JUNIPER NETWORKS

Network Automation with Ansible and OpenConfig / YANG

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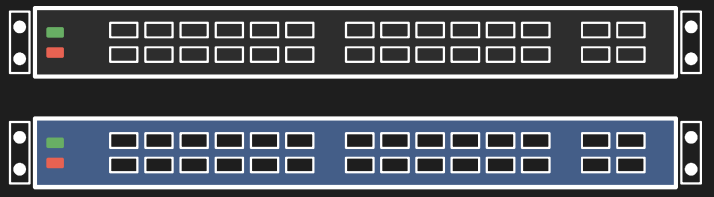
Agenda

- One Protocol – many languages to master …
- From CLI scraping to NETCONF
- NETCONF Python Tools
- Common Data Model Language YANG
- OpenConfig
- Ansible for Juniper Network Devices
- Demo

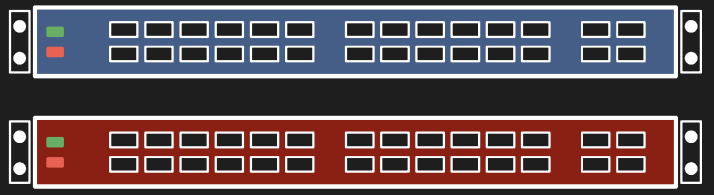
One Protocol – many languages to master …

```
router bgp as-number 12345
```

```
router bgp 12345
```

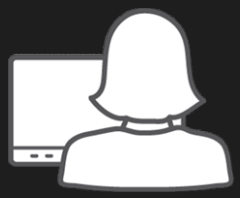


```
configure router autonomous-system 12345
```



```
set routing-options autonomous-system 1234
```

Wait, we have been here 25 years ago …

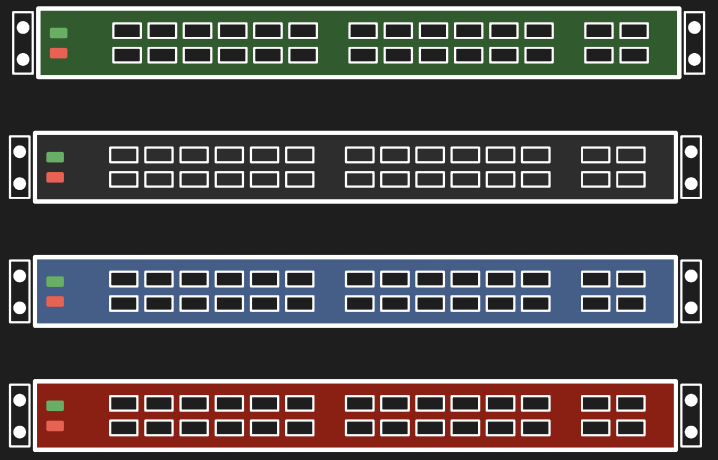


SNMP RFC 1157 Get and Set Operations

Standard: MIB

Enterprise Specific MIBs:

A B C D



Standard and Enterprise specific MIBs don't mix !

Why CLI scraping is bad …

Simple Task: Get IP address of a Linux Server

```
IP=$(hostname --ip-address | awk '{print $1}')
```

Host1: hostname --ip-address
172.17.0.3

Host2: hostname --ip-address
172.17.0.4 172.20.0.3 172.18.0.2 172.19.0.2

Host3: hostname --ip-address
2a05:4f8:1130:55b0::2 193.5.1.23

The Network Configuration Protocol - NETCONF

- Protocol to “install, manipulate and delete configuration”
- Extensible Markup Language (XML)-based data encoding for configuration data and protocol messages
- NETCONF protocol operations over a simple RPC layer
- Defined by the IETF in RFC 4741 in 2006, updated in RFC 6241
- NETCONF over SSH first defined in RFC 4742, updated in RFC 6242

NETCONF Python Tools

- ncclient: Python library for NETCONF clients (http://ncclient.org/)
  Can automate operations, but still low low level operation
- Junos PyEZ uses ncclient and adds a level of abstraction
  ➔ "easy" to use, even for network operators
  https://github.com/Juniper/py-junos-eznc
- Ansible uses PyEZ

YANG

- Data model language for the Network Configuration Protocol (NETCONF)
- Defined by the IETF in RFC 6020 in 2010
- YANG is an acronym for "Yet Another Next Generation"
- Human readable
- Any encoding format, including XML and JSON
- Transport over NETCONF over SSH and recently also over gPRC

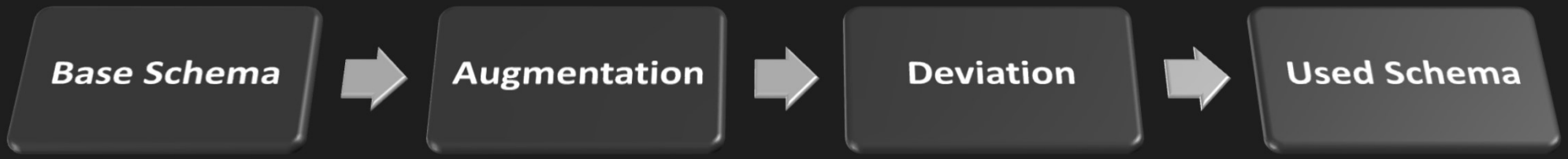
https://tools.ietf.org/html/rfc6020

YANG Schema Example

```
grouping bgp-global-config {
...
        leaf as {
          type inet:as-number;
          mandatory true;
          description
            "Local autonomous system number of the router.  Uses
            the 32-bit as-number type from the model in RFC 6991.";
        }
...
```

```
[edit openconfig-bgp:bgp global config]mwiget@oc1# set as ?
Possible completions:  <as>  Local autonomous system number of the router.  Uses
                             the 32-bit as-number type from the model in RFC 6991.
```

YANG Augmentation and Deviation



IETF
OpenConfig
Custom

Add new
container, leaf
or description

Disable
container
or leaf

Active
Schema

maintained in separate text files

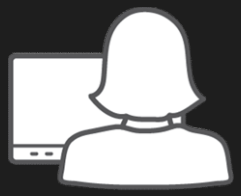
OpenConfig

http://www.openconfig.net

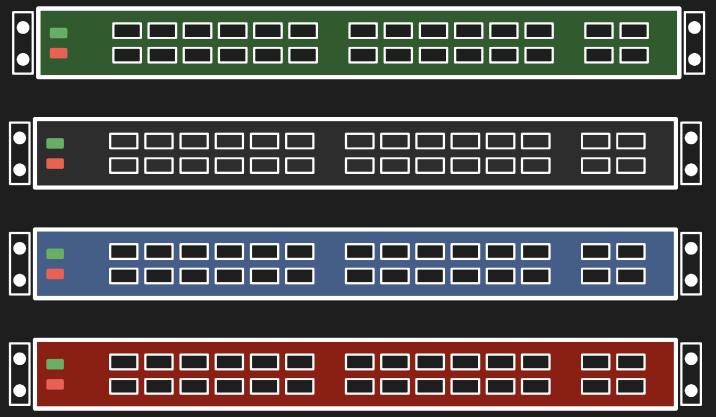
- Vendor-neutral, model-driven network management designed by users
- Common Data Models written in YANG
- Streaming Telemetry
- Published on GitHub

OpenConfig
One Protocol – one language to master all vendors

```
openconfig-bgp:bgp global as 12345
```

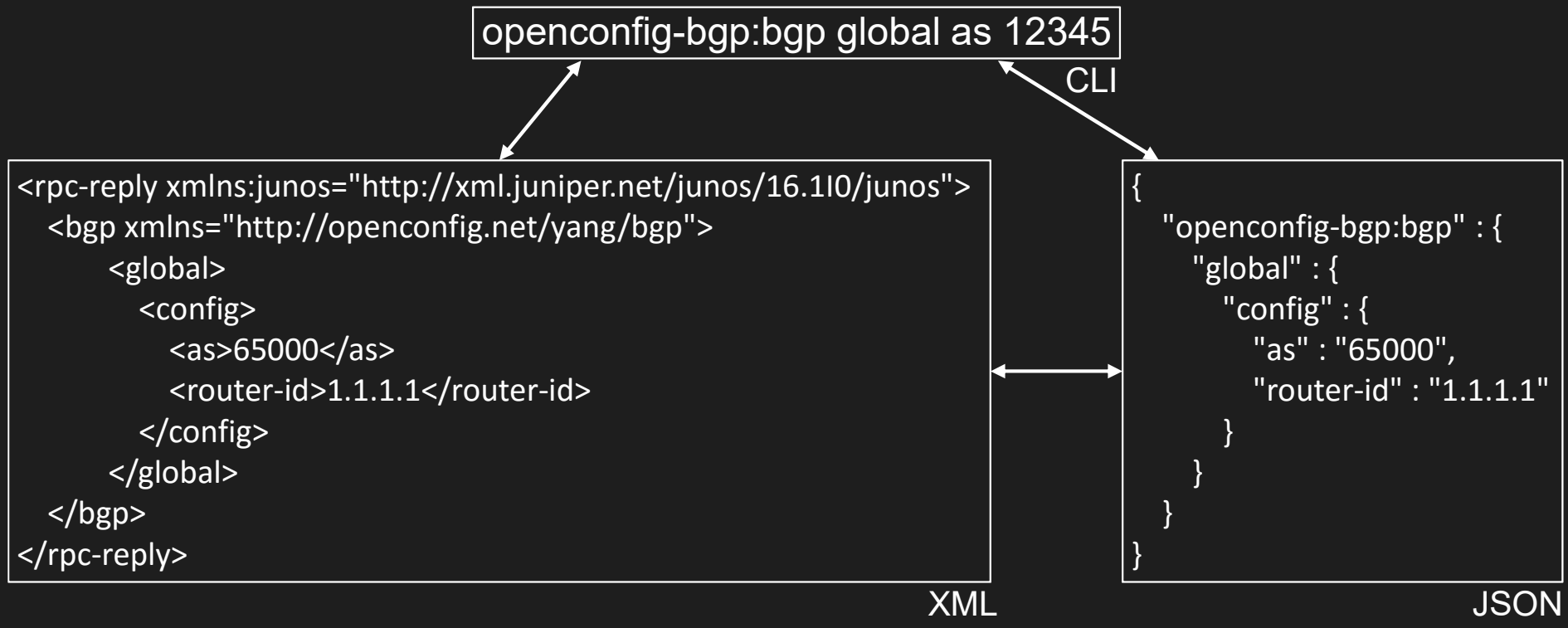


(over CLI, NETCONF/SSH & gRPC)



http://www.juniper.net/us/en/solutions/automation/

OpenConfig
One Protocol – one language, many encoding



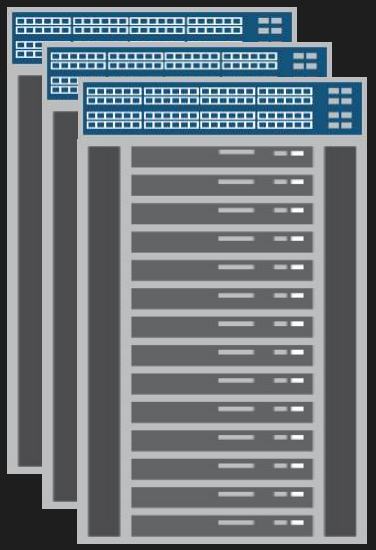
ANSIBLE

Ansible

Standard Mode: sends Python module over SSH, executes, then removes it

Python module over SSH

Network Devices



Servers

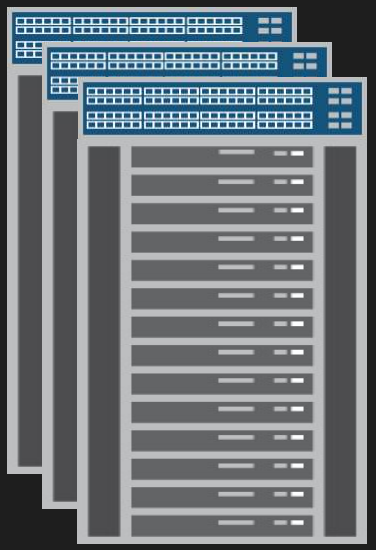
ANSIBLE + JUNIPER NETWORKS

Ansible

NETCONF over SSH

API Mode:
Modules run on server, communicate over an API

Network Devices



Servers

https://www.ansible.com/ansible-juniper

Junos Core Modules in Ansible 2.1

junos_config	Deploy configuration lines, zeroize, rollback
junos_template	Deploy configuration template or file
junos_facts	Gather device facts and configuration
junos_packages	Deploy and install packages/os on devices
junos_command	Execute any CLI or RPC commands remotely
junos_netconf	Enable NETCONF on devices

DEMO !

https://github.com/ksator/openconfig-demo

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- https://www.ansible.com/ansible-juniper
- https://www.juniper.net/developer
- https://www.juniper.net/us/en/solutions/automation/