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Jupyter Notebooks + XR for Modern Learning Process

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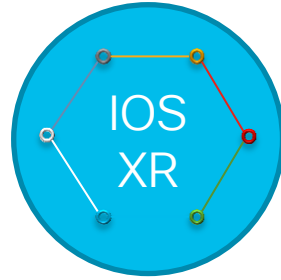Webex spaces will be moderated
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3
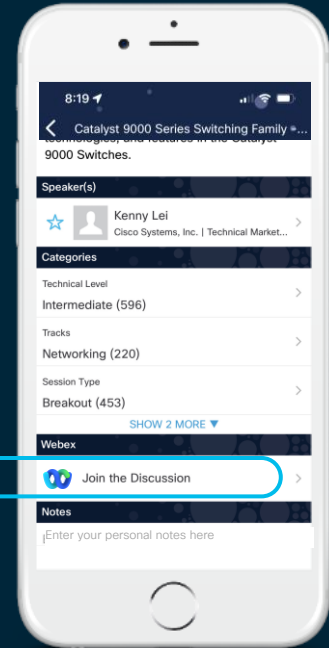
Agenda

- Introduction

- 8000 Emulator

- PyVXR Orchestration Tool

- Dcloud Offering

- Notebook Demo

- Conclusion

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Cisco IOS XR – Industry's #1 Network OS

IOS XR

Cisco NCS 5xx

Cisco NCS 5xxx

Cisco ASR9000

Cisco 8000

Session Topic

Merchant Silicon

Custom Silicon

Legacy Platforms – GSR, CRS, NCS6K

Flexible Platforms – Virtual & more...

Prices of semiconductors have risen as companies bid up prices

8000 Emulator

- Software simulation of Cisco 8000 available on Cisco Software Central for free with 8000 potential order;

- 8000 Simulator can emulate fixed or distributed devices;

- With current supply chain issues emulator can get you up to speed quicker with new platform.

8000 Series Virtual Router Emulator

Release 6.3_eft BETA

File Information

8000 IOS-XR 7.3.16 disk images for the 8804 platform
8000-7316-d-8804-images-eft6.3.tar
Advisories

8000 IOS-XR 7.3.16 disk images for the 8808 platform
8000-7316-d-8808-images-eft6.3.tar
Advisories

8000 IOS-XR 7.3.16 disk images for fixed platforms
8000-7316-f-images-eft6.3.tar
Advisories

PyVXR

- A package containing collection of tools to launch and manage virtual topologies using the VXR ("Virtual XR") backend.

- How to invoke
  - Use PyVXR API within a Python Environment
  - PyVXR CLI tool

```python
from pyvxr.vxr import Vxr
import logging
logging.basicConfig(level=logging.INFO)

cfg={
    'simulation': {
        'skip_auto_bringup' : True
    },

    'devices': {
      'router0': {
        'platform': 'spitfire_f' ,
        'image': '/auto/vxr/images/spitfire/8000-x64.iso',
      } }

vxr_sim=Vxr()
vxr_sim.no_image_copy=True

try:
    vxr_sim.start(cfg)
    ports=vxr_sim.ports()
except:
    print("Sim launch failed!")
    #get vxr log files for debugging
    vxr_sim.logs()
finally:
    vxr_sim.clean()
```

Topology defined in YAML

```yaml
simulation:
  no_image_copy: True
  rollback_xr_user: True

devices:
  R0:
    platform: spitfire_f-baked
    linecard_types: ['8201-sys']
    image: /opt/cisco/images/8000/xr7/7.3.16/8000-x64-7.3.16.qcow2
    xr_config: |
        netconf-yang agent ssh
    xr_port_redir: [22, 161, 830]
...
connections:
  hubs:
    R0R1hub:
        - R0.FourHundredGigE0/0/0/0
        - R1.FourHundredGigE0/0/0/0
```

Specify LC type

QCOW image from 8000-7316-f-*** tar

Config applied on bring up.

Redirected ports

Connections between virtual devices

$ vxr.py start <config_yaml_file>

8000 Emulator In Action through PyVXR

Emulator Requirements

Emulator	Operating System	CPU	Memory	Min Memory	Disk
8201 (fixed)	IOS-XR7	4	32G	12G	30G
8202 (fixed)	IOS-XR7	4	32G	12G	30G
8808 (modular)	IOS-XR7	8 (RP+LC)	64G	24G	30G

dCloud Session
Installation and Hosting provided by dCloud

Bring your own use case with fixed topology

Curated experience with Jupyter Notebooks

- PyVXR is a Python module that allows you to build a topology of virtual devices which are spun up as virtual

- Set of validated notebooks from Documentation team with contributors from engineering/TME

- Available on GitHub: https://github.com/ios-xr/network-notebooks

The Jupyter Notebook

- Named after 3 core languages- **Ju**lia, **Py**thon, and **R**

- Components
  - Notebook Web Application
  - Kernels
  - Notebook Documents

- A standard for Data Science

Interaction with Simulator – Networks within Notebooks

Notebooks (Jupyter)

Python
Client

Virtual routers with latest XR OS

User Experience with Notebooks

Read & Understand

Play

Customize

Product

In Browser Web Application
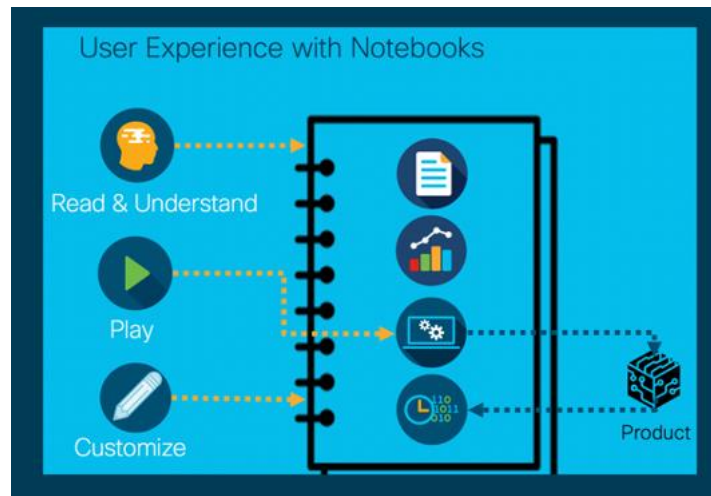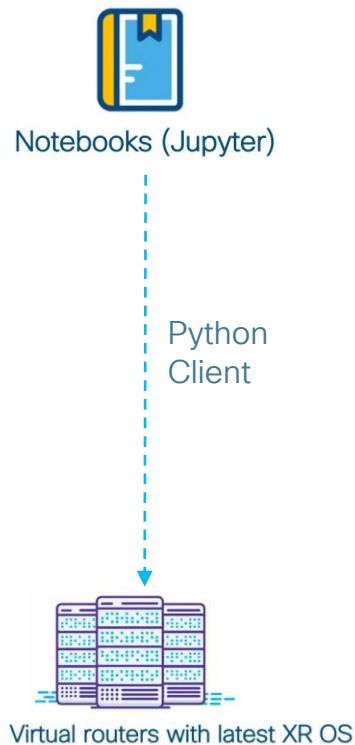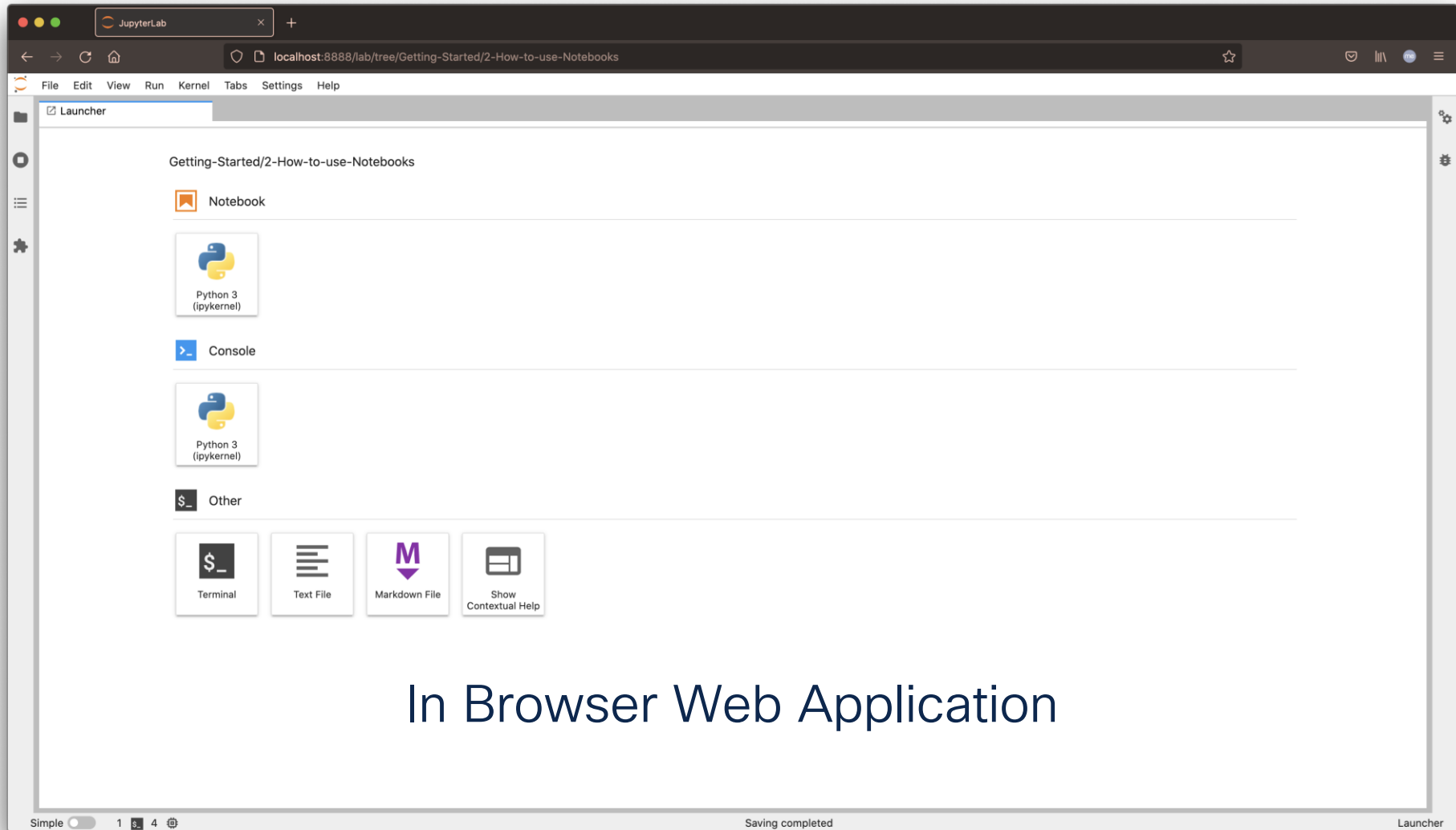
localhost:8888/lab/tree/Getting-Started/2-How-to-use-Notebooks/Notebook-magic.ipynb

File Edit View Run Kernel Tabs Settings Help

Notebook-magic.ipynb

Markdown ∨   **Toolbar**

Python 3 (ipykernel) ○   **Kernel**

Let's see how this actually happens. In this notebook, we will be using a 2 router back-to-back network topology, like below.

TOPOLOGY

Images

In the cell below, the python module **b2b_routers** contains the code to set up the python enviroment, the simulated 2-router topology as depicted in the topology diagram along with the base configuration of the routers. The variable **sim** is initiailized to the CiscoVxr module. The **sim.init** and **sim.up** API calls initialize the 2 routers and brings up the network. For more informaiton on the router configuration and topology, refer to the **b2b_routers.py** file in this folder.

Play the below cell to bring up the network. Please note that the bring up can be slow, sometimes taking 10 minutes or more.

```
[ ]: from b2b_routers import *
     sim = CiscoVxr()
     sim.clean()
     cfg = {'devices':
            {'r0': {'platform':'spitfire_f'},
            }
        }
     print(cfg)
     sim.init(cfg)
     sim.up()
```

Code

At this point, console access to the routers is available. Play the below cell and obtain the telnet and ssh connection details of the routers. You can access the simulated router consoles directly from your laptop through telnet/ssh or you can just continue playing the subsequent code-cells of this notebook and watch the notebook access the telnet console and execute commands on the router.

```
[ ]: print('Consoles can be reached by:')
     print('PE1:', get_telnet_cmd(sim, 'pe1'), '\nPE2:', get_telnet_cmd(sim, 'pe2'))
     print('or better:')
     print('PE1:', get_ssh_cmd(sim, 'pe1'), '\nPE2:', get_ssh_cmd(sim, 'pe2'))
     print('The password is cisco123')
```

When the below cell is played the notebook accesses the telnet consoles of the routers.

Simple   1 S. 4 ⊛ Python 3 (ipykernel) | Idle   Saving completed   Mode: Command ⊗ Ln 1, Col 1 Notebook-magic.ipynb

Demo 2: Jupyter Notebook for GRE Tunnel Configuration

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Existing Notebooks

Setup Network for Transport

- Simplify Your Network Using EVPN VPWS

- Segment Routing v6 Over An IS-IS Network

Secure Network

- Integrity Measurements To Handle Threats (IMA)

- Manage Your Router Database Securely (MongoDB)

- Type 6 Password Authentication For BGP

Traffic Management

- Configure Policies for Quality of Service

- Prioritize Delay-Sensitive Traffic Using QOS

- Configure QoS Using NSO

- Filter Network Traffic Using Access Control List

- Filter Network Traffic Using ACL Yang

Existing Notebooks (cont.)

Network Monitoring

- Traffic Monitoring With Encapsulated Remote Switched Port Analyzer (ERSPAN)

- Stream CPU Utilization Data Using Model-driven Telemetry

- Deploy YANG Data Model to Stream CPU Utilization Data Using Model-driven Telemetry

- Setup a Pipeline and Stream CPU Utilization Data Using Model-driven Telemetry

APIs

- Super-charge Your Router Performance With Service-layer APIs

Utilities

- Generate Real-time Network Traffic On Simulated networks

- Analyze Bit Level Information of Traffic Flows

- Utilize Linux Servers Effectively Within Simulated Networks

Other Virtualization Options

- XRv9000

- XRd

- Cisco Modeling Labs

- GNS3

Why Bother?

Automates the creation and bring-up of the topology on the simulator

Customize topology on the fly by modifying YAML config

Test proof-of-concept, use cases, or features to existing problems

Leverage it as a tutorial for educational purposes

Simulate use cases and play them before actual deployments

Call to Action

- Check out our github

- Contact your account team or myself for access to the emulator

- View the Emulator datasheet

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