login manually to their data. All that is required is an Excel file that stores authentication data for all managing boxes.

Here's the example of switch list file:



	A	B	C	D	E
1	Name	IP address	Username	Password (telnet)	Password
2	S1	192.168.0.253	pynet	elet6300telnet	elet6300
3	rtr-1	192.168.1.254	admin	telnet	P@ssw0rd
4	rtr-2	10.88.17.23	root	testtelnet	ekf9Seirmf
5	sw-1	172.21.16.10	pynet	netprogtelnet	asdofoI97u
6	cisco3500	172.21.15.17	npdg	0f9AmingLO	0f9AmingLO
7	cat3548	10.10.2.100	nnpe	telnetcisco	Weci86@
8					

Configuration: All files, Python scripts and an Excel file, have to be in the same folder. Open Command Prompt for Windows or Terminal for Mac/Linux. Go to the folder where files locate. Then run this command:

```
python main_program.py
```

Program Demo:

As the program starts, the list of authentication information of the managing boxes is loaded, and the program asks users to select device.

```
C:\Users\NEW\Desktop\Project>python main_program.py

Network Devices List
1. Name: S1,     IP: 192.168.0.253
2. Name: rtr-1,  IP: 192.168.1.254
3. Name: rtr-2,  IP: 10.88.17.23
4. Name: sw-1,   IP: 172.21.16.10
5. Name: cisco3500,      IP: 172.21.15.17
6. Name: cat3548,        IP: 10.10.2.100
Select device: _
```

After device selection, users have options to configure or retrieve data from the device.

```
C:\Users\NEW\Desktop\Project>python main_program.py

Network Devices List
1. Name: S1,    IP: 192.168.0.253
2. Name: rtr-1, IP: 192.168.1.254
3. Name: rtr-2, IP: 10.88.17.23
4. Name: sw-1,  IP: 172.21.16.10
5. Name: cisco3500,     IP: 172.21.15.17
6. Name: cat3548,       IP: 10.10.2.100
Select device: 1

Name: S1,       IP: 192.168.0.253

########################################
#        Cisco Configuration           #
# 1. Hostname                          #
# 2. Username and password             #
# 3. IP address and default gateway    #
# 4. Interface                         #
# 5. Retrieve data                     #
# 6. Show all commands                 #
# 7. Apply configurations              #
# 8. Save configuration changes        #
# 9. Back to device selection          #
# 0. Exit                              #
########################################
Select:
```

Hostname: Change the device's name

```
C:\Users\NEW\Desktop\Project>python main_program.py

Network Devices List
1. Name: S1,    IP: 192.168.0.253
2. Name: rtr-1, IP: 192.168.1.254
3. Name: rtr-2, IP: 10.88.17.23
4. Name: sw-1,  IP: 172.21.16.10
5. Name: cisco3500,     IP: 172.21.15.17
6. Name: cat3548,       IP: 10.10.2.100
Select device: 1

Name: S1,       IP: 192.168.0.253

########################################
#        Cisco Configuration           #
# 1. Hostname                          #
# 2. Username and password             #
# 3. IP address and default gateway    #
# 4. Interface                         #
# 5. Retrieve data                     #
# 6. Show all commands                 #
# 7. Apply configurations              #
# 8. Save configuration changes        #
# 9. Back to device selection          #
# 0. Exit                              #
########################################
Select: 1

Enter hostname: cat3548_
```

Username and password: Change Username and Password

```
########################################
#        Cisco Configuration           #
# 1. Hostname                          #
# 2. Username and password             #
# 3. IP address and default gateway    #
# 4. Interface                         #
# 5. Retrieve data                     #
# 6. Show all commands                 #
# 7. Apply configurations              #
# 8. Save configuration changes        #
# 9. Back to device selection          #
# 0. Exit                              #
########################################
Select: 2

Enter username: pynet
Enter password: elet6300
```

IP address and default gateway: Assign IP address and Default Gateway to the device

```
########################################
#        Cisco Configuration           #
# 1. Hostname                          #
# 2. Username and password             #
# 3. IP address and default gateway    #
# 4. Interface                         #
# 5. Retrieve data                     #
# 6. Show all commands                 #
# 7. Apply configurations              #
# 8. Save configuration changes        #
# 9. Back to device selection          #
# 0. Exit                              #
########################################
Select: 3

Enter router/switch IP address (enter 'no' to disable): 192.168.0.253
Enter subnet mask (255.255.255.0): 255.255.255.0

Enter default gateway (enter 'no' to disable): 192.168.0.1
```

Interface: Configure interface including FastEthernet, GigabitEthernet, and VLAN

```
########################################
#        Cisco Configuration           #
# 1. Hostname                          #
# 2. Username and password             #
# 3. IP address and default gateway    #
# 4. Interface                         #
# 5. Retrieve data                     #
# 6. Show all commands                 #
# 7. Apply configurations              #
# 8. Save configuration changes        #
# 9. Back to device selection          #
# 0. Exit                              #
########################################
Select: 4

Select interface
1. FastEthernet
2. GigabitEthernet
3. VLAN
0. Go back
Select: 1

Select FastEthernet port (0/1 - 0/48): 0/1


FastEthernet0/1
1. Description
2. VLAN
3. 'spanning-tree portfast'
0. Back to main menu
Select:
```

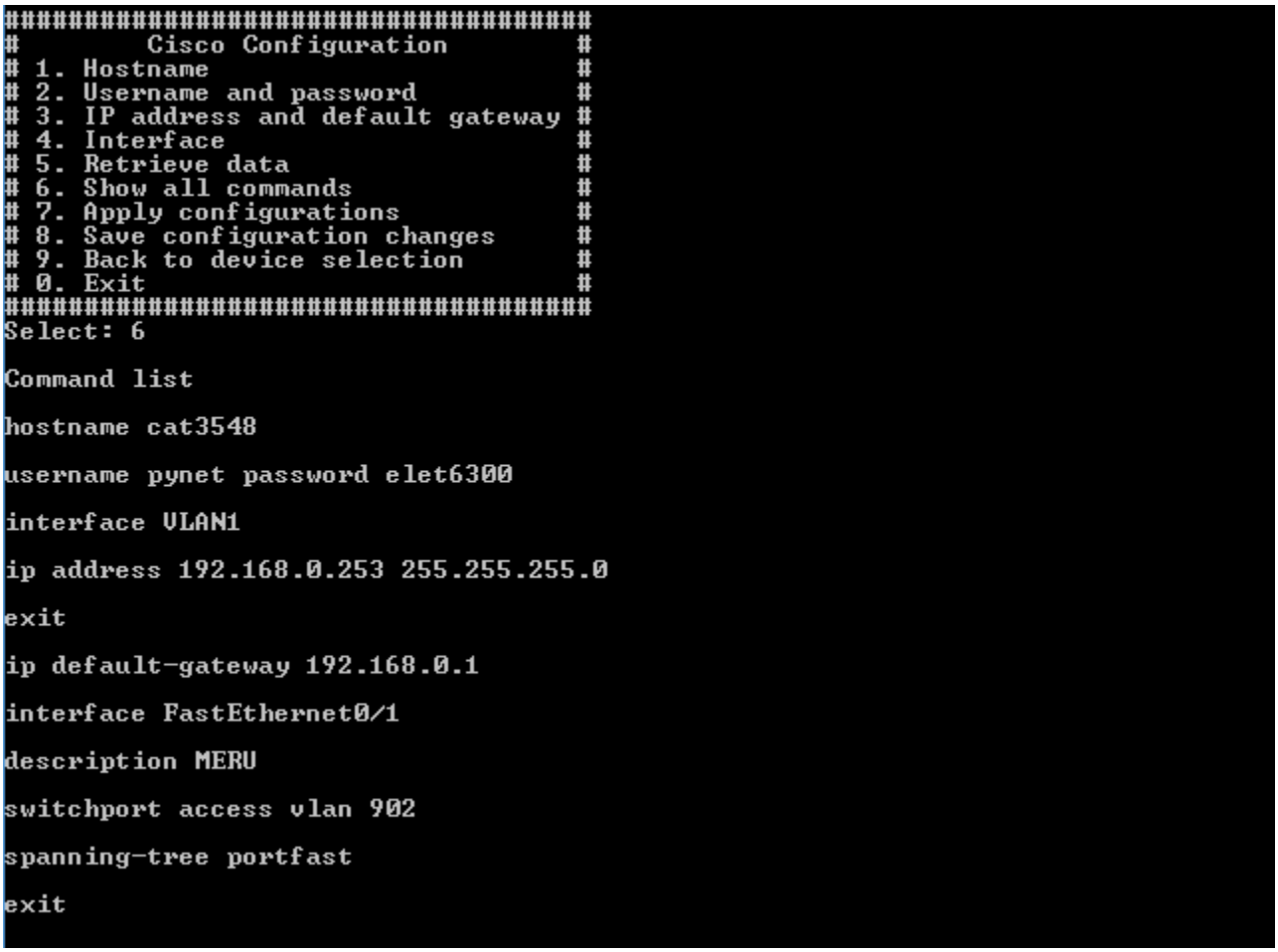
Retrieve data: Show data of the device.

There are four show commands: *show version*, *show running-config*, *show ip interface brief*, and *show vlan*

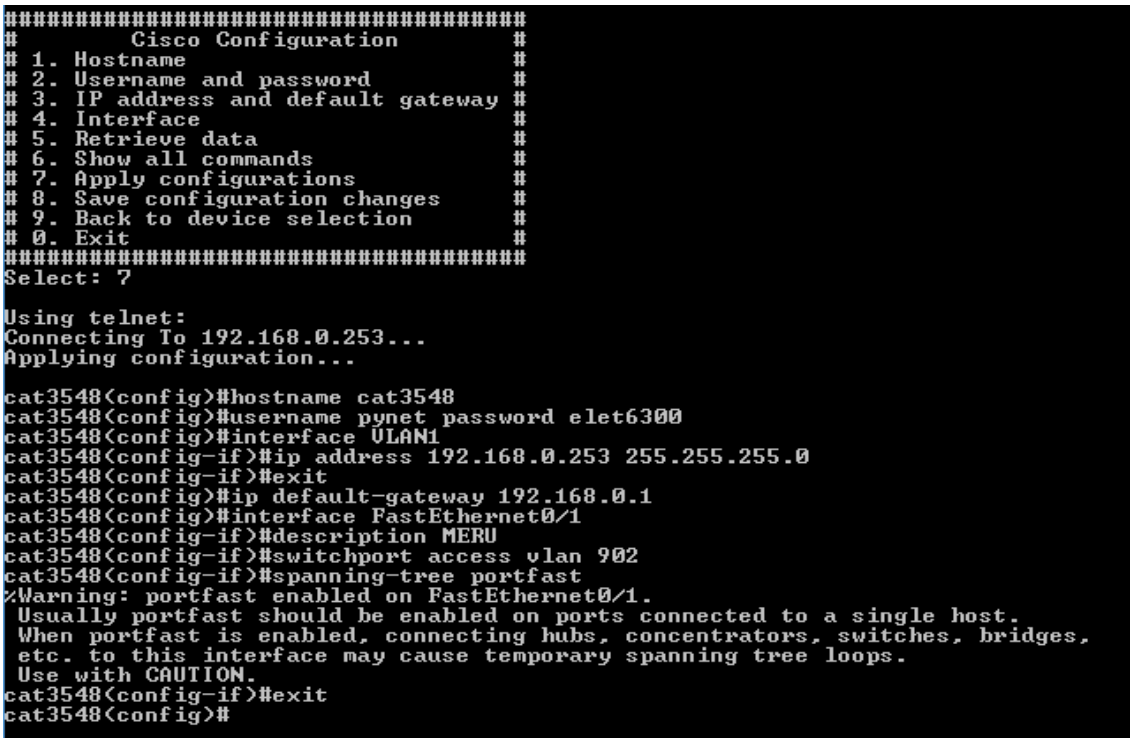
```
########################################
#        Cisco Configuration           #
# 1. Hostname                          #
# 2. Username and password             #
# 3. IP address and default gateway    #
# 4. Interface                         #
# 5. Retrieve data                     #
# 6. Show all commands                 #
# 7. Apply configurations              #
# 8. Save configuration changes        #
# 9. Back to device selection          #
# 0. Exit                              #
########################################
Select: 5

Select command
1. 'show version'
2. 'show show running-config'
3. 'show ip interface brief'
4. 'show vlan'
0. Back to main menu
Select: 2

Using telnet:
Connecting To 192.168.0.253...

cat3548#show running-config
Building configuration...

Current configuration:
!
version 12.0
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname cat3548
!
enable secret 5 $1$vCNQ$cFSrVR23pL2AfLfTlFlaI1
!
username pynet password 0 elet6300
!
!
!
!
!
ip subnet-zero
!
!
!
interface FastEthernet0/1
 description MERU
 switchport access vlan 902
 spanning-tree portfast
!
```

Show all commands: display all Cisco CLI commands that users have selected

Using option number 6, users are able to see all Cisco CLI commands before applying to the device.



Apply configurations: Send all Cisco CLI commands that users have selected to the device using Telnet



Save configuration changes: send *copy running-config startup-config* to the device

Back to device selection: go back to device selection menu

Exit: exit program.