Programmability Webinar Series with DevNet

Session 8: Play with Linux & Python on Networking Devices

Speaker: Stuart Clark

Hostess: Kara Sullivan
Jointly presented by DevNet & NetAcad

8 May, 2019

Welcome to the 8th session of the Programmability with Cisco DevNet webinar series

- Use the Q and A panel to ask questions.

- Use the Chat panel to communicate with attendees and panelists.

- A link to a recording of the session will be sent to all registered attendees.

- Please take the feedback survey at the end of the webinar.

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The Webinar Series

Date	Topic
Oct'18	Networking with Programmability is Easy
Oct'18	A Network Engineer in the Programmable Age
Nov'18	Software Defined Networking and Controllers
Jan'19	Adding API Skills to Your Networking Toolbox
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▶ May'19	Play with Linux & Python on Networking Devices
Jun'19	Automate your Network with a Bot

All Series Details can be Found @ **http://bit.ly/devnet2**

The Webinar Series – Raffle & Certificates

Raffle

- ✓ We will be raffling off a total of 15 Amazon gift cards in the amount of $25 US dollars at the end of this series.*
- ✓ 10 Amazon gift cards in the amount of $25 US dollars raffled off to everyone who participates in all of the live sessions
- ✓ 5 Amazon gift cards in the amount of $25 US dollars raffled off to everyone who participates in all of the sessions by either attending the live sessions or viewing/downloading the recording (can be a combination of the two in this raffle).

* Please note that this is a raffle and not everyone who qualifies will receive a gift card. There will be a total of 15 winners.

Certificate of Participation

- ✓ There will be an opportunity to sign up for a Certificate of Participation at the end of this series.
- ✓ To qualify, you must have participated in all sessions of the series.
- ✓ You can do this by attending the live sessions, viewing the recordings, or a combination of the two.
- ✓ Certificates will not be given out for individual sessions, but for the series as a whole.

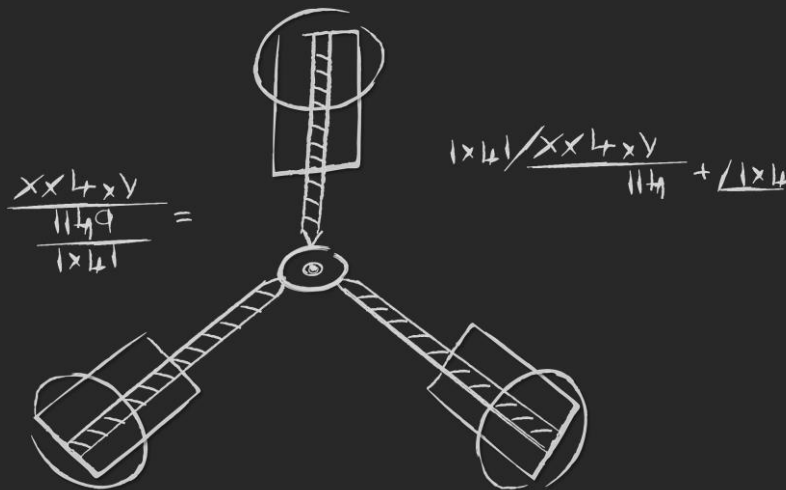# Play with Linux and Python on the Networking Devices

Stuart Clark
Developer Advocate
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Agenda

✓ IOS-XE, XR, NX OS, ... architectures built on Linux

✓ NX-OS examples with Linux bash access

✓ Python Guest shell examples on a Cat9k, ISR4k

✓ Demo time!

✓ Learn more

Technical Terms

✓ GS – Guest Shell

✓ PNP – Plug and Play

✓ CAF – Cisco Application Framework

✓ IOx – Virtual Service Manager

✓ DNS – Domain Name System

✓ PIP – (Pip Installs Packages) Tool for installing and managing python packages

✓ YUM – (Yellowdog Updater Modifier) open source package management tool

✓ CentOS – Linux distribution derived from from RHEL

✓ MontaVista CGE7 – Linux distribution provided by MontaVista Software Company

Why LINUX skills today?

✓ GitHub/GitLab

✓ OpenDaylight

✓ OpenStack

✓ Docker

✓ Kubernetes

✓ Linux networking stack

✓ Linux operating system

The skills you need

✓ Linux commands

✓ Linux networks

✓ Linux prompt basics

✓ Linux file systems

✓ Editing, copying, moving, and deleting files

✓ Changing file owners and permissions

✓ Managing processes from the command line

Operating systems

✓ **Cisco IOS**: Found in "borderless networks" (i.e. networks that allow "anyone, anywhere, and on any device" to connect with a corporate network). For example, a Cisco 3900 Series ISR2 router runs Cisco IOS.

✓ **Cisco NX-OS**: Found on Cisco Nexus switches located in data centers. For example, a Cisco Nexus 9000 Series switch runs Cisco NX-OS

✓ **Cisco IOS-XR**: Found on Cisco service provider routers. For example, a Cisco XR 9006 Series router runs Cisco IOS-XR

✓ Cisco ASA: Family of security devices protects corporate networks and data centers, Offers integrated IPS, VPN

✓ Cisco NGFW: Application Visibility and Control (AVC), optional Next-Gen IPS (NGIPS), Advanced Malware Protection (AMP) for Networks, and URL Filtering

XE, XR, NX-OS Architectures

IOS XE

Is built on Linux and provides a distributed software architecture that moves many operating system responsibilities out of the IOS process and has a copy of IOS running as a separate process.

IOS XR

Originally designed for 64-bit operation, built on a Linux kernel, IOS-XR is built on the QNX Neutrino Microkernel. QNX is similar to UNIX and is now owned by BlackBerry.

NX-OS

NX-OS is built on a Linux kernel, and it natively supports the Python language for creating scripts on Cisco Nexus switches. Additionally, it has multiple high availability features, and it doesn't load all of its features at once.

Intro to Running applications on Cisco devices with VMs or Containers
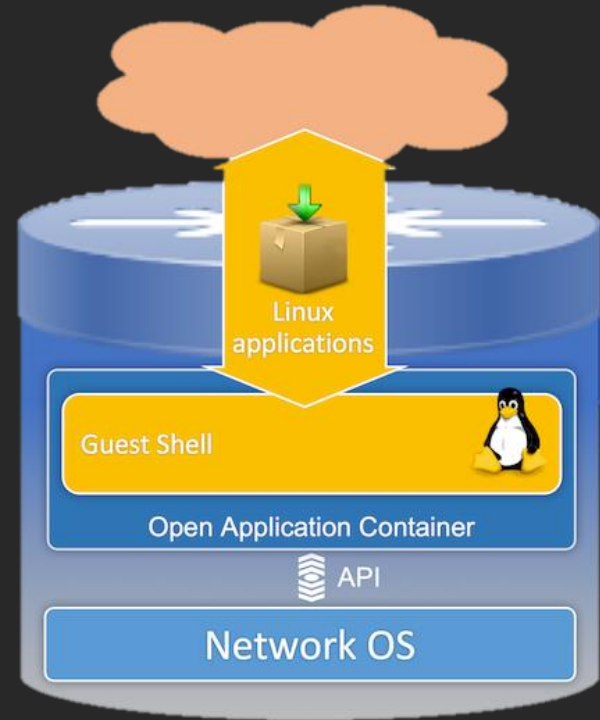
A tool to complement the OS of the network element

✓ Fast feature delivery

✓ Independent from network OS release cycle

✓ Enable custom feature delivery "for me only"

✓ Tool to provide for easy integration into existing/custom tool chains

✓ Security domains isolate "my stuff" from network OS

✓ Integration tools (Puppet, Chef, .. plugins)

✓ Guest Shell

✓ Network Applications (Distributed Network Analytics, Self Learning Networks…)

Application hosting types VM/LXC/docker

Cisco IOS XE applications are pre-packed in containers using different formats:

✓ KVM-based VM – Includes applications, binaries, libraries and entire guest OS

✓ LXC Linux containers – Enables OS-level virtualization for multiple Linux systems on a single host

✓ Docker containers – Makes the process of creating and maintaining Linux containers easier
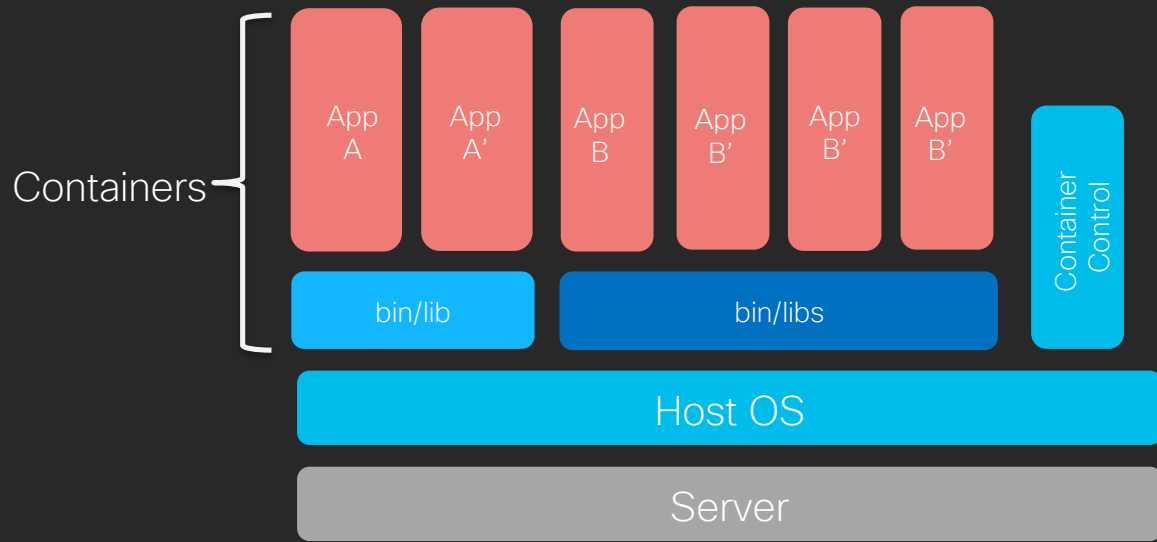
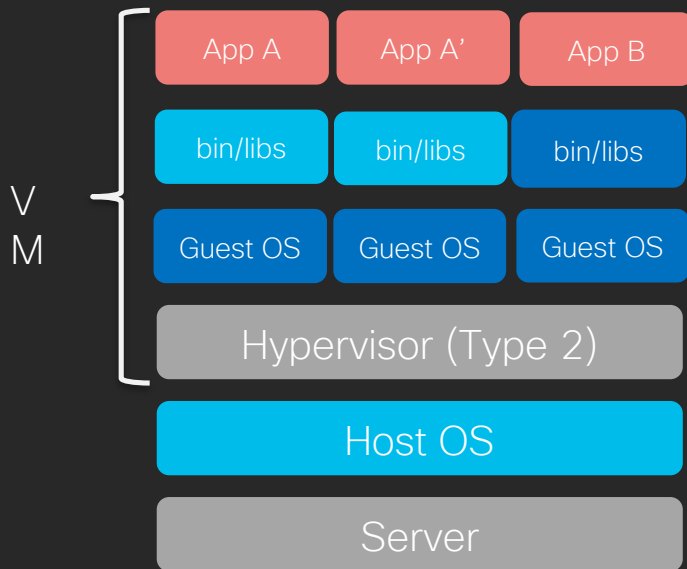# Types Of Applications (TL;DR)

Recommended:

✓ Performance/ Throughput testing

✓ Configuration Management Agents

✓ Packet collection / Analysis
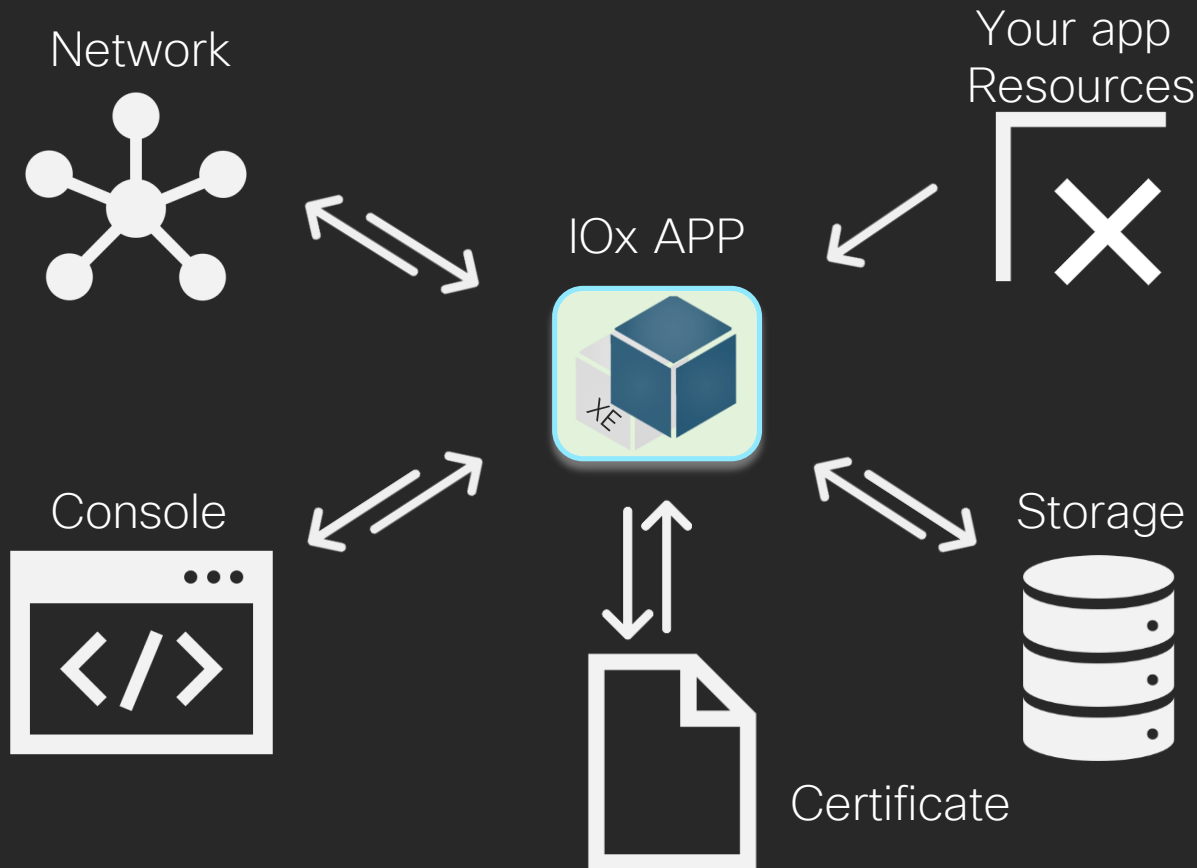
✓ Python applications

Not such a great idea imo:

✗ Video games (except Zork I: The Great Underground Empire)

✗ Currency mining (bitcoin)

Containers and Virtual Machines

Containers are isolated but share OS and where appropriate bins/libraries Guest OS

V M

App A	App A'	App B
bin/libs	bin/libs	bin/libs
Guest OS	Guest OS	Guest OS

Hypervisor (Type 2)

Host OS

Server

Containers

App A	App A'	App B	App B'	App B'	App B'

bin/lib	bin/libs	Container Control

Host OS

Server

Characteristics of an IOx Container

Network

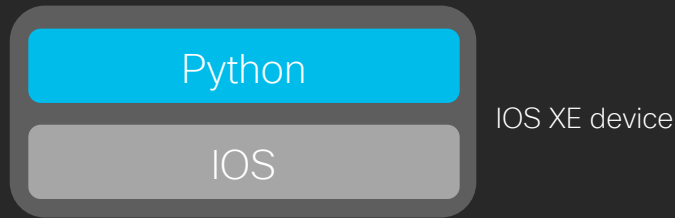Your app
Resources

IOx APP

Console

Certificate

Storage

Why Python?

✓ Python is the defacto automation language
✓ Users are familiar with Linux and Python
✓ Help over operation shortcomings of command line interface

Using python on Cisco

"On Box Python"

Python

IOS

IOS XE device

✓ Scripts executed locally on the switch/router

Ideal for:

- ✓ Provisioning automation (ZTP)
- ✓ Automating EEM responses
- ✓ Application development
- ✓ IOT

"Off Box Python"

Python

External Python
Execution environment

ssh / netconf

IOS

IOS XE device

✓ Scripts executed externally from the switch/router

Ideal for:

- ✓ Configuration management automation
- ✓ Telemetry / operational data
- ✓ Controller use inc Cisco DNA / Cisco Network PNP

Demo Time

NX-OS examples with Linux bash access

Python Guest shell examples
on a Cat9k, ISR4k

Continue your journey

✓ Cisco Networking Academy

  ✓ PCAP: Programming Essentials in Python
  https://www.netacad.com/courses/programming/pcap-programming-essentials-python

  ✓ OS & IT courses https://www.netacad.com/courses/os-it

✓ Learning Labs

  ✓ Coding Fundamentals http://cs.co/lab-coding-fundamentals

  ✓ **Introduction to Guestshell on IOS XE** http://cs.co/introduction-to-guestshell-on-ios-xe

✓ DevNet Sandboxes

  ✓ IOS XE on Catalyst 9000 http://cs.co/iosxe-cat9k

  ✓ OS XE Programmability http://cs.co/ios-xe-programmability

Summary

✓ IOS-XE, XR, ASA, ...
architectures built on Linux

✓ NX-OS examples with Linux
bash access

✓ Python Guest shell examples
on a Cat9k, ISR4k

✓ Demo time!

✓ Learn more

Got more questions? Stay in touch!

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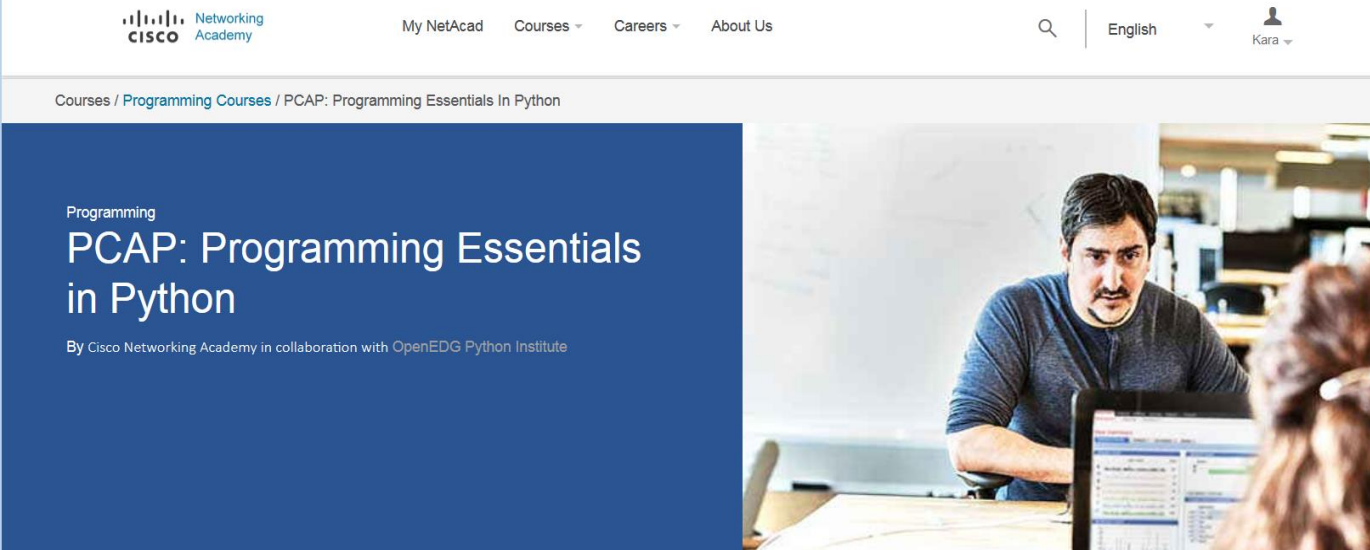
http://github.com/CiscoDevNet

Want to Learn More About Python?

- Free online self-paced course
- 70 Hours
- Level: Intermediate
- No prior knowledge of programming is required

Enroll at: http://bit.ly/pythonessentialscourse

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