

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](#)

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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.

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
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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

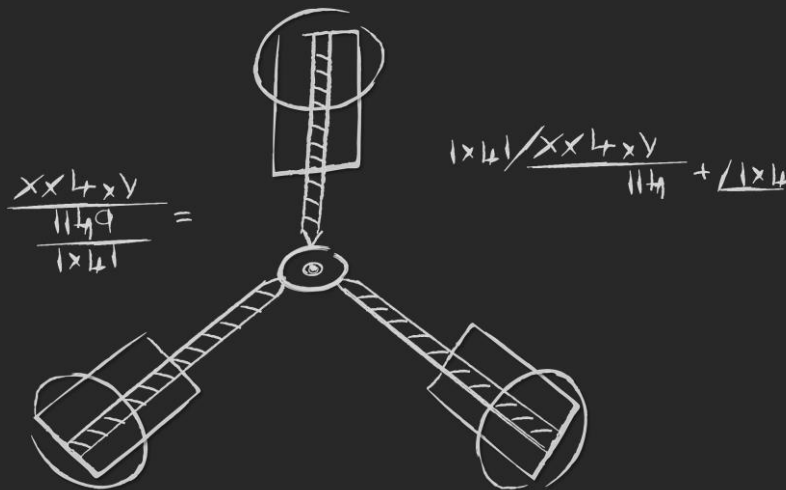
Stuart Clark

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.

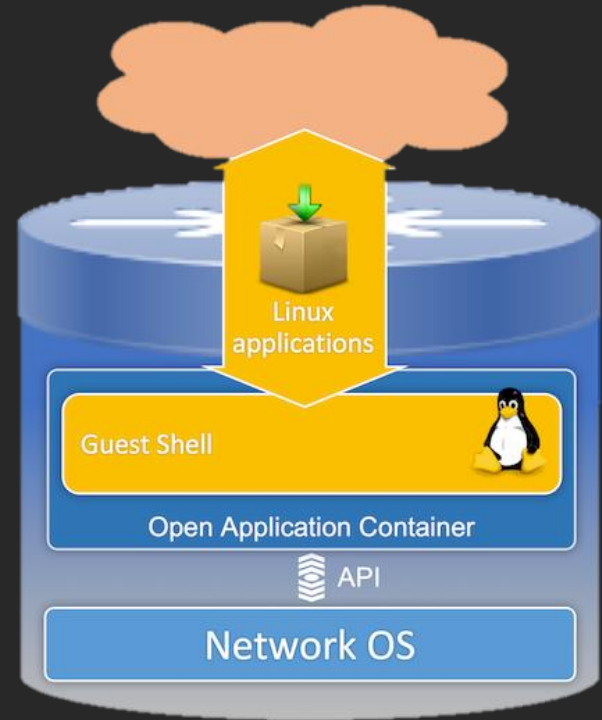
IOS XR

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:

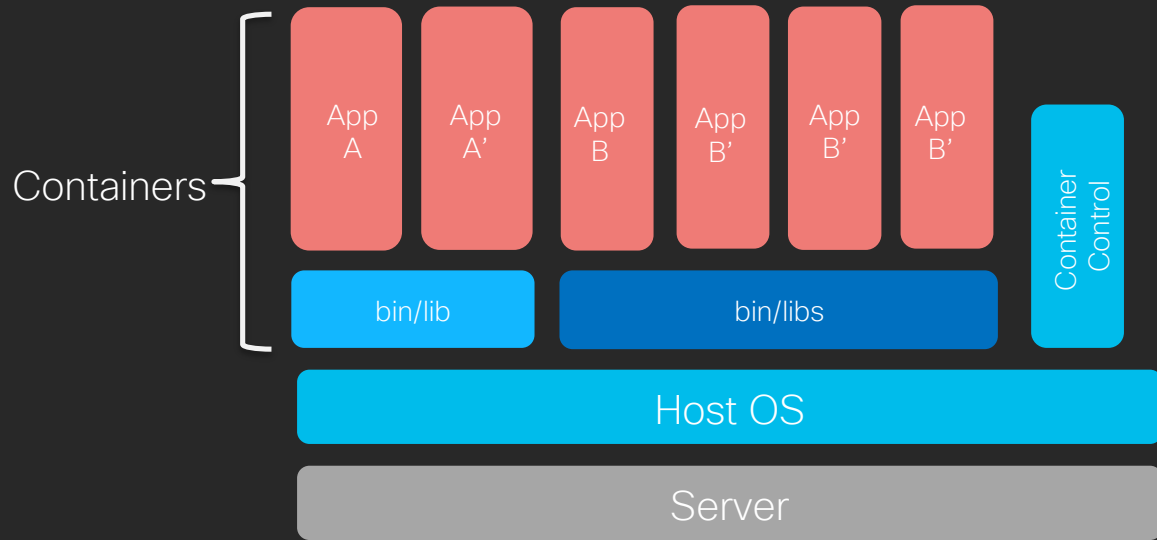
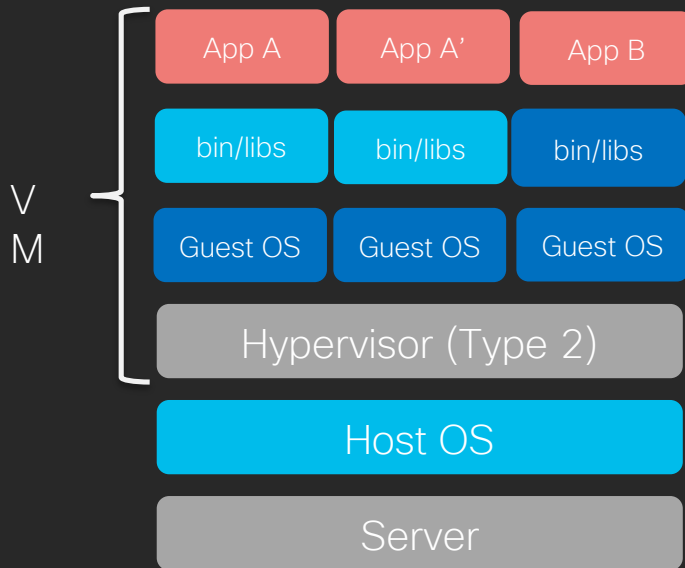
- ✓ Performance/ Throughput testing
- ✓ Configuration Management Agents
- ✓ Packet collection / Analysis
- ✓ Python applications

Not such a great idea imo:

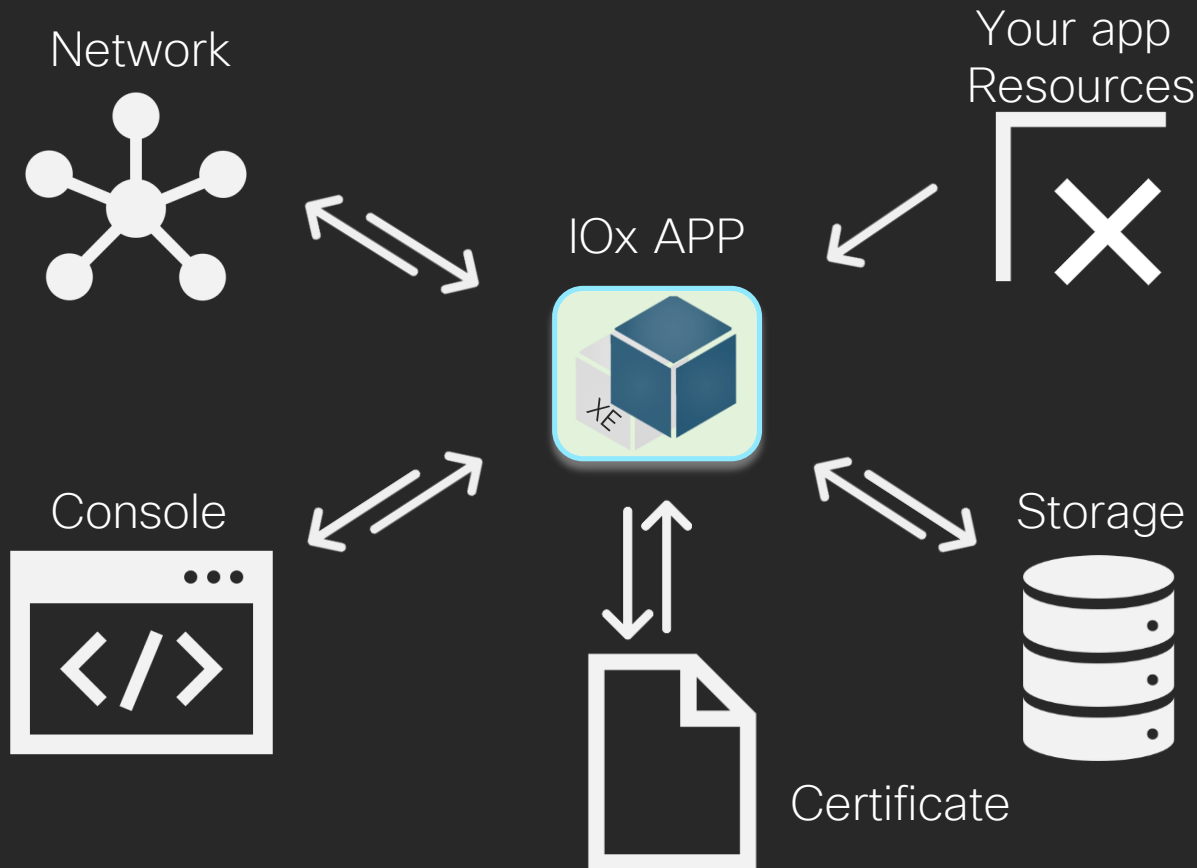
- ✗ Video games (except Zork I: The Great Underground Empire)
- ✗ Currency mining (bitcoin)

Containers and Virtual Machines

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



Characteristics of an IOx Container



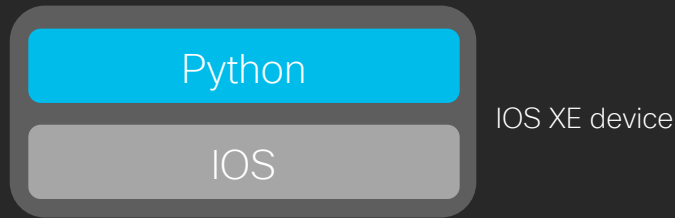
Why Python?



- ✓ 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”



- ✓ Scripts executed locally on the switch/router

Ideal for:

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

“Off Box Python”



- ✓ 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
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Got more questions? Stay in touch!



Stuart Clark



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[@bigevilbeard](https://twitter.com/bigevilbeard)



<http://github.com/bigevilbeard>



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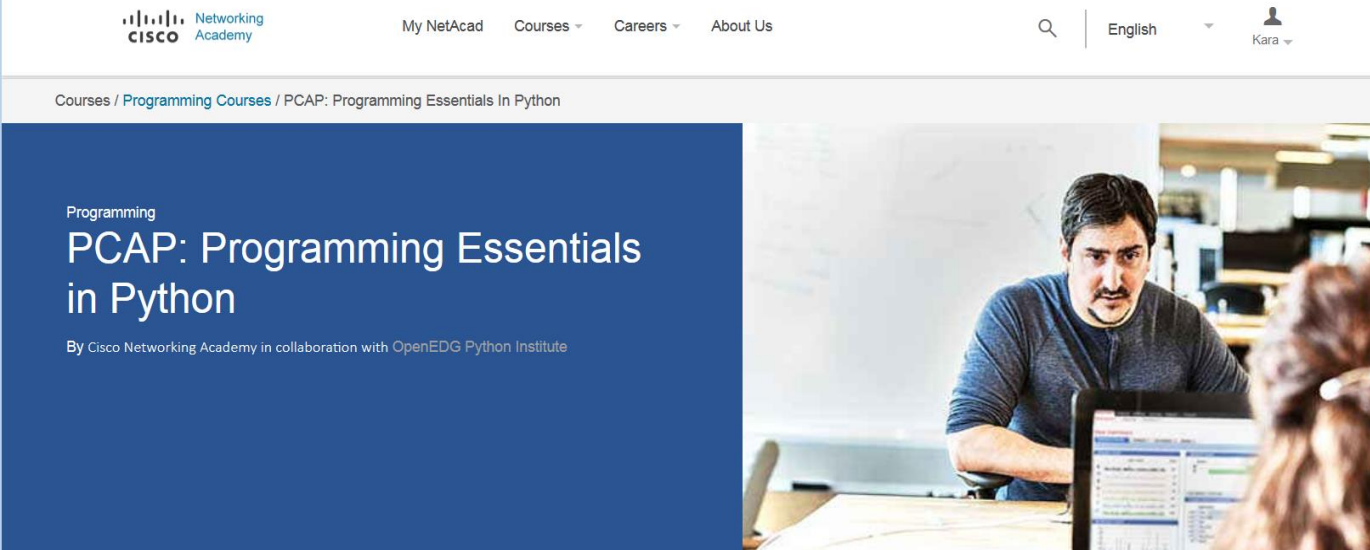


facebook.com/ciscocodevnet/



<http://github.com/CiscoDevNet>

Want to Learn More About Python?



The screenshot shows the Cisco Networking Academy website. At the top left is the Cisco logo and 'Networking Academy'. Navigation links include 'My NetAcad', 'Courses', 'Careers', and 'About Us'. A search bar and language selector (English) are on the right. Below the navigation is a breadcrumb trail: 'Courses / Programming Courses / PCAP: Programming Essentials In Python'. The main content area has a dark blue background on the left with the text: 'Programming', 'PCAP: Programming Essentials in Python', and 'By Cisco Networking Academy in collaboration with OpenEDG Python Institute'. On the right is a photograph of a man with a mustache sitting at a desk with a laptop, looking at the screen, with another person's head visible in the foreground.

- 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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