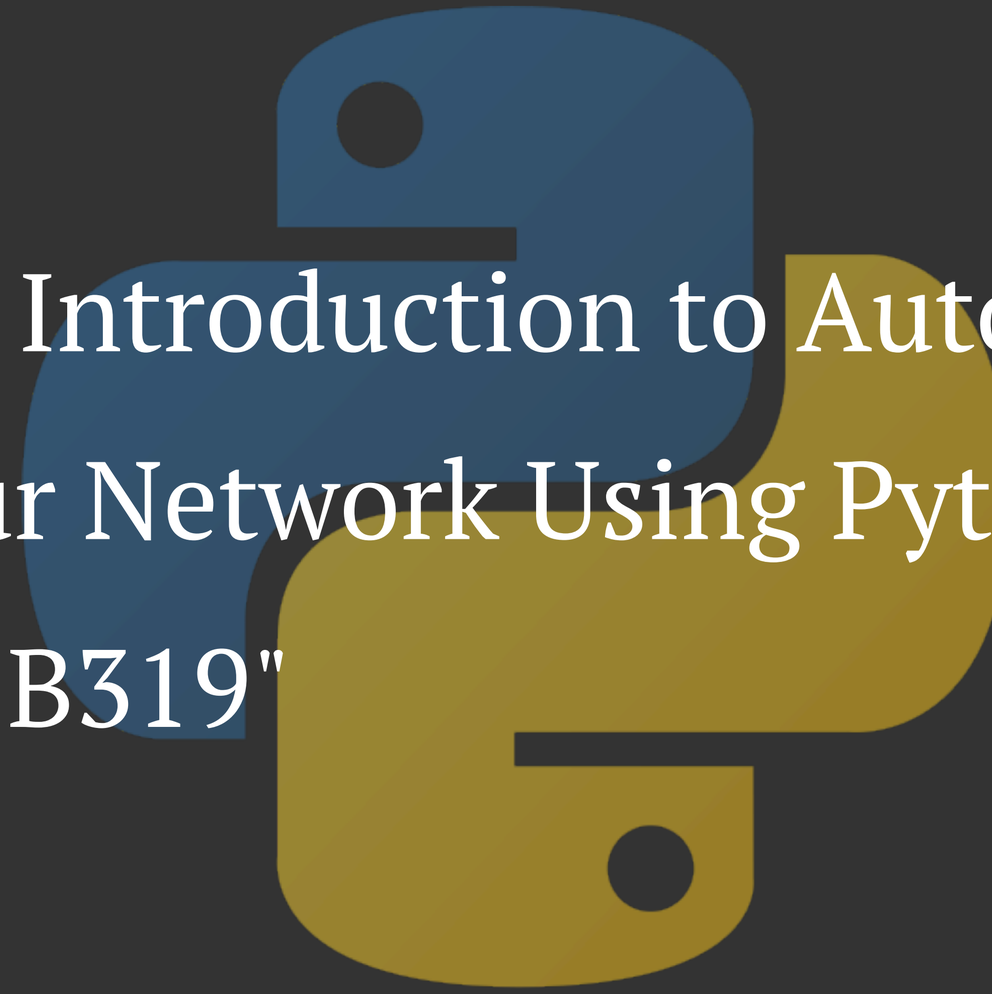

```
{
  "Title":"An Introduction to Automating
           Your Network Using Python",
  "Session":"B319"
}
```

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COLLEGE OF
Saint Benedict Saint John's
UNIVERSITY

Enik Pluimer - Network Administrator

Saint Joseph - Collegeville, MN

2 Campuses - 6 Miles Apart

Undergraduate Enrollment - 3,405

17,000 Switch Ports

1,100 Access Points

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Agenda

Getting Started

Python for Network Automation

Lab Demo

Further Reading

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Getting Started

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Getting Started

Reasons for Python

Python 2 and 3

Python Text Editors

Supporting Parts

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Reasons for Python

High Level and Readable Language

Large Developer Community

Resources, Libraries, Documentation, Forums

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Reasons for Python

Highly Mentioned in Networking

Quickly be Productive as a Beginner

Powerful for Advanced Users

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Python 2 or Python 3

Whichever is Most Productive

Python 2 Most Support

Python 2 Default Version

Young or New Choose 3

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Python Text Editor

Simple to Use

Syntax Coloring

Auto Completion and Tabbing

Line Numbering

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Python IDE

Integrated Development Environment

Everything you ever wanted

But not as simple

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Supporting Parts

API = Application Programming Interface

REST = Representational State Transfer

JSON = JavaScript Object Notation

XML = Extensible Markup Language

YAML = Ain’t Markup Language

PIP = Python Package Index

SNMP = Simple Network Management Protocol

SSH = Secure Shell

Supporting Parts

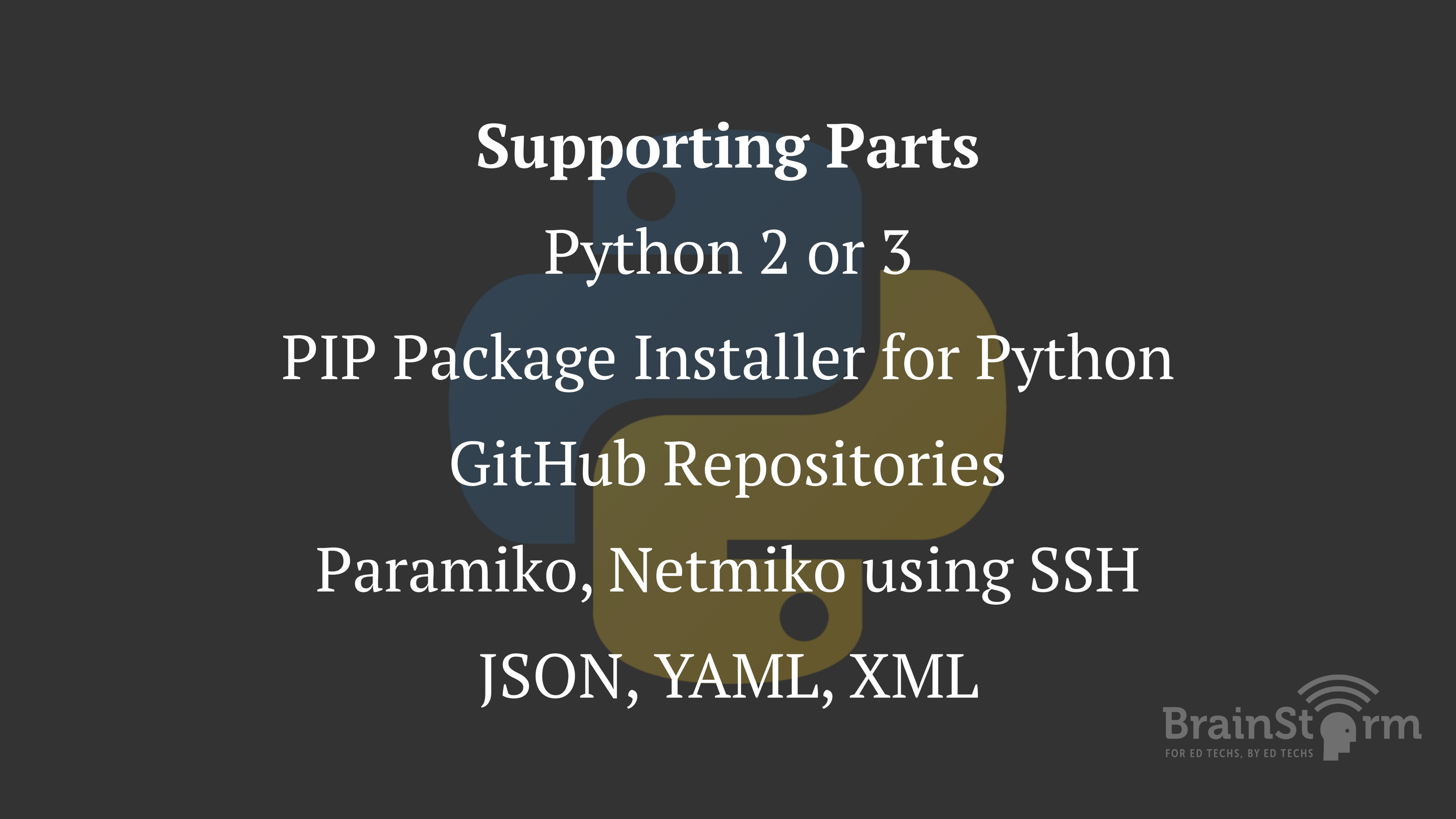
Python 2 or 3

PIP Package Installer for Python

GitHub Repositories

Paramiko, Netmiko using SSH

JSON, YAML, XML



Supporting Parts

Regular Expressions (regex101)

API Documentation

Postman API App

SNMP MIB Walk

Stack Overflow

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www.python.org/shell/

Indents = 4 spaces

```
>>> for octet3 in range(256):
...     for octet4 in range(256):
...         ip = "192.168.%d.%d" % (octet3, octet4)
...         print (ip)
```

pastebin.com/d0QnKYum

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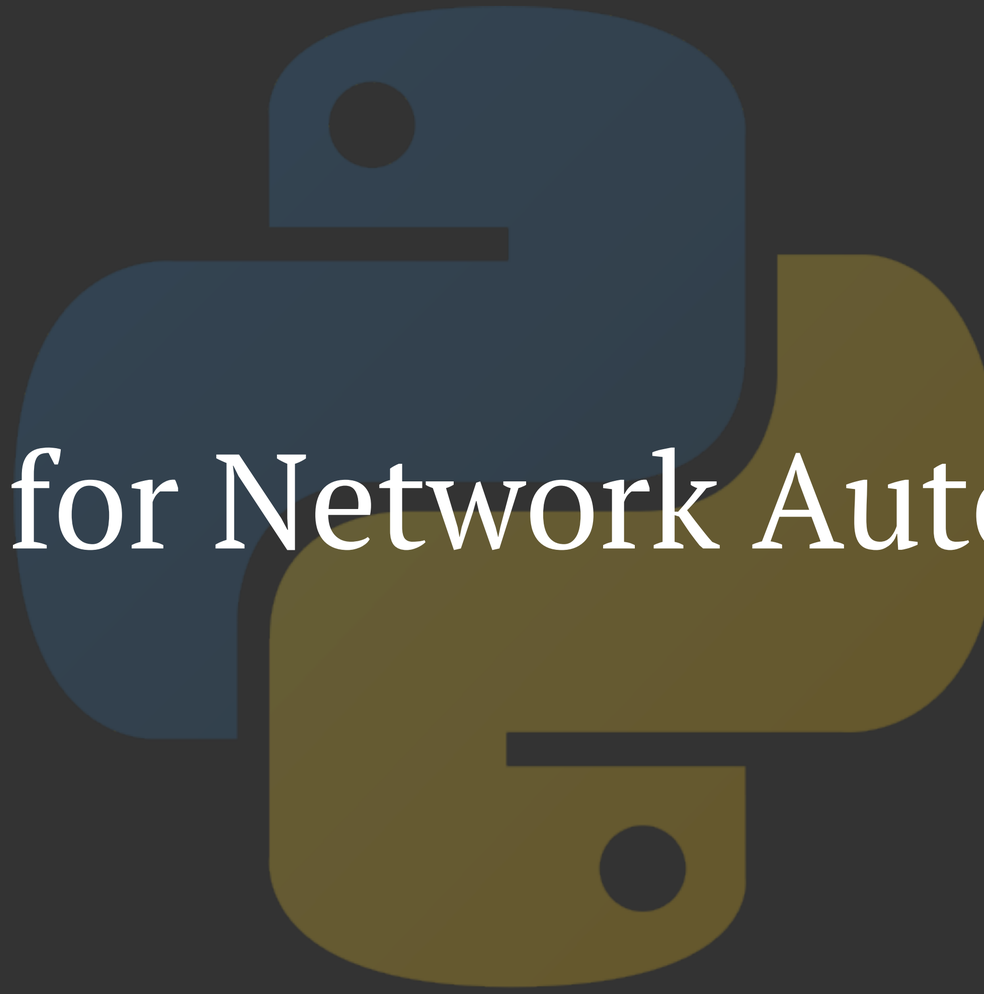

Python for Network Automation

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Define Automation

Reasons for Automation

Challenges and Solutions

Tips for Beginners

Interaction Methods

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“Network automation is the process of automating the configuration, management, testing, deployment, and operations of physical and virtual devices within a network.”

-Juniper Networks

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“to make life easier for people who are not primarily programmers, but need to interact with services in a programmatic manner (e.g. automation)”

-github.com/michaelrosejr/pyaos8

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Learning to code takes time, requires effort. The first time you write code, it will take you 10 times longer than just going into the CLI and typing the required commands.

Tasks should become shorter and easier each subsequent time and can be scaled up.

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Reasons for Automation

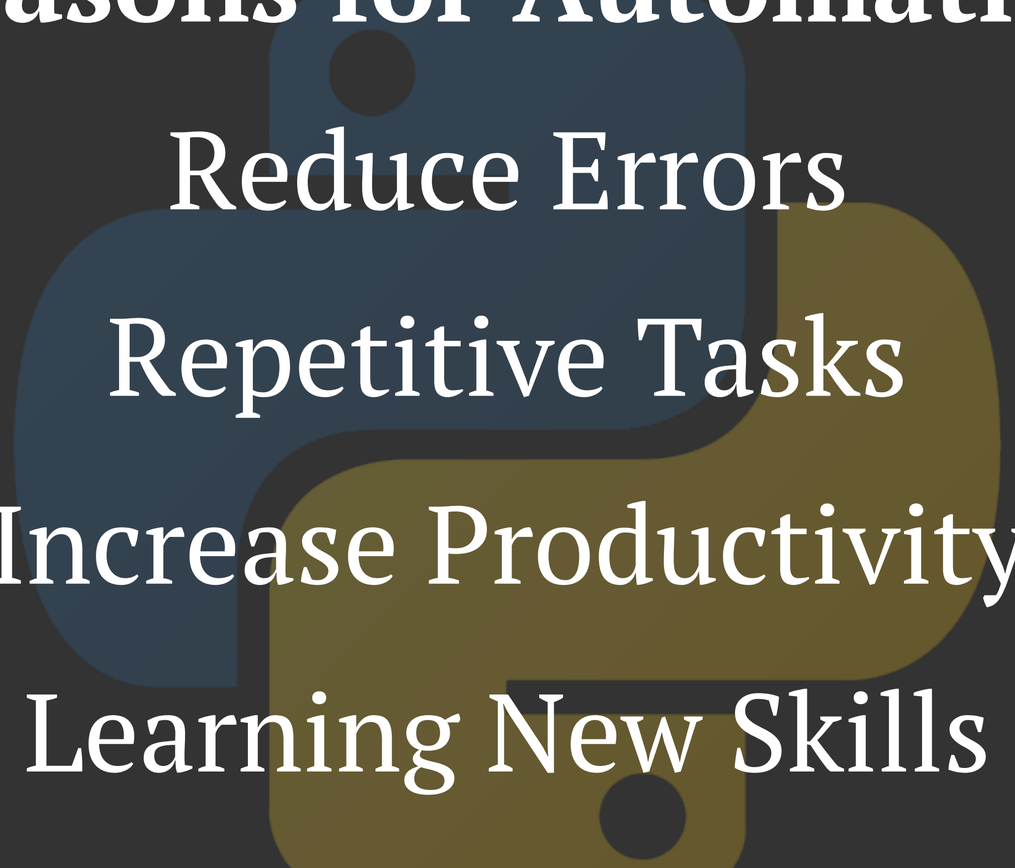
Reduce Errors

Repetitive Tasks

Increase Productivity

Learning New Skills

Become Innovative



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Challenges for Automation

Learning new skills

Code revisions on hardware

Unstructured and varying data

Maintaining code

Doing too much at once

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Overcoming Challenges

Dedicate your time and have fun

Small feedback loops

Learn to log and debug

Low risk and time consuming tasks

Avoid "All or Nothing”

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Python Coding Tips for Beginners

Define problems and goals

Write functions that accomplish one thing

See yourself repeating patterns

Start thinking about reusable code

Python Coding Tips for Beginners

Getting things done effectively

Code readability matters

Follow PEP-8 conventions

Don’t build something that already exists

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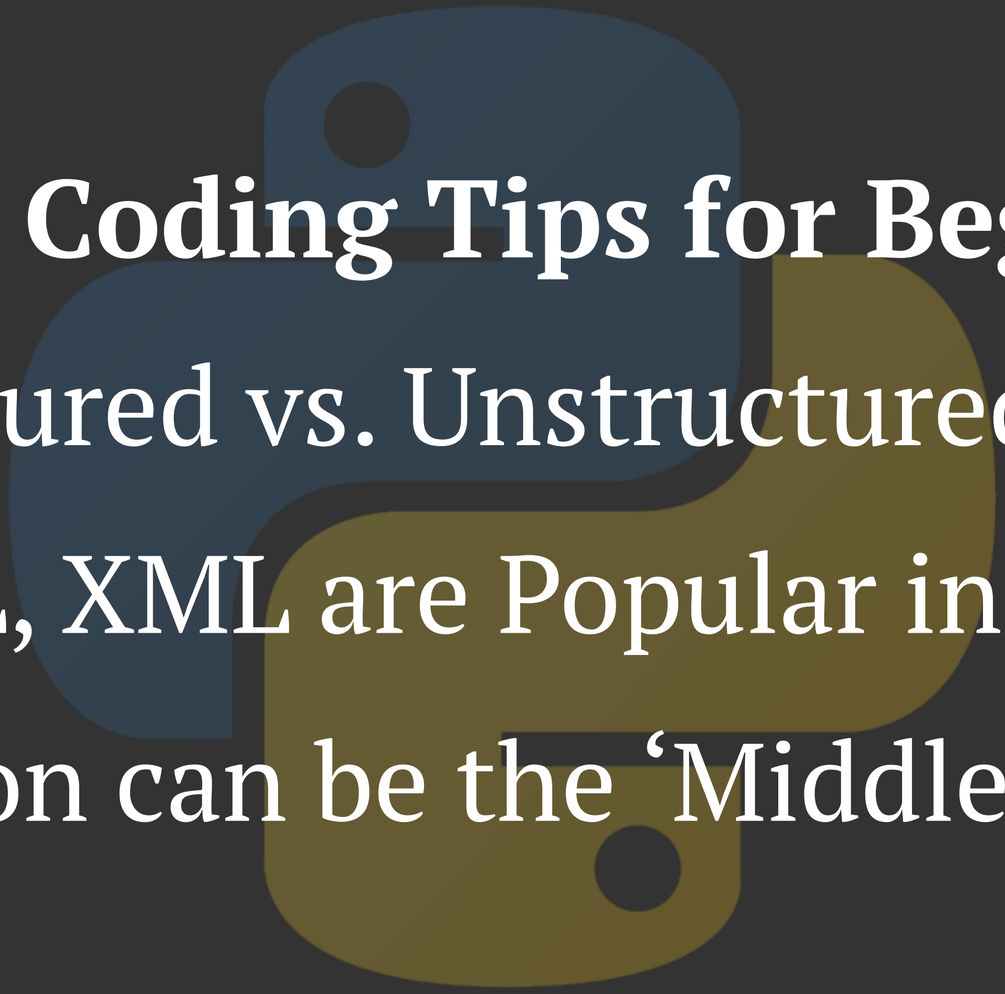
Python Coding Tips for Beginners

Structured vs. Unstructured Data

JSON, YAML, XML are Popular in Networking

Python can be the ‘Middleware’



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Interaction Methods

Copy / paste generated text to console

Scripted interaction with CLI via SSH

SNMP Read / Write

API GET/PUT/POST/DELETE

Interaction Methods

SSH (CLI) - netmiko
Encrypted and authenticated tunnel between devices using RSA public and private keys

SNMP - pysnmp
Query / response strings and ‘trap’ notifications that can be best protected using v3

REST API - requests
Uses GET/PUT/POST/DELETE methods over HTTP or HTTPS secured connections

Interaction Methods

SSH (CLI) - netmiko
Good for sending configuration commands
Data retrieved is best for humans

SNMP - pysnmp
Good for retrieving statistics quickly and efficiently

REST API - requests
Structured and secured input and output
Offers promise, but still developing

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Unstructured Data using CLI

```
VLAN ID  Name                | Status          Voice   Jumbo
-------------------------------+--------------------------------
120      Printers            | Port-based      No      No
251      Lab                 | Port-based      No      No
300      Voice               | Port-based      Yes     No
810      Data                | Port-based      No      No
```

Structured Data using API

VLAN: 120	NAME: Printers
VLAN: 251	NAME: Lab
VLAN: 300	NAME: Voice
VLAN: 810	NAME: Data

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Status and Counters - VLAN Information - VLAN 300

VLAN ID : 300

Name : Voice

Status : Port-based

Voice : Yes

Jumbo : No

Private VLAN : none

Associated Primary VID : none

Associated Secondary VIDs : none

Port Information Mode Unknown VLAN Status

---------- -------- ---------- ----------


```
{
        "is_dhcp_server_enabled": false,
        "is_dsnoop_enabled": false,
        "is_jumbo_enabled": false,
        "is_voice_enabled": true,
        "name": "Voice",
        "status": "VS_PORT_BASED",
        "type": "VT_STATIC",
        "uri": "/vlans/300",
        "vlan_id": 300
    }
```

Structured Data using SNMP

ifDescr.449 = STRING: VLAN120

ifDescr.580 = STRING: VLAN251

ifDescr.629 = STRING: VLAN300

ifDescr.1139 = STRING: VLAN810

www.python.org/shell/

```
>>> vlan = 100
>>> port_start = 1
>>> port_end  = 25
>>> for interface in range(port_start, port_end):
...         output_int = "interface GigabitEthernet %s" %interface
...         output_cmd = "switchport access vlan %s" %vlan
...         print (output_int)
...         print (output_cmd)
```

pastebin.com/inLKQLYH

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Lab Demo

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Configuration Text Output

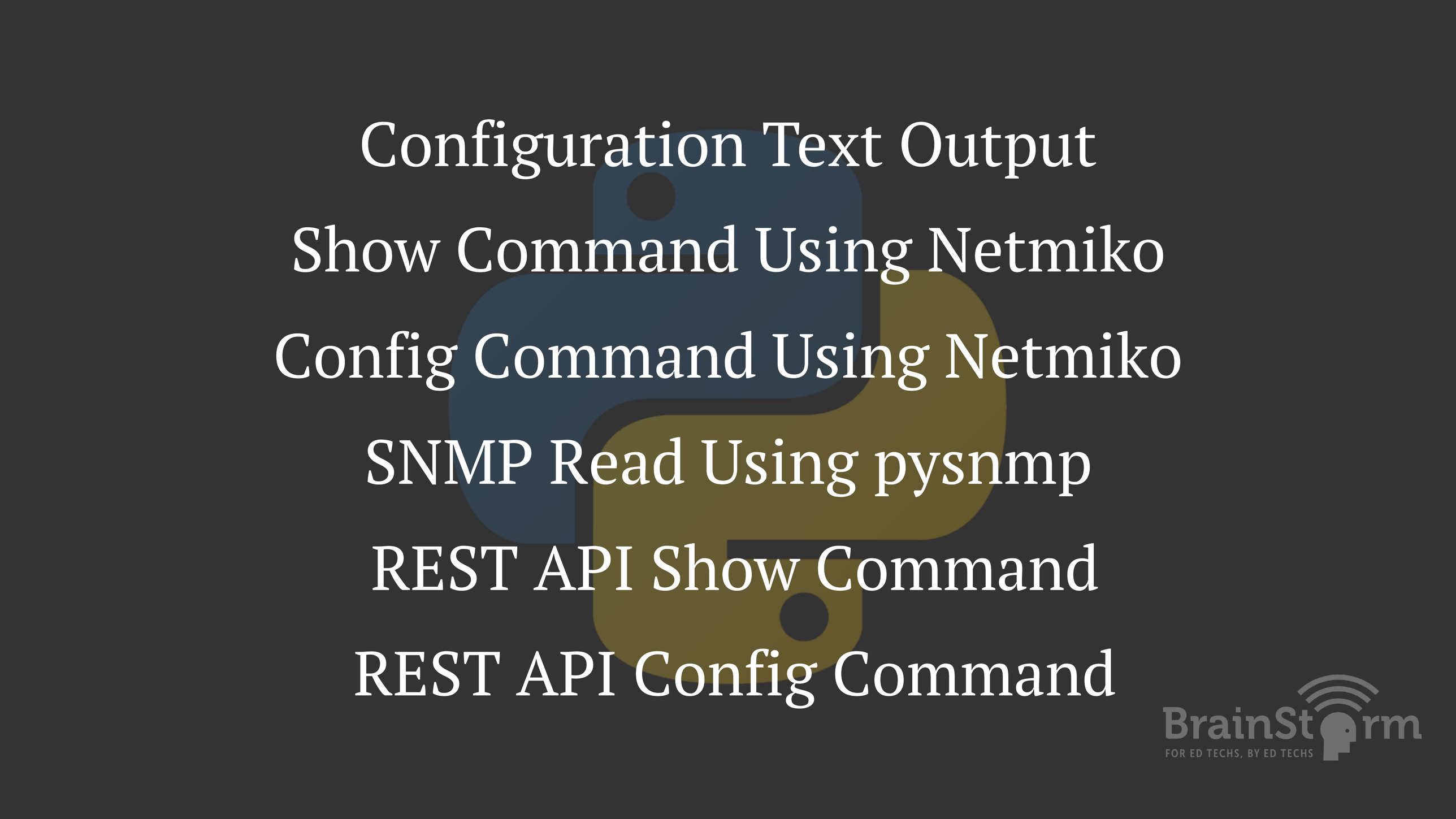
Show Command Using Netmiko

Config Command Using Netmiko

SNMP Read Using pysnmp

REST API Show Command

REST API Config Command



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Further Reading

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- Kirk Byers Python course for beginners
- Mark Lutz’s Learning Python
- Matt Harrison’s courses at the O’Reilly online learning platform

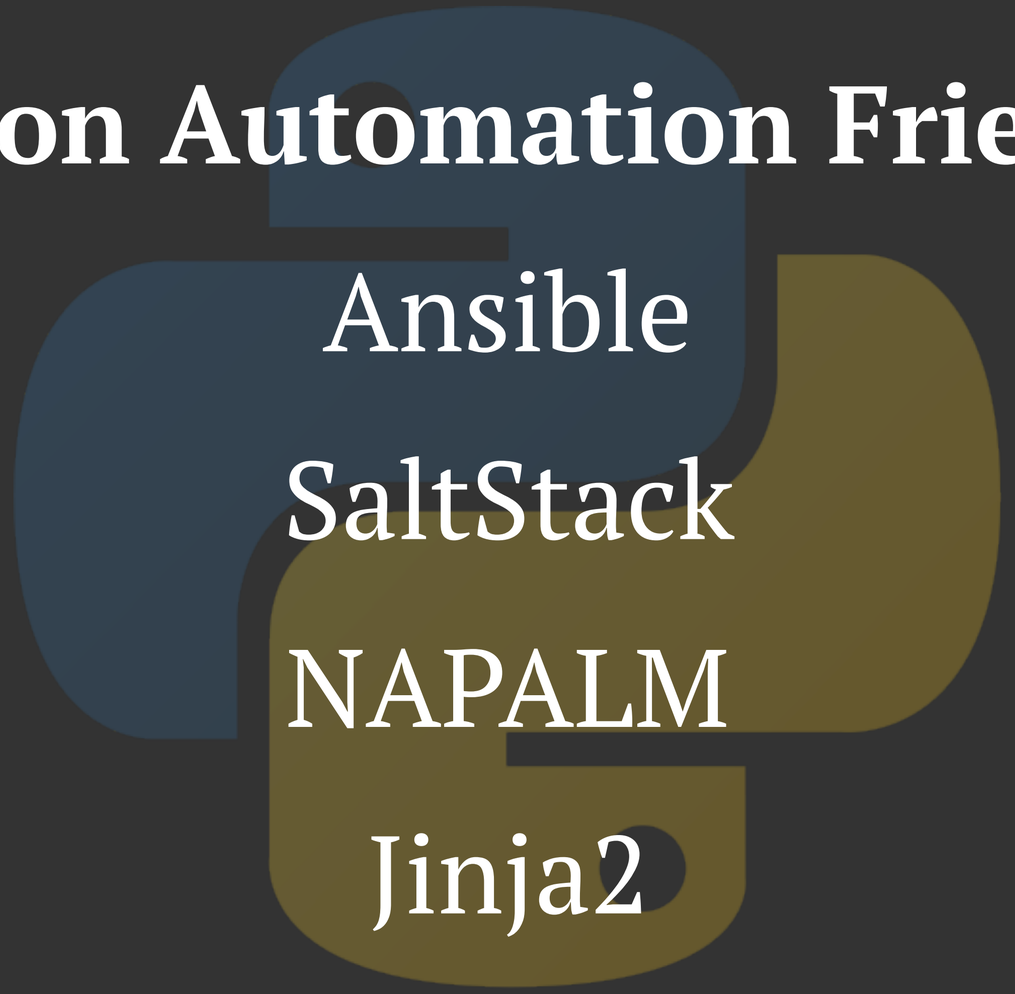
Python Automation Friendly

Ansible

SaltStack

NAPALM

Jinja2



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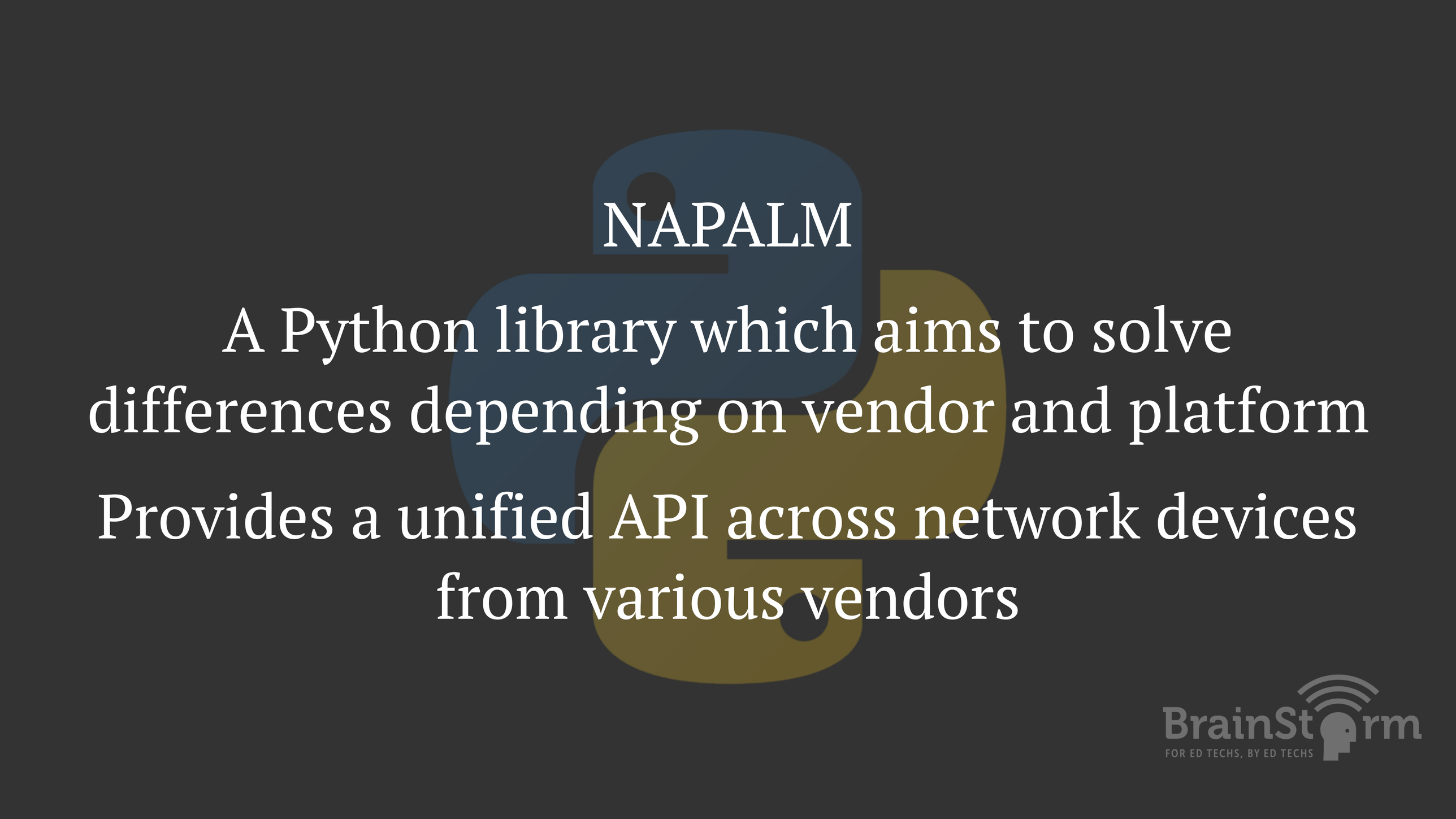
NAPALM

A Python library which aims to solve differences depending on vendor and platform

Provides a unified API across network devices from various vendors



Links

www.w3schools.com/python/python_intro.asp

www.learnpython.org

www.codecademy.com

www.udemy.com/master-python-network-automation-for-network-engineers

www.extremenetworks.com/support/api-app

labs.networkreliability.engineering

mirceaulinic.net

github.com/networktocode/awesome-network-automation

www.python.org/dev/peps/pep-0008

pypi.org

realpython.com/python-first-steps