Python for Networking Devices

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About Me

• Elisa Jasinska

• Automating large-scale networks for almost 10 years

• Past AMS-IX, LLNW, MSFT, NFLX

• Now freelance systems architect and software engineer @bigwaveit

• Github/Twitter @fooelisa

• For fun @symatenka
Network Engineering

• Ethernet, VLANs, ACLs, BGP, OSPF, ISIS, MPLS, EVPN, VXLAN, etc.

• Manage and maintain network infrastructure, switches, routers, firewalls, optical etc.
Network Engineering

- Lots of Manual Changes
- Mostly done via CLI
- Relying on Skilled Engineers
- Close to the Hardware
- Equipment either Bleeding Edge …or End-of-life
Glamorous!
Automation for Networks

- Monitoring Network State
- Alerting
- Telemetry (SNMP, NetFlow, sFlow)
- Troubleshooting
- Device Provisioning
- Service Provisioning
Facebook Defined Networking

- FBNet
- NetSonar
- Audit Framework
- Emitter
- One Detection
- NetNORAD
- Megazord
- Vendors
- Drain services
- Poltergeist
- Carrier Maintenance

Source: Facebook @ RIPE71, Dr. NMS
Router OS

- Juniper - JunOS
- Arista - EOS
- Cisco - IOS, IOS-XR, NXOS
- etc
Network Device Access

• CLI
  • line by line configuration -&gt; not transactional
• First Telnet
• Now SSH
Router Configurations

```
hostname ios-xrv-unittest-changed

interface MgmtEth0/0/CPU0/0
ipv4 address 192.168.56.202 255.255.255.0

interface GigabitEthernet0/0/0/0
ipv4 address 192.168.78.12 255.255.255.0

router bgp 65000
vrf test
   neighbor 1.1.1.2
      remote-as 1

vrf test2
   neighbor 2.2.2.3
      remote-as 2

ssh server v2
xml agent tty
lldp
end
```

```
interfaces {
    ge-0/0/0 {
        unit 0 {
            family inet {
                address 192.168.56.203/24;
            }
        }
    }
    ge-0/0/1 {
        unit 0 {
            family inet {
                address 192.168.77.11/24;
            }
        }
    }
    ge-0/0/1 {
        unit 0;
    }
}
protocols {
    lldp {
        interface all;
    }
}
```

Netconf

- Underlying SSH transport
- Transactions
- Structured Data
- Error Reporting
## Retrieve Data - Arista

```
eos.edgel>show arp
Address         Age (min)  Hardware Addr   Interface
10.220.88.1             0  001f.9e92.16fb  Vlan1, Ethernet1
10.220.88.21            0  1c6a.7aaf.576c  Vlan1, not learned
10.220.88.28            0  5254.00ee.446c  Vlan1, not learned
10.220.88.29            0  5254.0098.69b6  Vlan1, not learned
10.220.88.30            0  5254.0092.13bb  Vlan1, not learned
10.220.88.38            0  0001.00ff.0001  Vlan1, not learned
```
Retrieve Data - Juniper

root@qfx.edge1> show arp

<table>
<thead>
<tr>
<th>MAC Address</th>
<th>Address</th>
<th>Name</th>
<th>Interface</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:1f:9e:92:16:fb</td>
<td>10.220.88.1</td>
<td>10.220.88.1</td>
<td>vlan.0</td>
<td>none</td>
</tr>
<tr>
<td>00:19:e8:45:ce:80</td>
<td>10.220.88.22</td>
<td>10.220.88.22</td>
<td>vlan.0</td>
<td>none</td>
</tr>
<tr>
<td>f0:ad:4e:01:d9:33</td>
<td>10.220.88.100</td>
<td>10.220.88.100</td>
<td>vlan.0</td>
<td>none</td>
</tr>
</tbody>
</table>

Total entries: 3
Generic Access Libraries

- Pexpect
  https://github.com/pexpect/pexpect

- Paramiko
  https://github.com/paramiko/paramiko

- Ncclient
  https://github.com/ncclient/ncclient
Network Vendor Libraries

- Arista's pyeapi
  https://github.com/arista-eosplus/pyeapi

- Cisco IOS-XR pyiosxr
  https://github.com/fooelisa/pyiosxr

- Juniper's py-junos-eznc
  https://github.com/Juniper/py-junos-eznc
Multivendor Libraries

- Netmiko
  https://github.com/ktbyers/netmiko

- NAPALM
  https://github.com/napalm-automation/napalm
Vendor Differences

When Cisco asks you to remove the comments from your config to make it load

https://honestnetworker.wordpress.com/2015/07/20/when-cisco-asks-you-to-remove-the-comments-from-your-config-to-make-it-load/
Thanks!

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