slido.com
#033 942

Jak získat ze síťových zařízení maximum – App Hosting

Peter Morvay – Systems Engineer

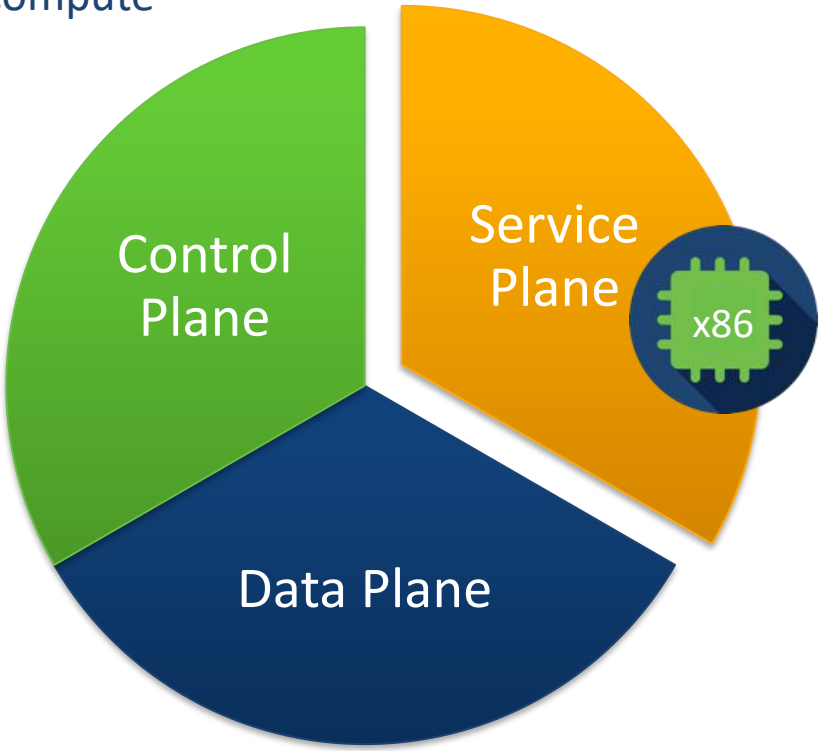
Dominik Soukup – Technical Solutions Specialist

29.6 2021

I can get even more from what is already in my NW?

What is Service Plane?

Opens door for Edge Compute



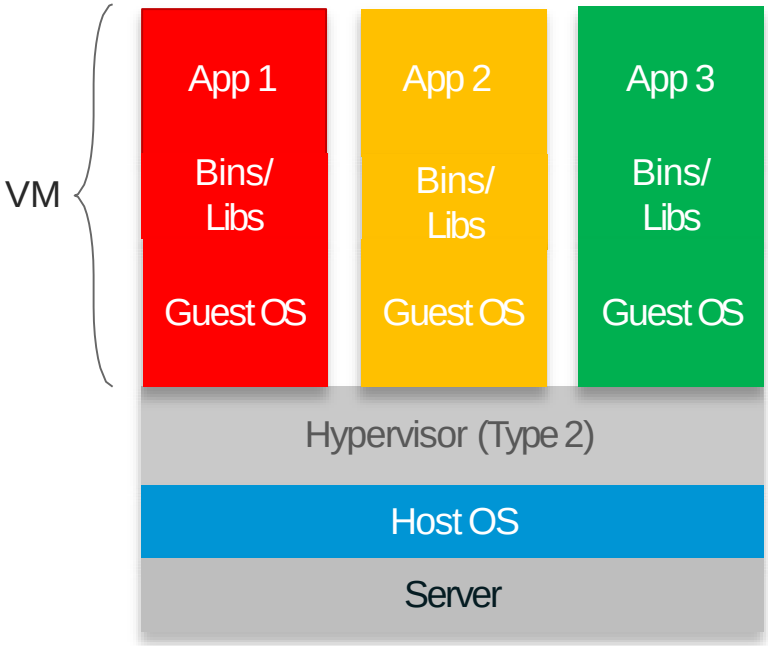
Current Application Challenges

Not Enough Network Bandwidth	Data Reduction
Most Data is not interesting	Filtering
Use of Data at the Edge	Latency Optimization
Computation to be optimized	Partitioning
Data Normalization	Application Simplification
Data Redirection based on Content	Dynamic Changes
Data Timestamping & Algorithm analysis	Analytic Support

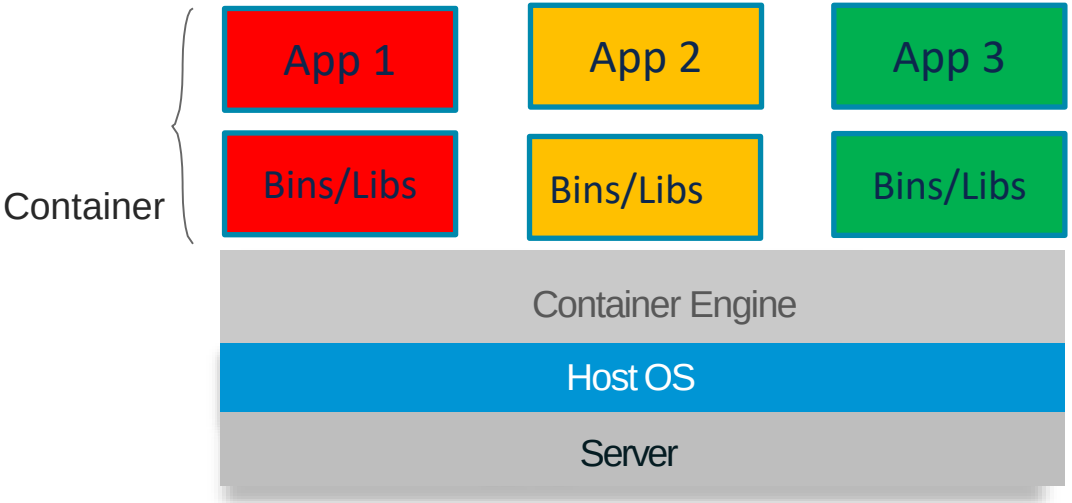
Virtual Machines vs Containers

- **Virtual Machine** - Includes the application, binaries & libraries along with entire guest OS.
- **Containers (LXC)** - OS level virtualization method for running multiple isolated Linux containers on a single control host.

Virtual Machines vs Containers



Containers are isolated but share OS



What is a Service Container?

Service Containers leverage virtualization layer (LXC and KVM) to provision an application hosting environment on Cisco routers/switches.

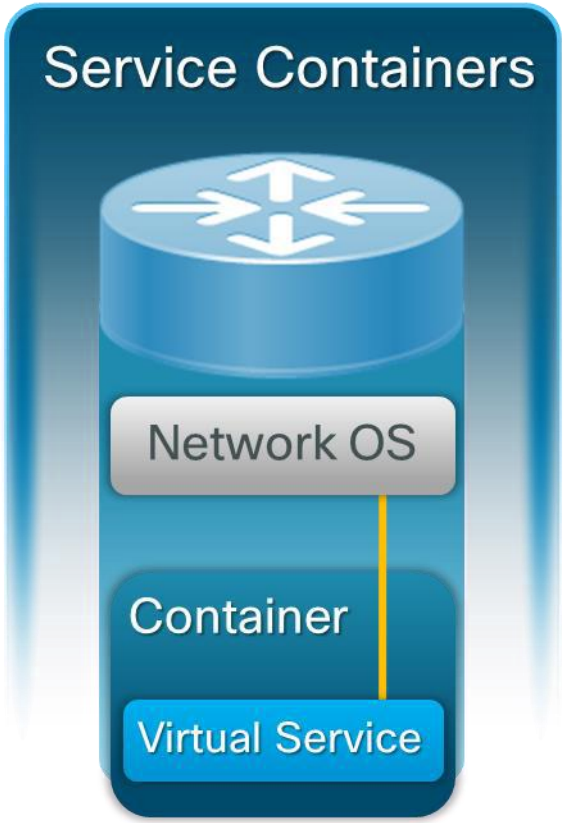
Gives ability to code application/service once and run it everywhere.

Cisco Virtual Services:

- Example: WAAS, SNORT

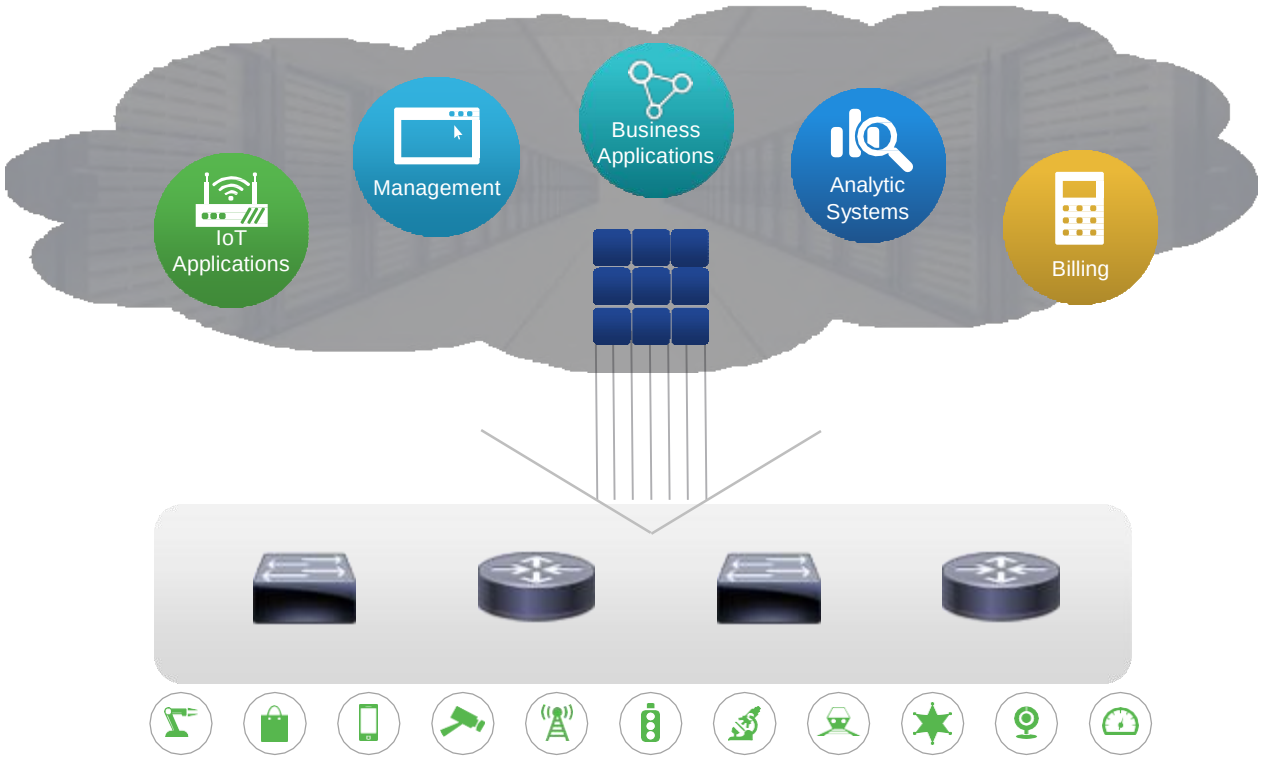
Third Party Services:

- Example: Wireshark, iperf etc.



Empowering the Edge – Leverage the Network!

- Existing hardware footprint
- No need for separate compute machinery
- Integrated security
- Reduced latency & bandwidth cost
- Owner is the NW team



Application Hosting Spectrum

Different models for different application needs.

Native Process

- Very Tight Integration
- Best Performance

LXC

- Strict Kernel Requirements
- Good performance with some security

Docker

- Emerging Industry Standard

KVM

- Any OS
- Complete separation
- Linux host OS normally – Type 2 hypervisor

Type 1 Hypervisor

- Service Module Only
- VMWare, HyperV, Zen…

Application Hosting Security

IOS XE performance and security protection

- Memory and CPU usage for Apps are bounded using Control groups (**cgroups**).
- Process and files access for Apps are isolated and restricted (using user **namespace**)
- Disk usage is isolated using separate storage.

Cgroups HW Resource Sharing

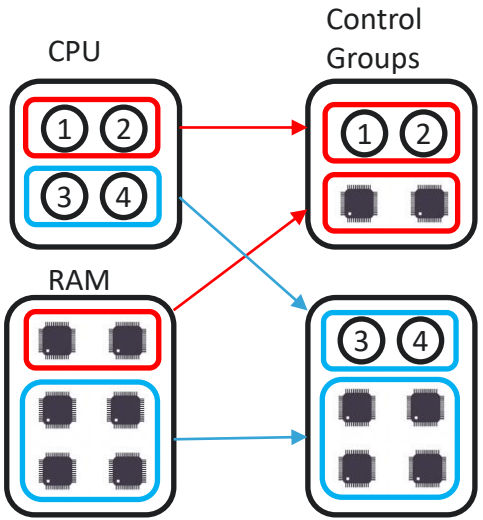
Cgroups limits Application resources for:

- System Memory
- CPU resource

System Memory: defines how much Memory available for Applications.

CPU resource: defines dynamic CPU load sharing among 3 Cgroups.

- Linux OS processes (highest priority)
- IOS-XE Control Plane
- Applications

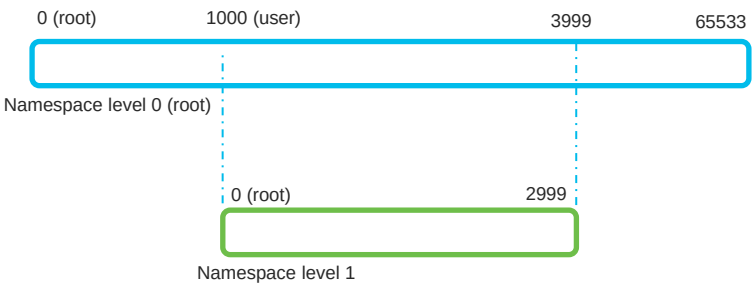


- If one cgroup is idle or under-utilizing allocation, other active cgroup(s) can be used extra CPU resources from that cgroup.
- If fully congested, each cgroup cannot exceed their CPU allocation.

Cisco Application Framework (CAF) validates available HW resources before activating Containers.

User namespace

- A feature that can be used to separate the user IDs and group IDs between the host and containers.
- Can provide a better isolation and security.
- Privileged **user (root)** in the container can not be mapped to a privileged **user (root)** on the host.



Storage Security

CAT9K

SSD offers two layers of security:

- AES-256 Hardware encryption on SSD
- Passcode Authentication on the switch and SSD

Match

```
Switch#hw-module switch 1 usbflash1 security ?
  disable disable security on USB3.0
  enable   Enable security on USB3.0
  unlock   Unlock USB3.0
```

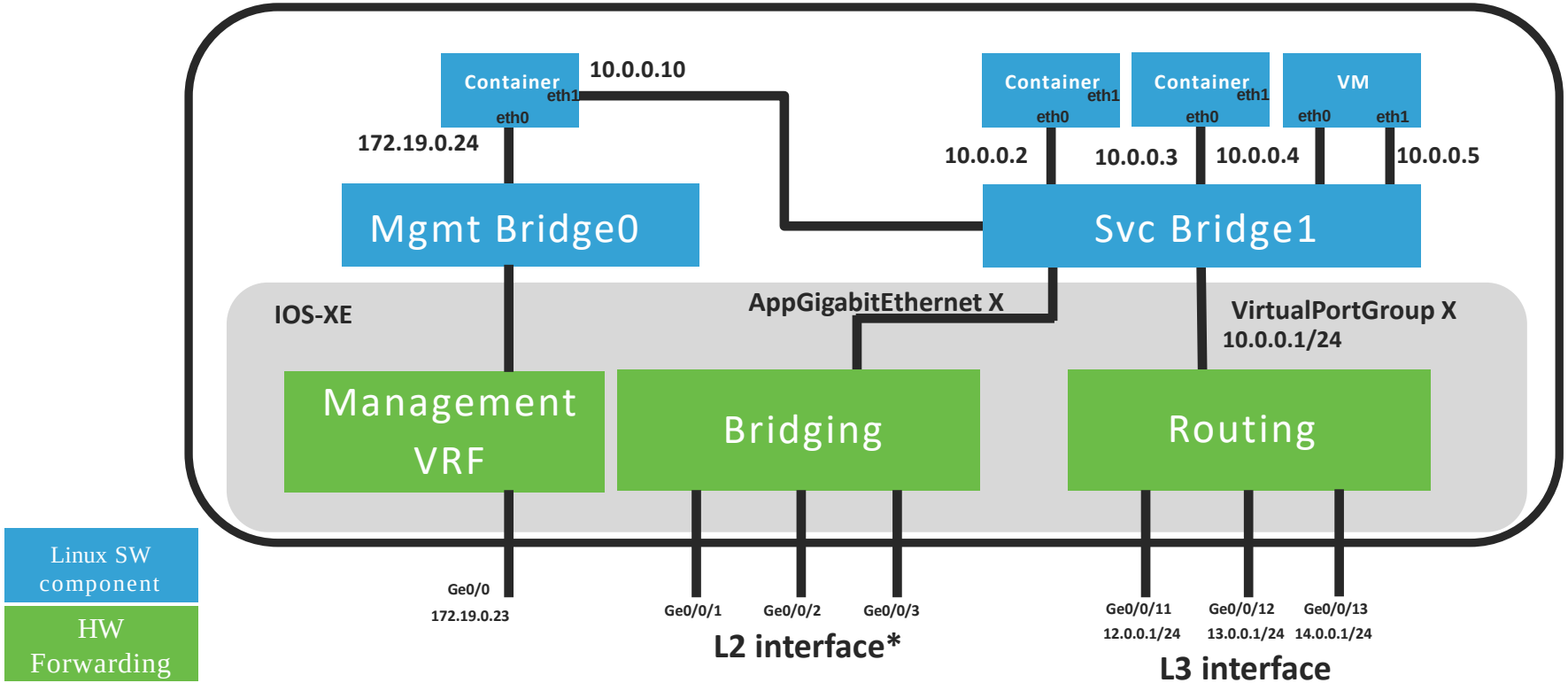
```
Switch# conf t
Switch(config)# hw-module switch 1 usbflash1-password
Switch(config)# no hw-module switch 1 usbflash1-password
```

Secure Framework

- Application Signature Verification
- Secureboot for Cisco signed applications
- Memory, CPU: bound by Control groups
- Process, files access: user namespace
- Disk usage: separate storage
- Network level isolation within applications

Application Hosting Networking

Containers Networking



Containers Networking: IP Configuration

Linux CLI

Logging directly into VM and configure using **Linux commands**

DHCP

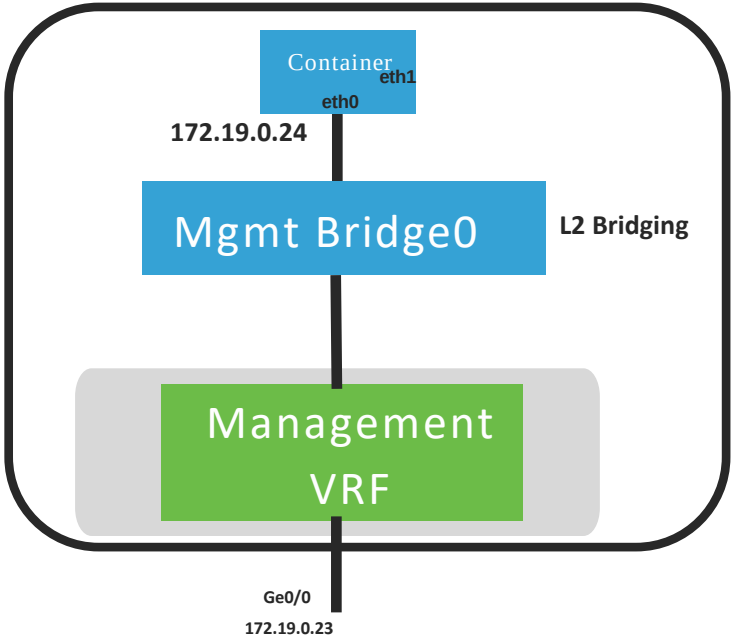
Enabling **DHCP service** in KVM/LXC and configuring DHCP server/relay

IOS XE CLI

IOS assigned explicitly with **IOS XE CLI**

Containers Networking: Management Interface

CAT9K




```
Switch#sh run int gi0/0
Building configuration...

Current configuration : 122 bytes
!
interface GigabitEthernet0/0
 vrf forwarding Mgmt-vrf
 ip address 10.197.218.202 255.255.255.248
 negotiation auto
end
```

Management Interface

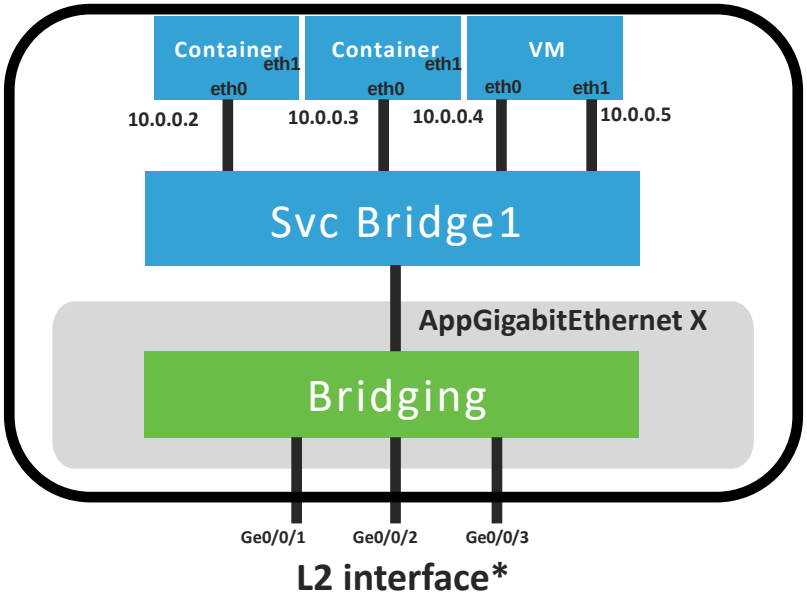
```
Switch#sh run | sec appid
app-hosting appid iperf
 app-vnic management guest-interface 0
```

LXC/VM vNICs

Containers Networking: Data Port

Data ports can be accessed using IOS XE AppGigabitEthernet Port

CAT9K




```
Switch#sh run | sec appid
app-hosting appid iperf
 app-vnic AppGigabitEthernet trunk
  vlan 100 guest-interface 1
   guest-ipaddress 20.20.20.2 netmask 255.255.255.0
 app-default-gateway 20.20.20.1 guest-interface 1
 app-resource docker
  run-opts 1 "--restart=unless-stopped -p 5201:5201/tcp -p 5201:5201/udp"
```

AppGigabit Interface

```
Switch#sh ip int bri | in up
Vlan100              20.20.20.1      YES manual up                    up
```

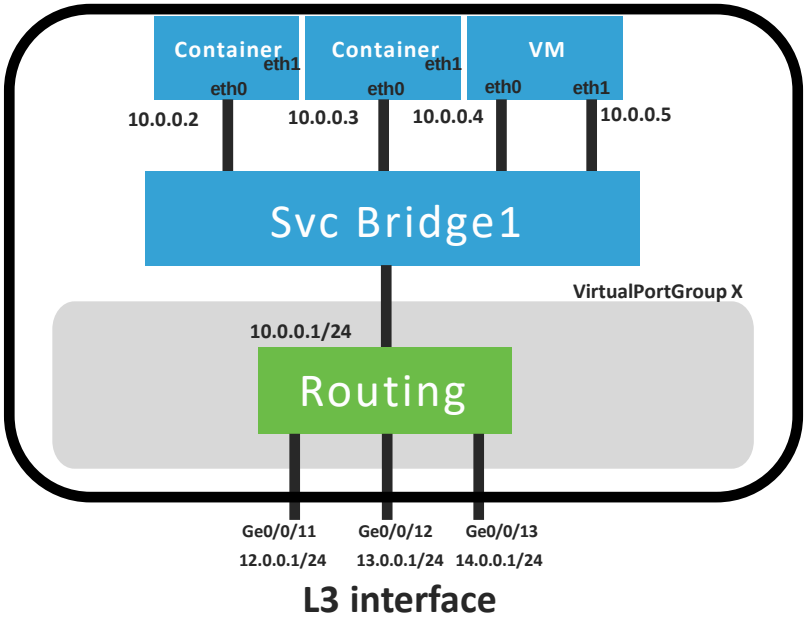
```
Switch#sh run int gi1/0/2
Building configuration...

Current configuration : 90 bytes
!
interface GigabitEthernet1/0/2
 switchport access vlan 100
 switchport mode access
end
```

Outgoing Port

Containers Networking: Data Port

Data ports can be accessed using IOS XE Virtual Port Groups

ISR4K



L3 interface

Virtual Port Group (VPG) Interface Connection

- Layer 3 Routed mode
- Network Address Translation
- ip-unnumbered

Full Network Connectivity

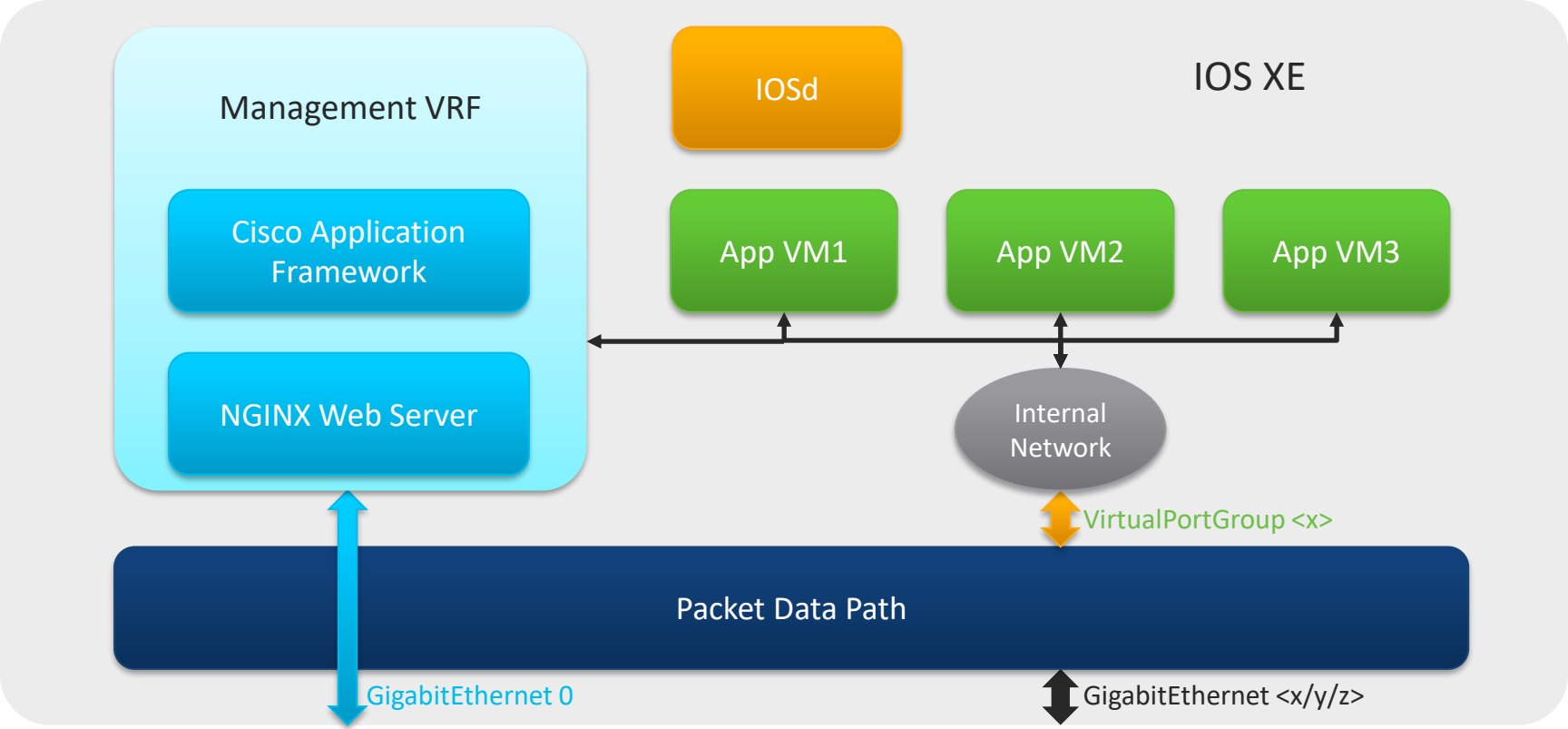
Management GigabitEthernet0 Interface Connection

- Support Layer 2-3 packets
- Applications are not aware of VRF configuration

Virtual Port Group (VPG) Interface Connection

- Layer 3 Routed mode
- Network Address Translation
- ip-unnumbered

Application Traffic Networking



VPG configuration- with NAT

```
iox-Router#conf t
iox-Router(config)#interface VirtualPortGroup1
iox-Router(config-if)#ip address 192.168.0.1 255.255.255.0
iox-Router(config-if)#ip nat inside      !! if NAT is desired
iox-Router(config-if)#no shutdown
iox-Router(config)#exit
iox-Router#
```

VirtualPortGroup interface acts as NAT inside interface

VPG configuration- with DHCP Pool

```
iox-Router#conf t
iox-Router(config)#interface VirtualPortGroup1
iox-Router(config-if)#ip address 192.168.0.1 255.255.255.0
iox-Router(config-if)#ip nat inside      !! if NAT is desired
iox-Router(config-if)#no shutdown
iox-Router(config)#ip dhcp pool iox-apps
iox-Router(dhcp-config)#network 192.168.0.0 255.25
iox-Router(dhcp-config)#default-router 192.168.0.1
iox-Router(dhcp-config)#domain-name sample.com
iox-Router(dhcp-config)#dns-server 171.70.168.183
iox-Router(dhcp-config)#option 42 ip 171.68.38.65 1.100.30.113
iox-Router(dhcp-config)#exit
iox-Router(config)#ip dhcp excluded-add 192.168.0.0 192.168.0.2
iox-Router(config)#ntp master
```

DHCP pool allows flexible IP allocation in Application space. Suitable mode for Application Developer.

VPG configuration- without NAT

```
iox-Router#conf t
iox-Router(config)#interface VirtualPortGroup1
iox-Router(config-if)#ip unnumbered GigabitEthernet0
iox-Router(config-if)#ip helper-address 1.100.30.114
iox-Router(config-if)#no shutdown
iox-Router(config)#ip dhcp pool iox-apps
iox-Router(dhcp-config)#network 192.168.0.0 255.255.255.0
iox-Router(dhcp-config)#default-router 192.168.0.1
iox-Router(dhcp-config)#domain-name sample.com
iox-Router(dhcp-config)#exit
iox-Router#
```

VPG using unnumbered configuration and Public IP as helper address.

App-VNIC and Gateway Configuration

```
iox-Router#conf t
iox-Router(config)#app-hosting appid myapp
iox-Router(config-app-hosting)#app-vnic gateway0
virtualportgroup 1 guest-interface 0
iox-Router(config-app-hosting-gateway0)#end
iox-Router#
```

Attaching logical gateway for specific VPG i/f and binding it to guest interface

Application Hosting on IOS XE Routing Platforms

Edge Routing Platforms

Catalyst 8300

Catalyst 8200

Catalyst 8500

ISR 4000

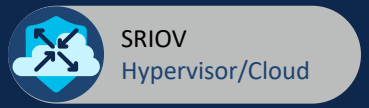
ISR1121-X

ISR1161-X

ENCS 5400

Catalyst 8200 uCPE

CSR 1000V

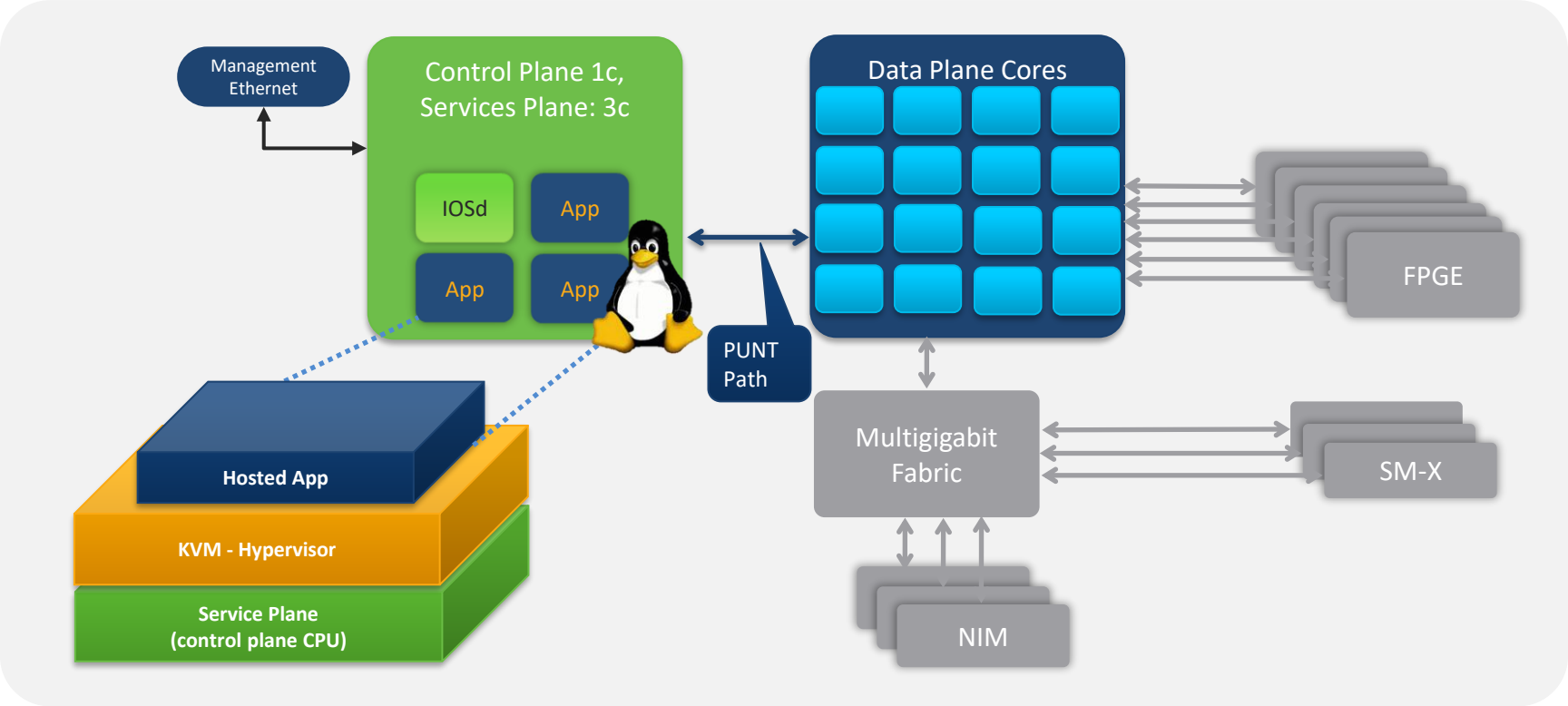


Catalyst 8000V

ASR 1000

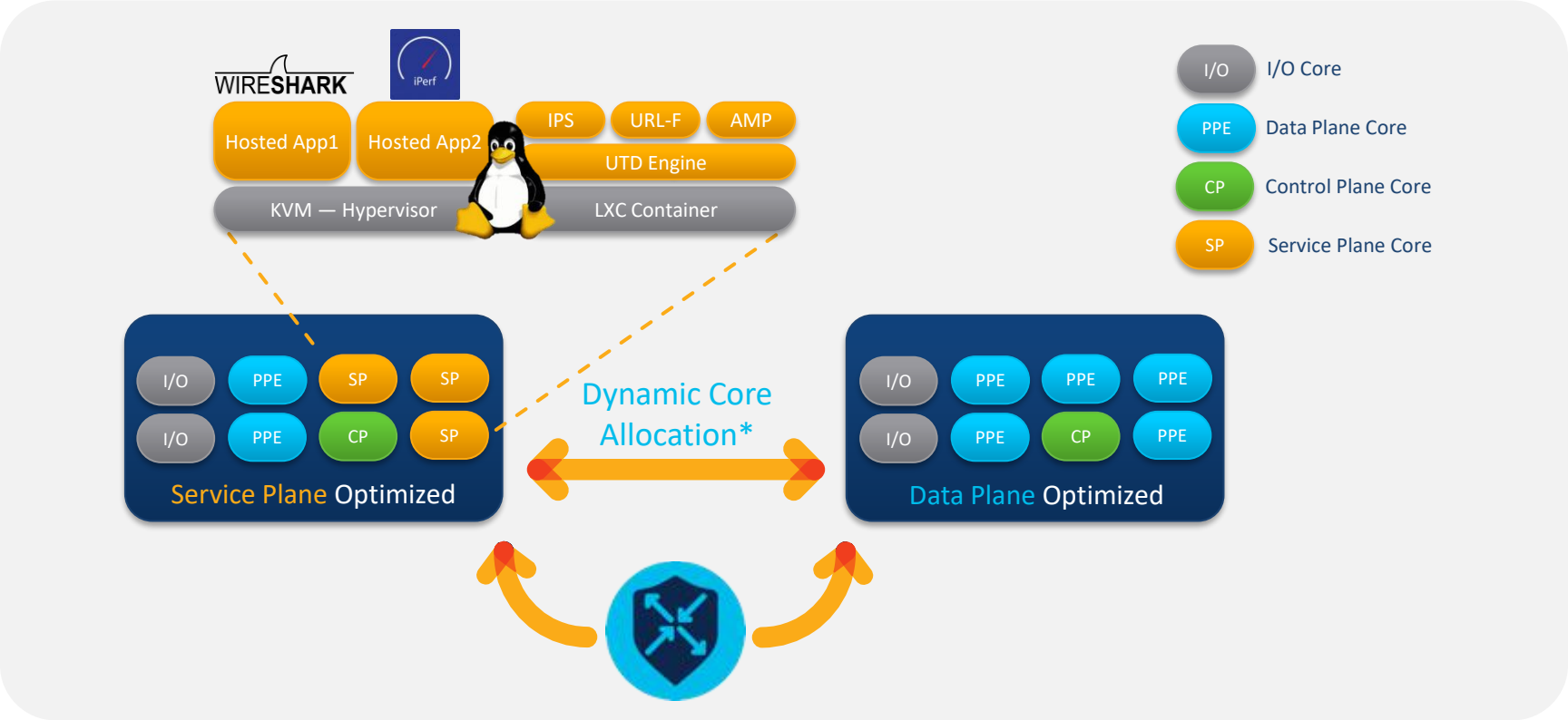
Service Plane Architecture

ISR 4000 Platforms



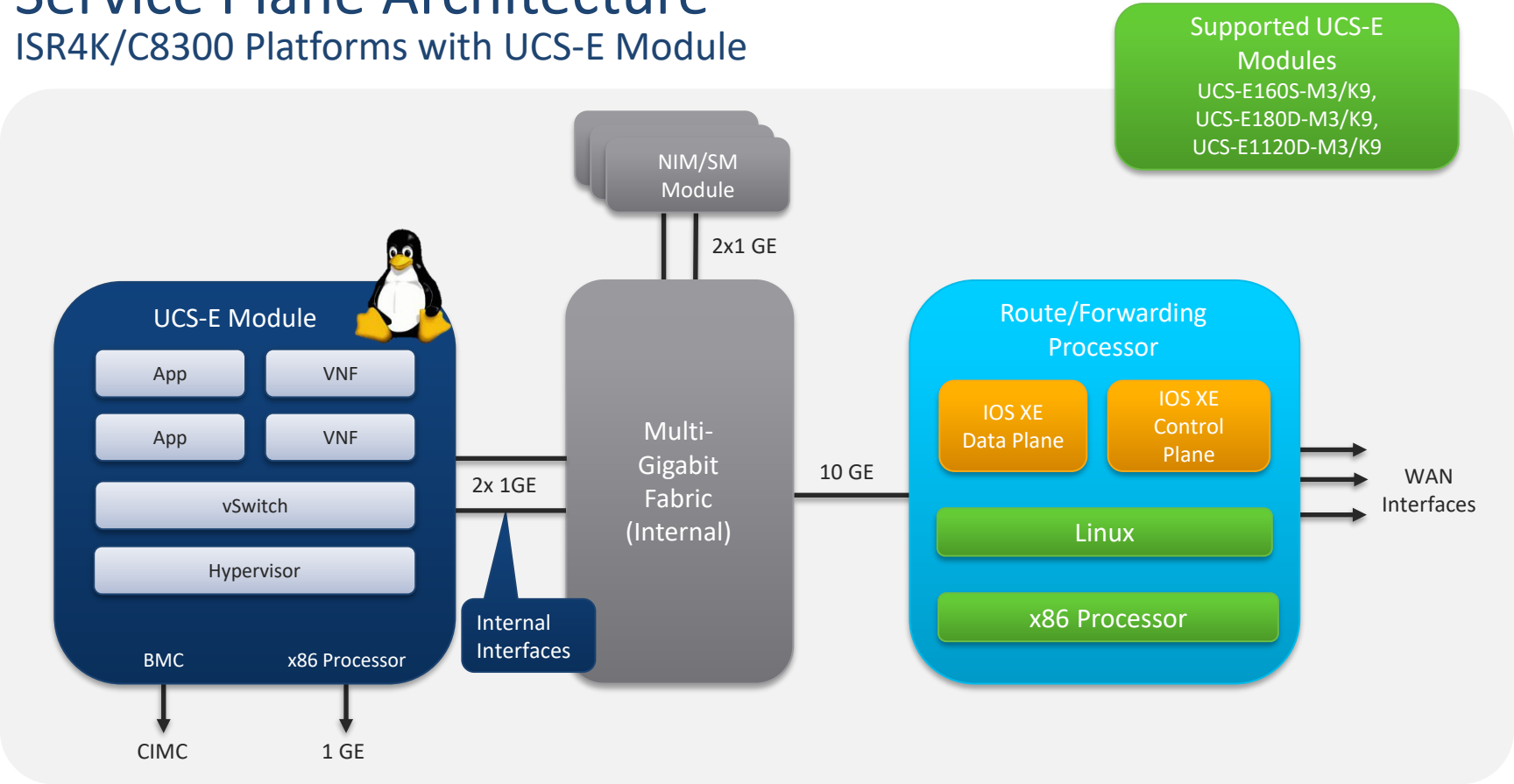
Service Plane Architecture

Catalyst 8300/8200/8500L Series Edge Platforms



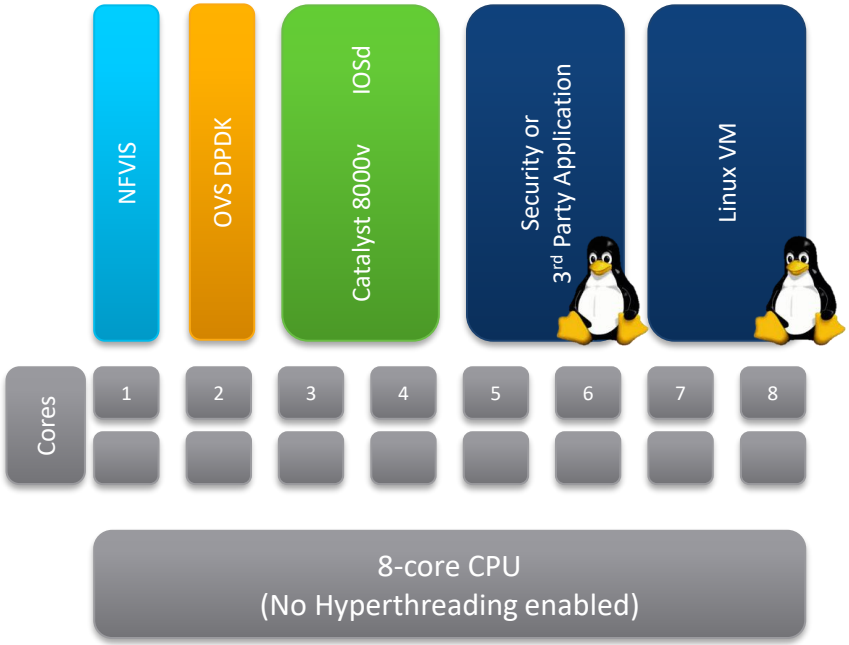
Service Plane Architecture

ISR4K/C8300 Platforms with UCS-E Module



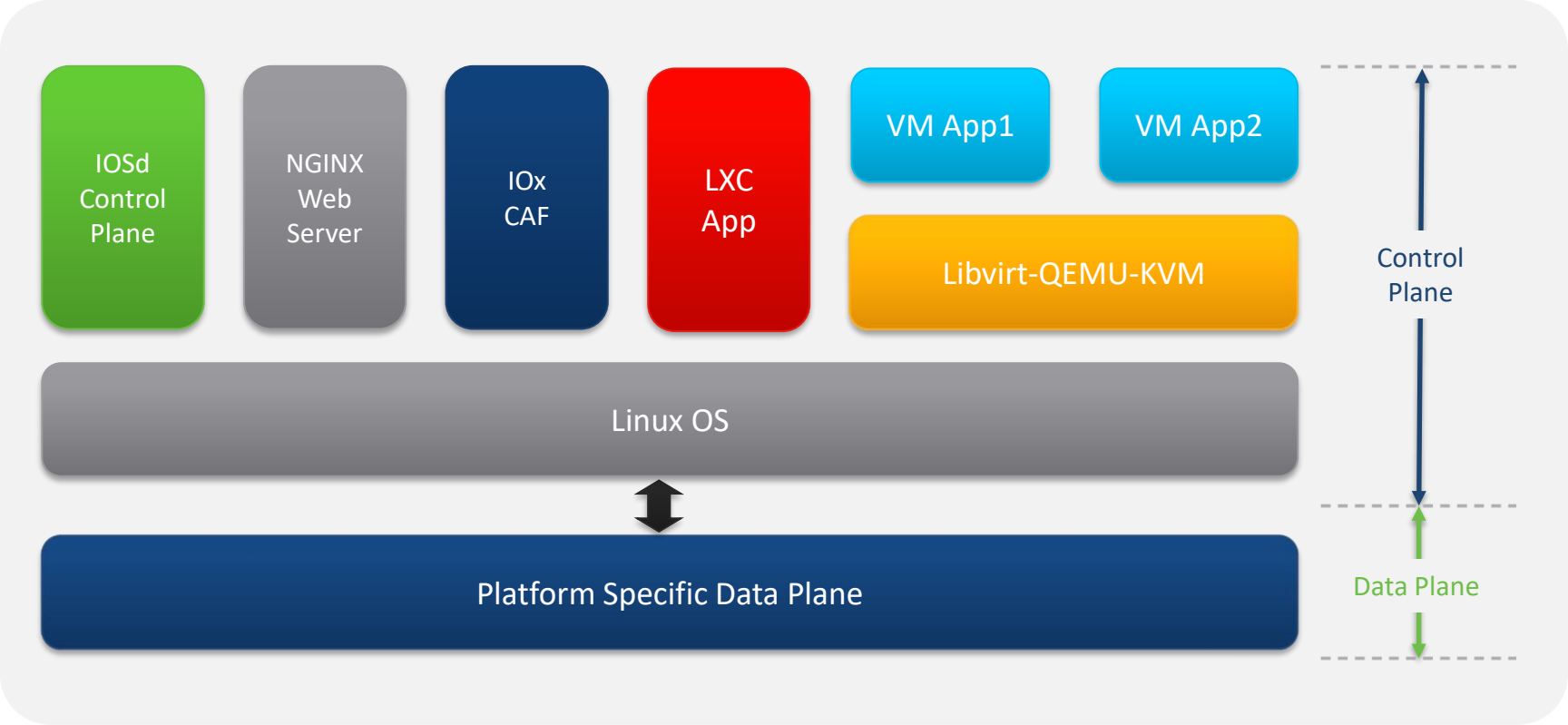
Service Plane Architecture

C8200 Edge uCPE Platform



Easy Orchestration from vManage in SD-WAN mode

App-hosting Architecture Overview



Application Resource Limits

Platform Dependent

```
iox-Router# show app-hosting resource
CPU:
  Quota: 80(Percentage)
  Available: 80(Percentage)   !! Max App-hosting % CPU limit
  Quota: 800(Units)
  Available: 800(Units)
VCPU:
  Count: 1        !! App-hosting CPU core limit for KVM
Memory:
  Quota: 4096(MB)
  Available: 4096(MB)
Storage space:
  Total: 225280(MB)
  Available: 203085(MB)
```

vCPU: Allows to use minimum 1 vCPU (thread) per KVM Application

CPU Quota: % CPU at Linux (host OS) level allocated for App-Hosting

Application Hosting on IOS XE Routing Platforms

- Only IOx LXC and KVM type containers are supported
- Docker workflow is supported
  - Use ‘ioxclient’ utility to package as IOx package

Storage for Application Hosting: harddisk, bootflash, M.2 NVMe

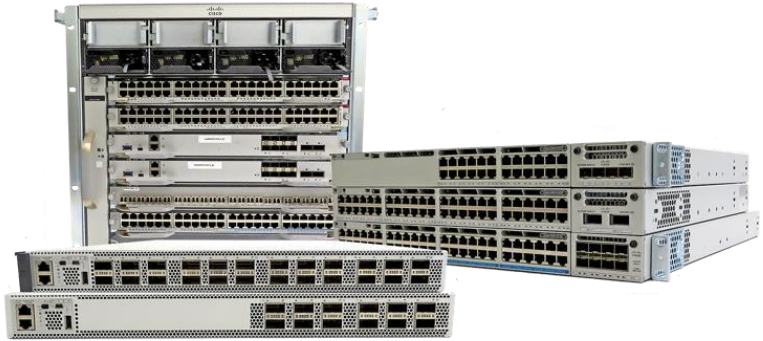
Connectivity Options:

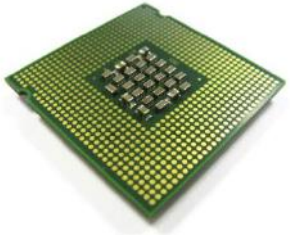
- Access via the management interface
- Access via the front-panel ports

Application Hosting
Cat 9K

Networking Today …

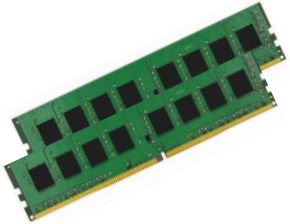
Catalyst 9000





x86 CPU

Linux-based OS



Memory/Storage

Enables hosting docker containers and 3rd party apps

Switching - Supported Platforms

Catalyst 9000

Catalyst 9300 – 16.12.1
Catalyst 9404,9407 - 17.1.1
Catalyst 9410 – 17.5.1
Catalyst 9500H – 17.5.1
Catalyst 9600 – 17.5.1

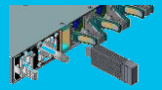
Note: Catalyst 9200 and 9500 (non-H) do not support Application Hosting

Catalyst 9000 switch storage and compute

	Resource type	Catalyst 9300	Catlyst 9300X	Catalyst 9400	Catalyst 9500 High Perf	Catalyst 9600
Networking	AppGig Port (1G)	Yes	No	Yes	No	No
	AppGig Port (10G)	No	Yes (2x10G)	No	No	No
	Management Port	Yes	Yes	Yes	Yes	Yes
Resources	Memory	2GB	8GB	up to 8GB	up to 8GB	up to 8GB
	CPU	1 core (25%)	2 core (50%)	1 core (25%)	1 core (25%)	1 core (25%)
	Storage	120/240 GB (USB3.0/SSD)	240GB (USB3.0/SSD)	240-960GB (SATA)	240-960GB (SATA)	240-960GB (SATA)

Catalyst 9300

USB 3.0
120/240GB



Back panel

Catalyst 9400

M2 SATA
240/480/960GB

Plug into removable SUP

Catalyst 9500 high-performance

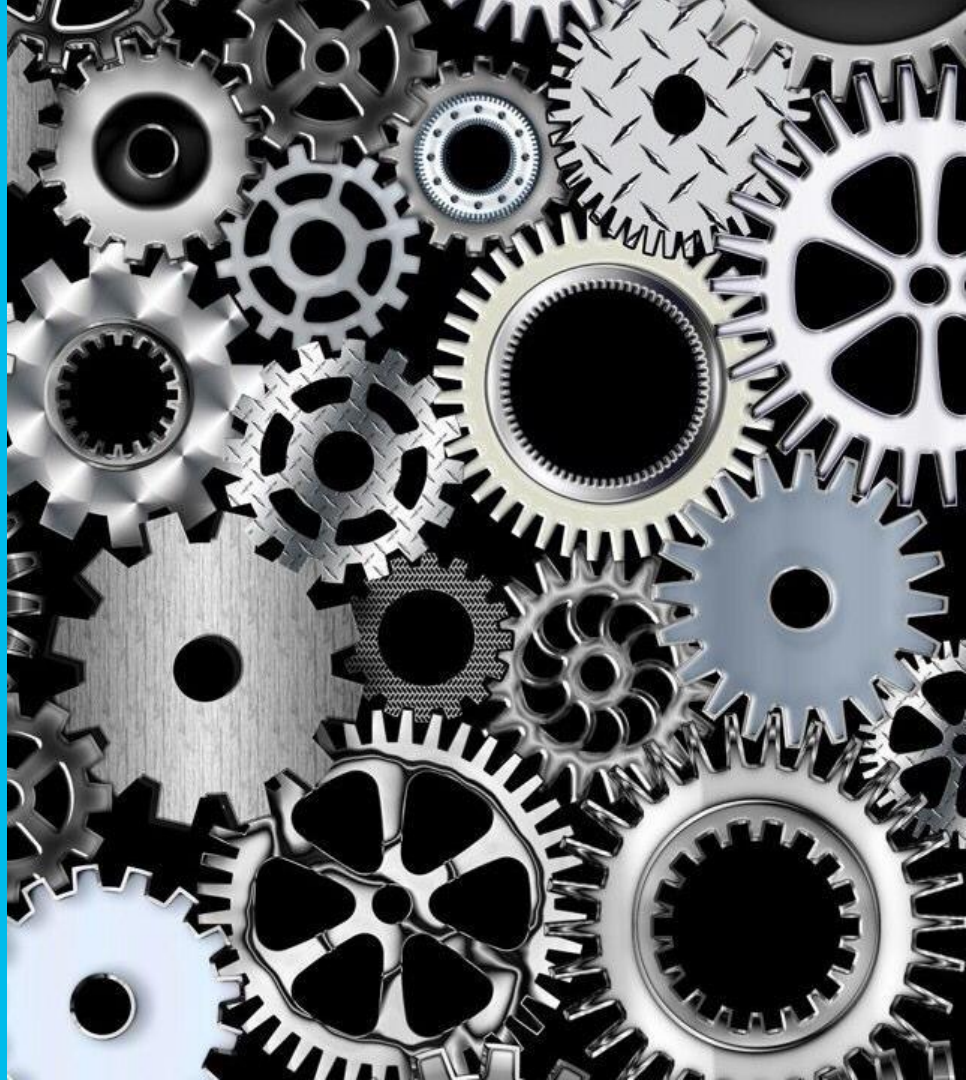
M2 SATA
240/480/960GB

Back panel

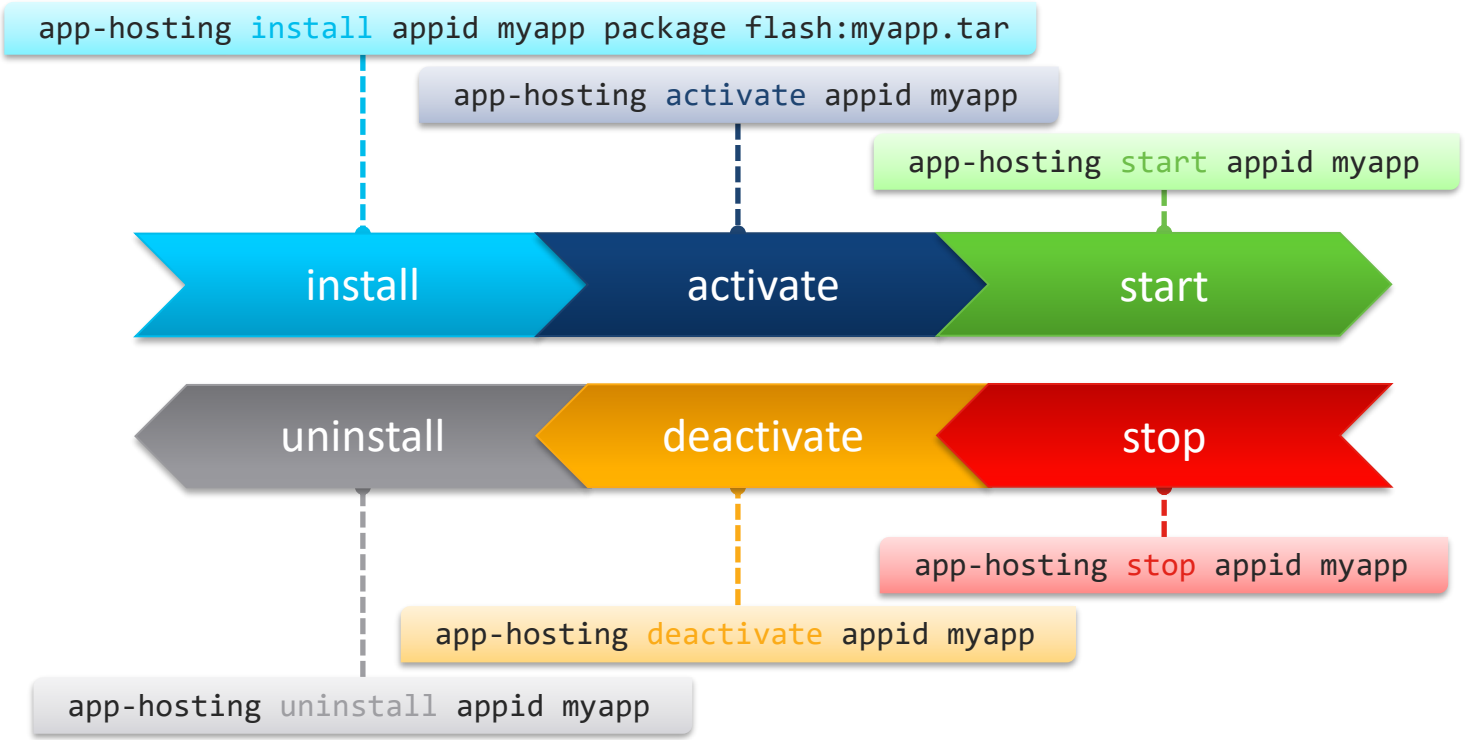
For local storage and app hosting production

- 3rd party USB drives in front panel are not supported
- Applications can be hosted via CLI too

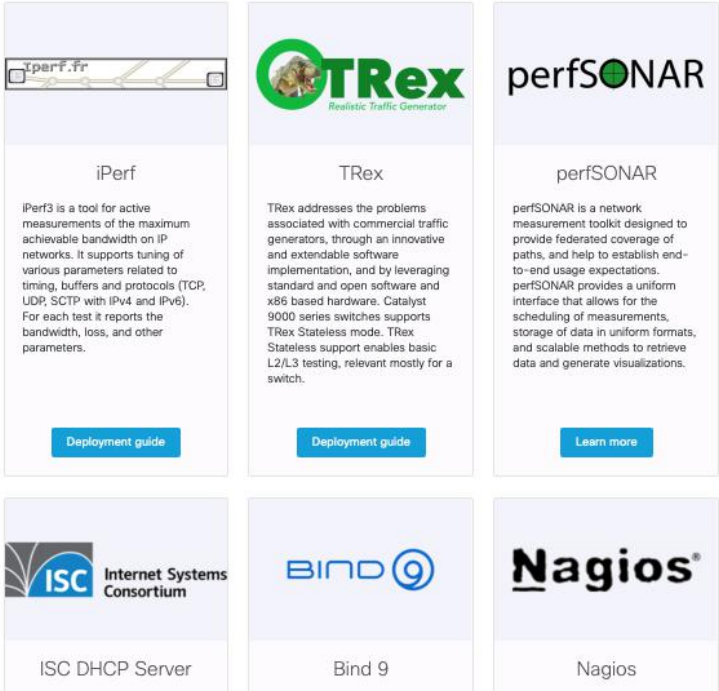
App Life-cycle



App Life-cycle: install, activate, start…

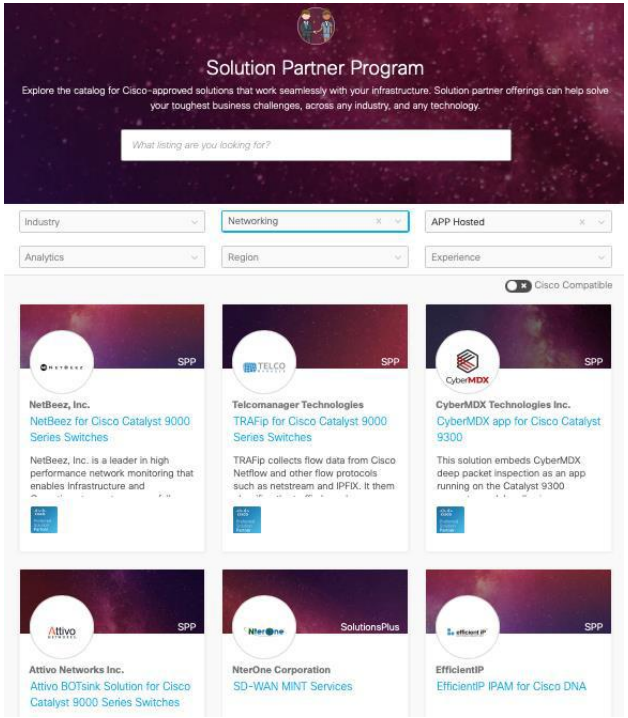


Open source apps



https://developer.cisco.com/app-hosting/opensource/

Ecosystem exchange



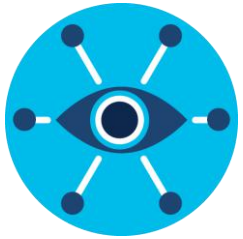
https://developer.cisco.com/ecosystem/spp/#deploymentModel=763&technology=Networking

Cyber Vision demo [CLI]

• Cisco Cyber Vision

Asset Inventory & Security Platform for the Industrial IoT

Protect your industrial control systems against cyber risks



Visibility

Know your assets

Operational Insights

Track your processes

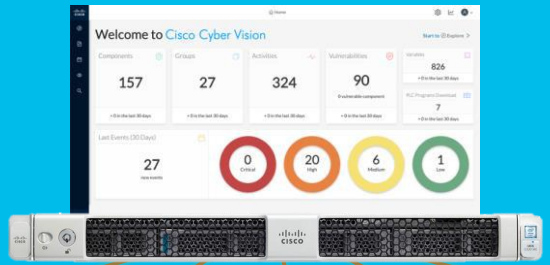
Detection

Trigger alerts

Two tier **edge monitoring** architecture

Industrial cybersecurity that can be deployed at scale

Cyber Vision Center:
Centralized analytics & data visualization



Cisco integrations

ISE, Stealthwatch, Firepower, DNA-C

Partner integrations

SIEM, CMDB
ICS vendor software

Sensor — Industrial Switching

Sensor — IoT Gateways / Compute

Sensor — Industrial Routing

Sensor — Industrial Wi-Fi

Sensor — Sensor Networking (RF Mesh)

Cyber Vision Sensors: Deep Packet Inspection built into network elements

Visibility: Comprehensive asset inventory

Explore / All data / Component list

May 29, 2018 3:16:34 PM - Jun 20, 2019 4:16:34 PM (1y 22d 1h) LIVE

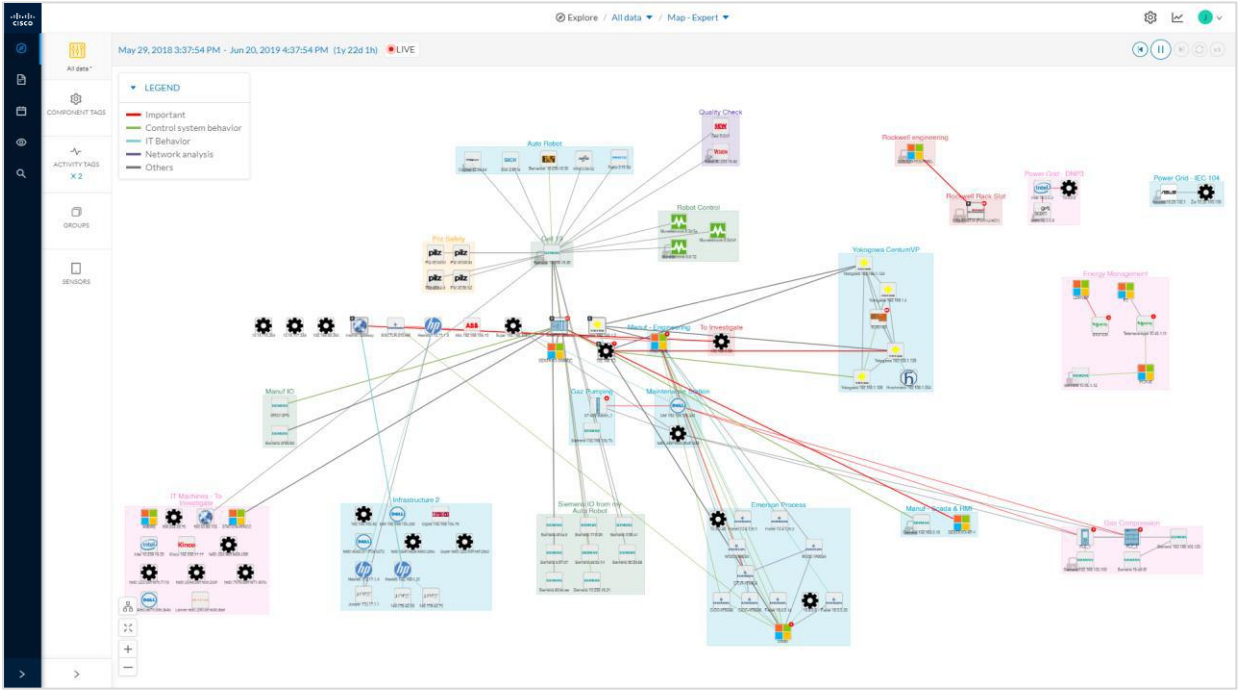
66 Components

1 2 3 4 20 / page

Component	Group	First activity	Last activity	IP	MAC	Tags	Flows	Vuln	Var	Vendor	OS
Dell 192.168.105.241	Maintenance Station	Apr 6, 2017 10:59:14 PM	Jun 18, 2019 12:23:34 AM	-	34:17:ebd1:c9:97	Read Var, Write Var, Engineering Station, Remote access	579	0	0	Dell Inc.	-
149.178.42.70	Infrastructure 2	Oct 5, 2017 6:03:16 PM	Jun 18, 2019 12:23:34 AM	-	2c:6bf5:62:e7:80	DNS Server, Public IP	38	0	0	Juniper Networks	-
232.108.116.118	-	Apr 6, 2017 10:58:44 PM	Jun 18, 2019 12:23:34 AM	-	01:00:5e:6c:74:76	Multicast, Public IP	8	0	0	-	-
AMBRE	IT Machines - To Investigate	Apr 6, 2017 10:58:58 PM	Jun 18, 2019 12:23:34 AM	-	00:24:9b:08:43:6f	Windows	7	0	0	Action Star Enterprise Co., Ltd.	-
10.16.116.254	-	Apr 6, 2017 10:58:44 PM	Jun 18, 2019 12:23:34 AM	-	00:22:e5:21:0a:86	Read Var, Write Var, Wireless IO Module, DeltaV	44	0	225	-	-
SIMATIC 300(1)	-	Apr 6, 2017 11:29:22 PM	Jun 18, 2019 12:23:34 AM	192.168.0.1	00:0e:8c:84:5b:a6	Read Var, PLC	25	10	13	Siemens AG A&D ET	-
10.8.0.6	-	Apr 6, 2017 10:58:45 PM	Jun 18, 2019 12:23:34 AM	-	84:8f:69:e1:a7:9b	Read Var, DNS Server, Time Server, Windows, DeltaV	16099	3	4	-	-
OWS1	Emerson Process	Apr 6, 2017 10:58:45 PM	Jun 18, 2019 12:23:34 AM	-	d4:ae:52:aa:dc:93	Read Var, Write Var, Windows, DeltaV	16071	3	113	Dell Inc.	Windows 7 or Windows Server 2008
239.192.24.4	-	Oct 5, 2017 6:03:14 PM	Jun 18, 2019 12:23:34 AM	239.192.24.4	01:00:5e:40:18:04	Multicast, Public IP	17	0	0	-	-
Hirschmann 192.168.1.254	Yokogowa CentumVP	Oct 5, 2017 6:03:14 PM	Jun 18, 2019 12:23:34 AM	192.168.1.254	ec:74:ba:03:98:6b	Time Server	4	0	0	Hirschmann Automation and Control GmbH	-
Fisher 10.4.0.14	Emerson Process	Apr 6, 2017 10:58:44 PM	Jun 18, 2019 12:23:34 AM	10.4.0.14	00:22:e5:1f:9a:54	Read Var, Write Var	35	0	16	Fisher-Rosemount Systems Inc.	-
WIOC-1F903A	Emerson Process	Apr 6, 2017 10:58:45 PM	Jun 18, 2019 12:23:34 AM	10.5.0.22	00:22:e5:1f:90:18	Read Var, Write Var, DeltaV	41	0	28	Fisher-Rosemount Systems Inc.	-
ff02::1:fffb:3b4b	-	Apr 6, 2017 10:59:14 PM	Jun 18, 2019 12:23:34 AM	ff02::1:fffb:3b4b	33:33:ff:fb:3b:4b	Multicast, Public IP	2	0	0	IPv6 Multicast	-
IM151-3PN	Manuf IO	Apr 6, 2017 11:29:22 PM	Jun 18, 2019 12:23:34 AM	192.168.0.2	08:00:06:6b:f6:16	IO Module	6	0	0	SIEMENS AG	-

Track the industrial assets to protect throughout their life cycles

Communication: Map application flows



Drive network segmentation and fine-tune configurations

Protocols

Standard Protocols	
Electrical engineering & Power system automation	IEC 104, IEC 101 over IP, DNP3, IEC 61850 (MMS, Goose), C31.118, DLMS / COSEM
Building Management	Bacnet, Ethercat
SCADA/Data acquistion	OPC-DA, OPC-UA, OPC-EA
IT Networks	Ethernet, TCP/IP, DNS, ARP, FTP, HTTP, HTTPS, TFTP, RDP, STP, DHCP, SQL SErver, IMPA (S), LDAP(S), Netbios, NTP, POP3, OSPF, Netbios, Telnet, Syslog, SMTP, IKE, LLD, SSH, browser, RPC, ICMP, SNMP, SMB, NTLM, DCERPC

demo

ThousandEyes demo [DNAC]

Deep visibility into every layer

ThousandEyes

Time Correlated

App Experience

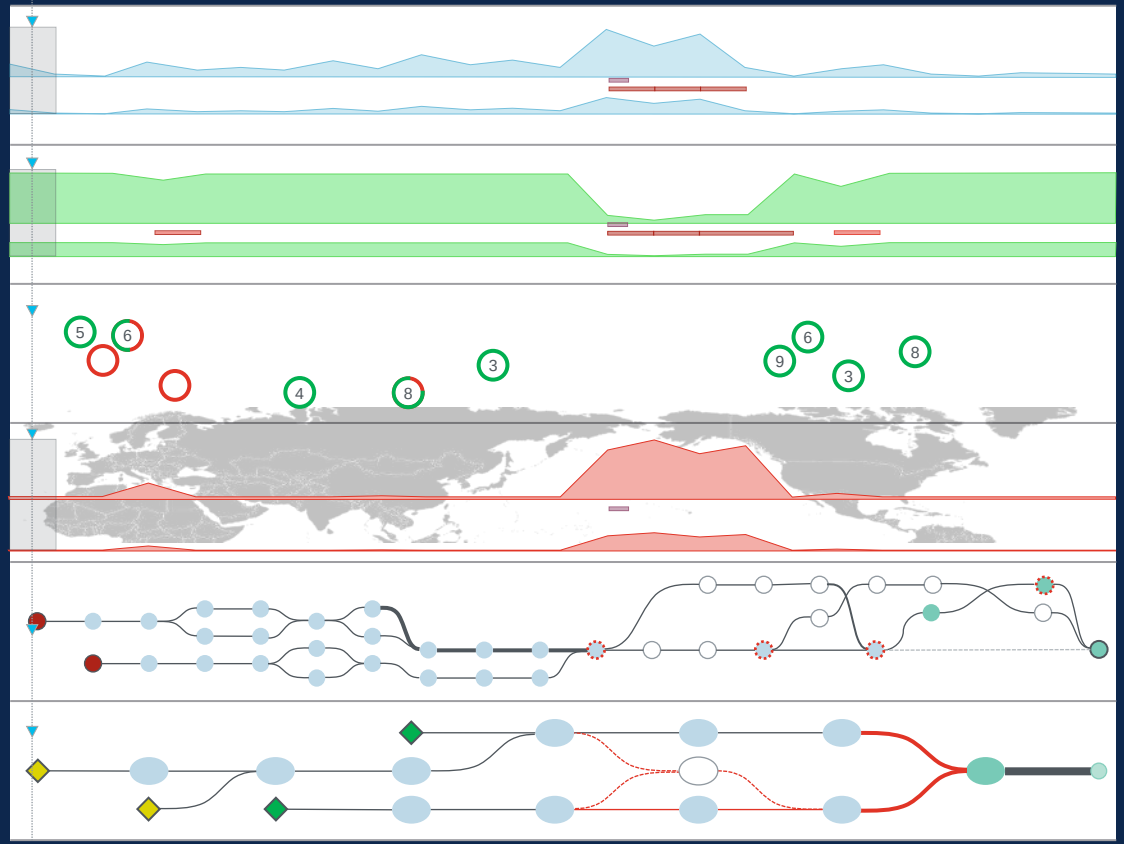
HTTP/DNS/RTP Server

Scope and Domain

Network Metrics

Network Path

BGP Monitoring



What is ThousandEyes?

Digital Experience Monitoring SaaS platform to see, understand, and improve digital experiences of customers and employees over any network. We offer a distribution of global vantage points from where users can run a variety of tests.

Cloud Agent

Globally distributed agents installed and managed by ThousandEyes in 200+ cities.

External Vantage Points

Enterprise Agent

Lightweight software-based agents, easily installed on your own network, provide visibility from within the enterprise campus, data centers, cloud VPCs/VNets, and branches. Supports active monitoring, SNMP-based monitoring, and topological mapping of internal network devices.

Enterprise Agent is applicable to Enterprise Switching Infra

Internal Vantage Points

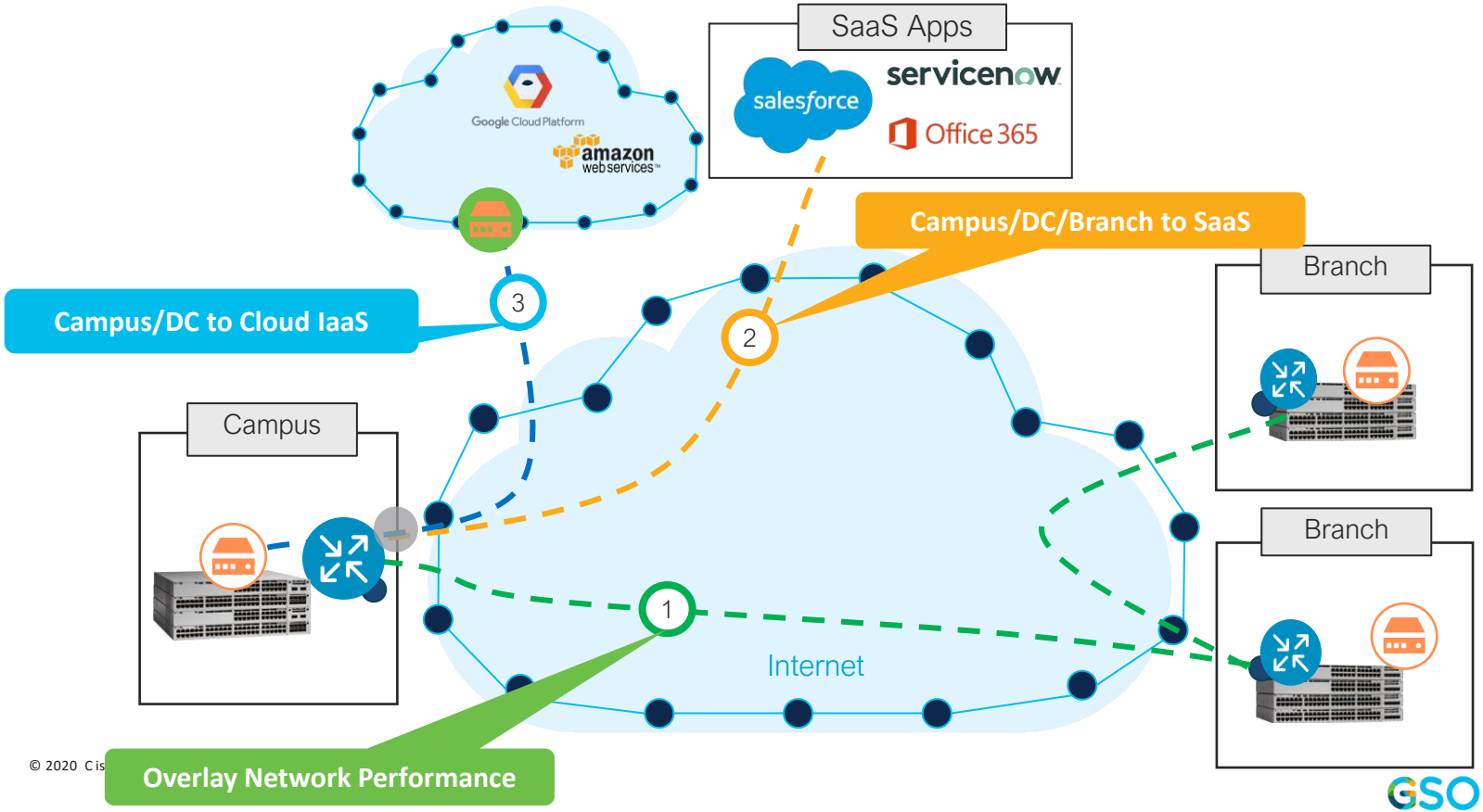
Endpoint Agent

Lightweight service installed on end-user laptops and desktops that provides proactive and real-time monitoring of application experience and network connectivity

End-User Experience

Service Assurance is beyond the Enterprise Domain

Use cases for ThousandEyes Enterprise Agent



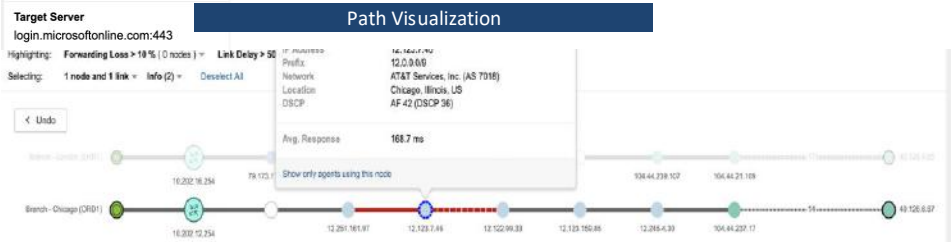
Agent to Agent/Server

Troubleshooting SaaS & Monitoring Campus

- Identifying **poor user experience**
  - Did traffic handoff to SaaS app optimally?
  - Was there an outage within Enterprise, WAN or SaaS backbone?
- **Full path visibility** to identify and resolve issues
- Active monitoring for **Latency, Loss, Bandwidth, Jitter**

Historical Performance View

Path Visualization



Hop-by-hop view of network paths and performance with Proactive Customizable Alerts

Platform support for Integrated ThousandEyes agent

Catalyst 9300
Catalyst 9300L

Catalyst 9400

	Running on Flash	Running on SSD
Docker size	~ 200MB	~ 1.2 GB
CPU	1-2 vCPUs	2 vCPUs
RAM	1-2 GB	2GB
Storage	Flash ~4GB (1GB app data)	SSD (120GB/240GB/..)
IOS	C9300:17.3.3 C9400:17.5.1	Starting from 17.6.1
Tests	Network DNS Voice HTTP (Page Load and Transaction tests are not included)	All Tests including Page Load and Transaction tests

ThousandEyes agent preloaded on flash

DNA Subscription Benefit

Enterprise Agent Units Pool

1 x DNA A/P License

22 x 1 (22 TE Units/Month)

2500 x DNA A/P Licenses

22 x 2500 (55,000 TE Units/Month)

5000 x DNA A/P Licenses

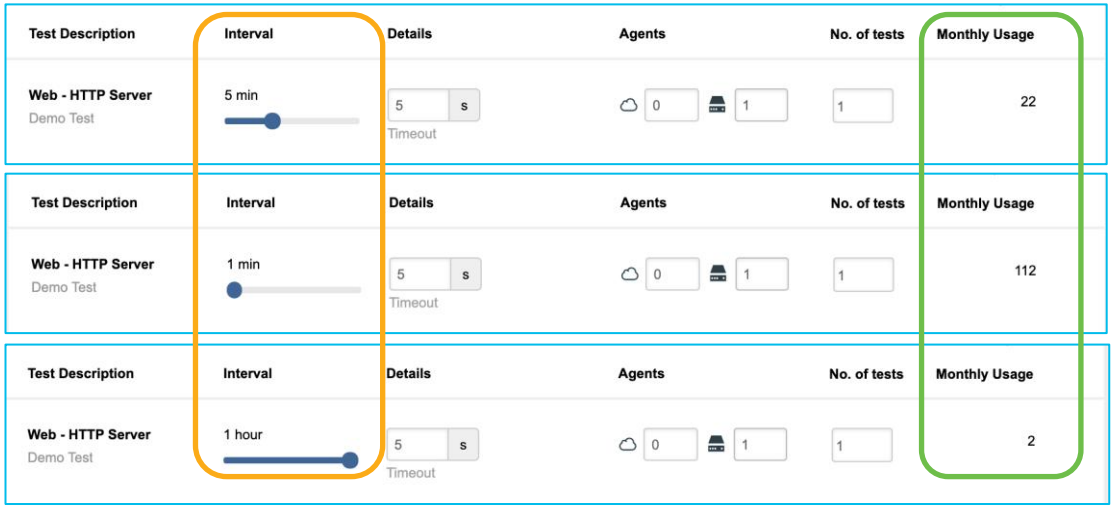
22 x 5000 (110,000 TE Units*/Month)

- Provide ThousandEyes Enterprise Agent units <u>every month</u> based on active DNA A/P license in CSSM
- Units will not rollover to next month.
- Not require to host TE Agents on every C9300/C9400.

* Maximum TE Enterprise Agent units offer per customer. Can purchase extra TE units on Cisco GPL

Enterprise Agent Units Consumption

- Flexibility of choosing different test intervals
- Option to purchase more TE units on Cisco GPL
- ThousandEyes Units Calculator: https://app.thousandeyes.com/calculator/



How to get the licenses

Cisco Software Central > **Smart Software Licensing**

InternalTestDemoAccount11.cisco.com

Smart Software Licensing

Feedback Support Help

Alerts | **Inventory** | Convert to Smart Licensing | Reports | Preferences | On-Prem Accounts | Activity

Virtual Account: PRG2-LAB

6 Major | 118 Minor | **Hide Alerts**

General | **Licenses** | Product Instances | Event Log

By Name | By Tag

Available Actions | Manage License Tags | License Reservation...

thousand

License	Billing	Purchased	In Use	Substitution	Balance	Alerts	Actions
ThousandEyes Activation for DNA P/A	Prepaid	1	0	-	+ 1		Actions
ThousandEyes Enterprise Agent Tests	Prepaid	0 (+1 pending)	0	-	0	Upgrade Pending	Actions

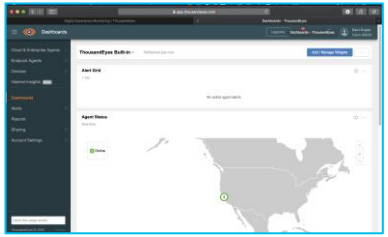
Showing All 2 Records

ThousandEyes Deployment Workflow

1

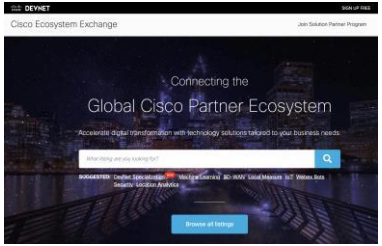
Account Creation

ThousandEyes Portal



2

Image Download



ThousandEyes Docker Image Download
(only if not present in Flash)

3

Deploy

Cisco DNA Center
(Mass Deployment)

<or>

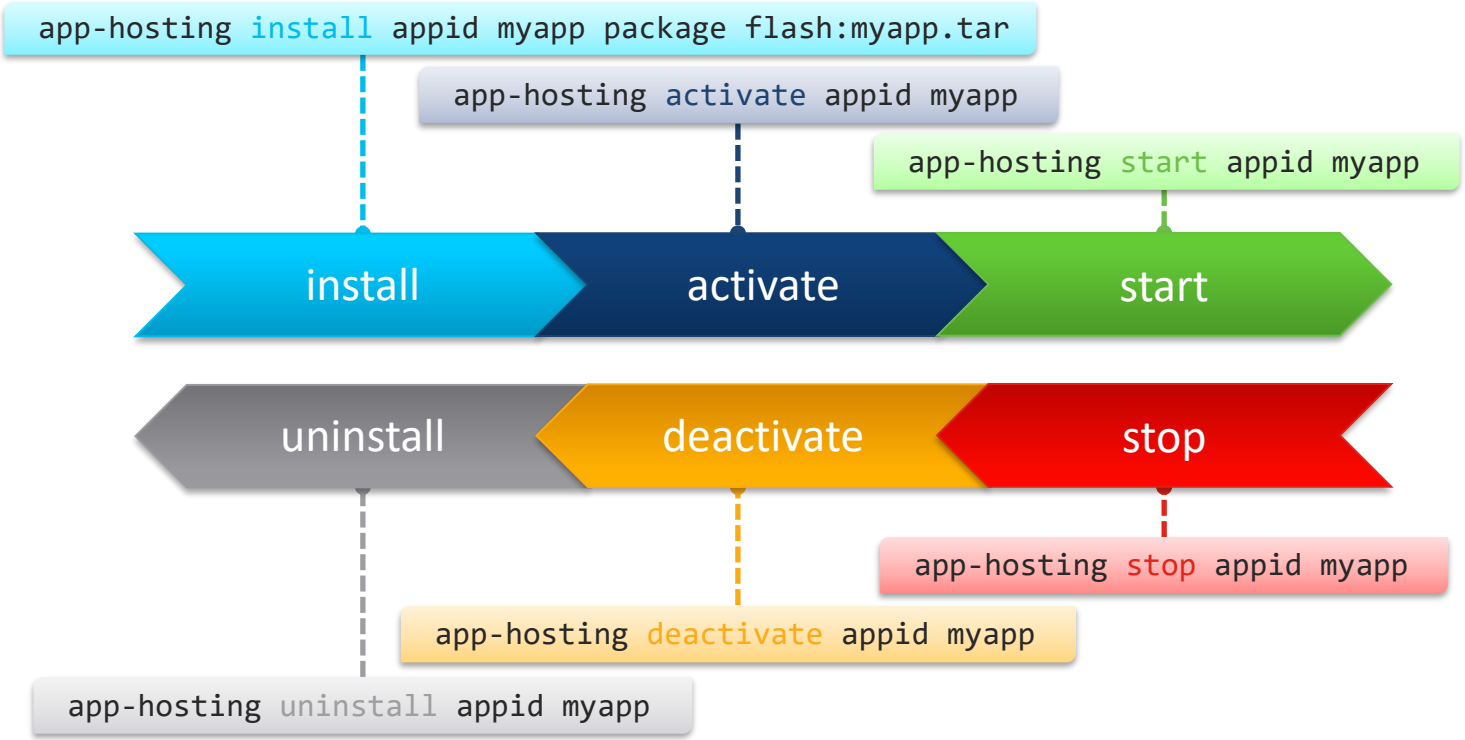
IOS XE CLI
(Single Deployment)

4

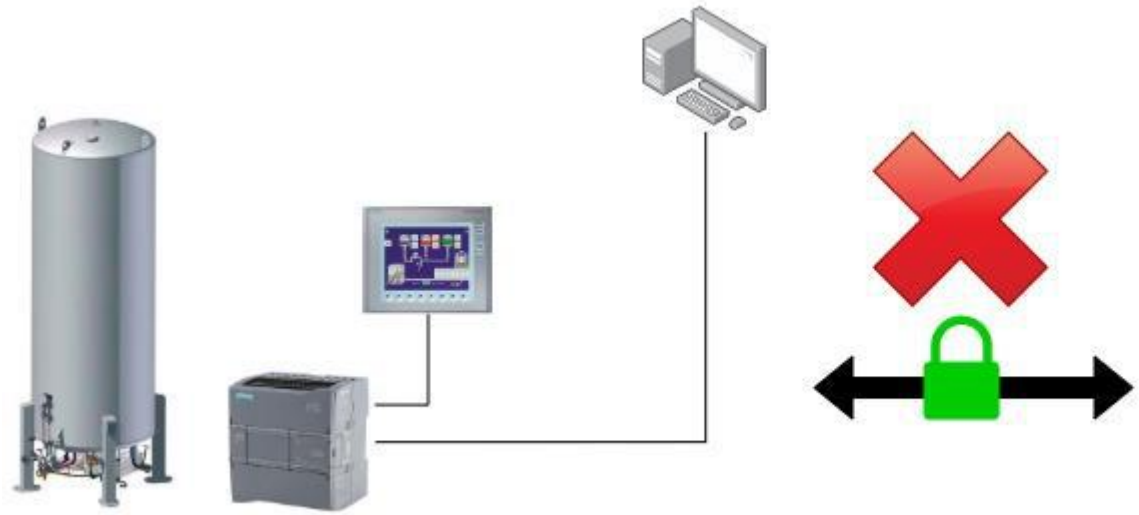
Agent register with ThousandEyes

demo

App Life-cycle: install, activate, start…



Original State



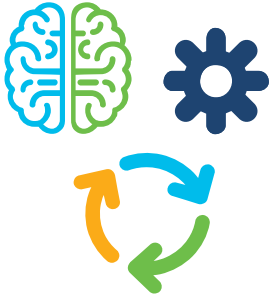
Target Application Workflow

Deploy New Location

1 **Connect IR1101 into** LNG/LCNG System

Any operational employee plugs IR1101 into the local LNG/LCNG Systems

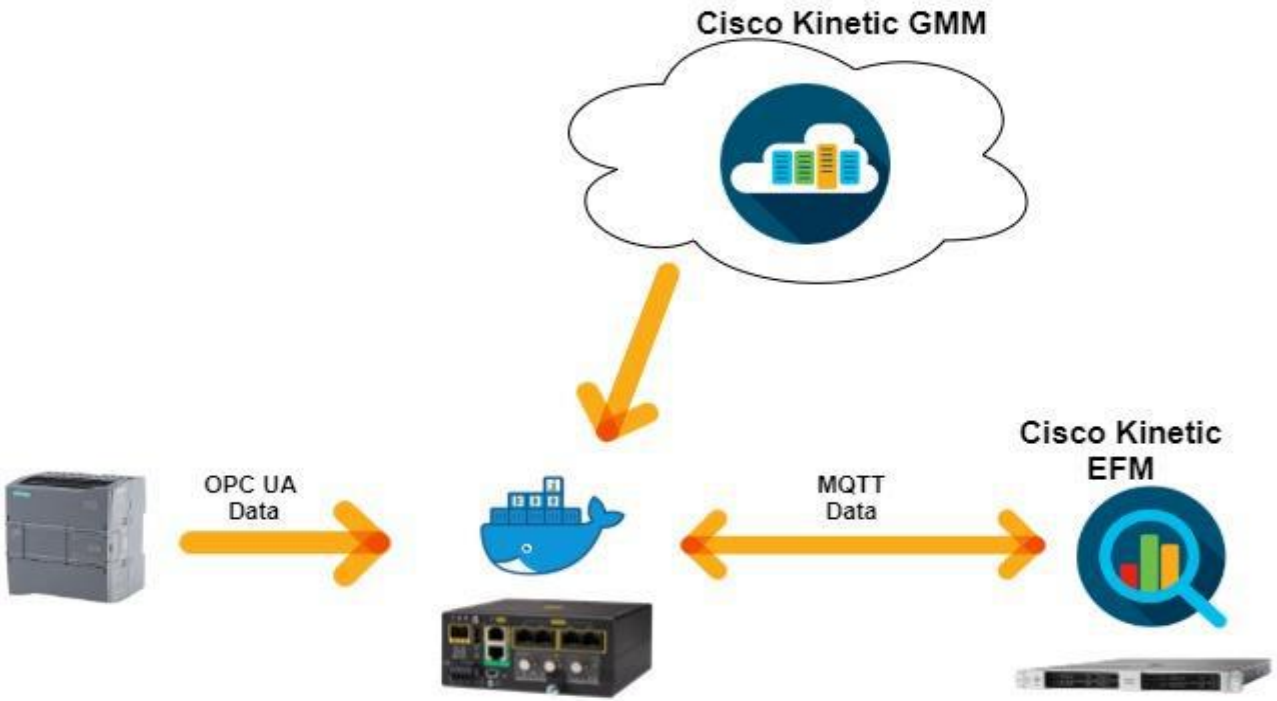
2 **Apply Kinetic ZTP Policies**

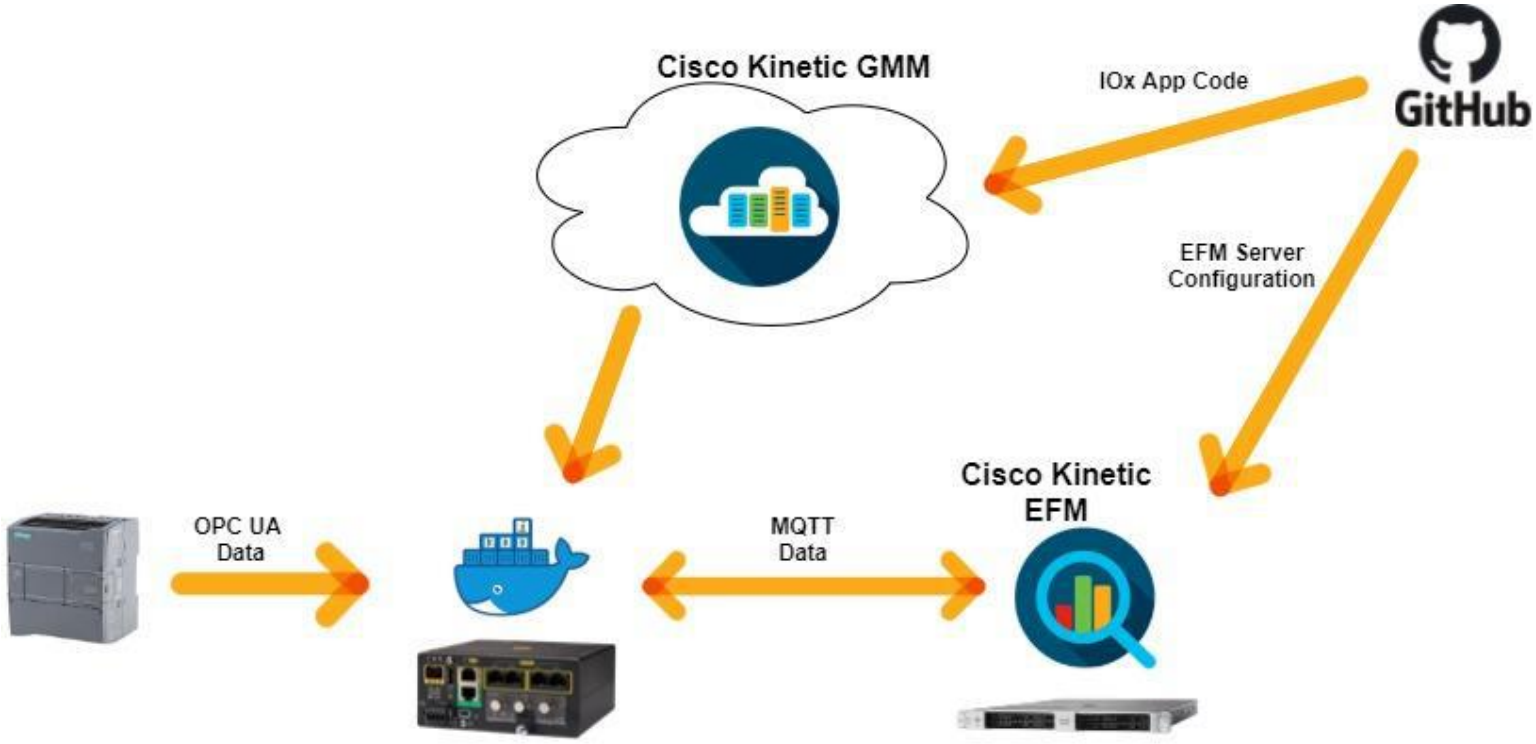


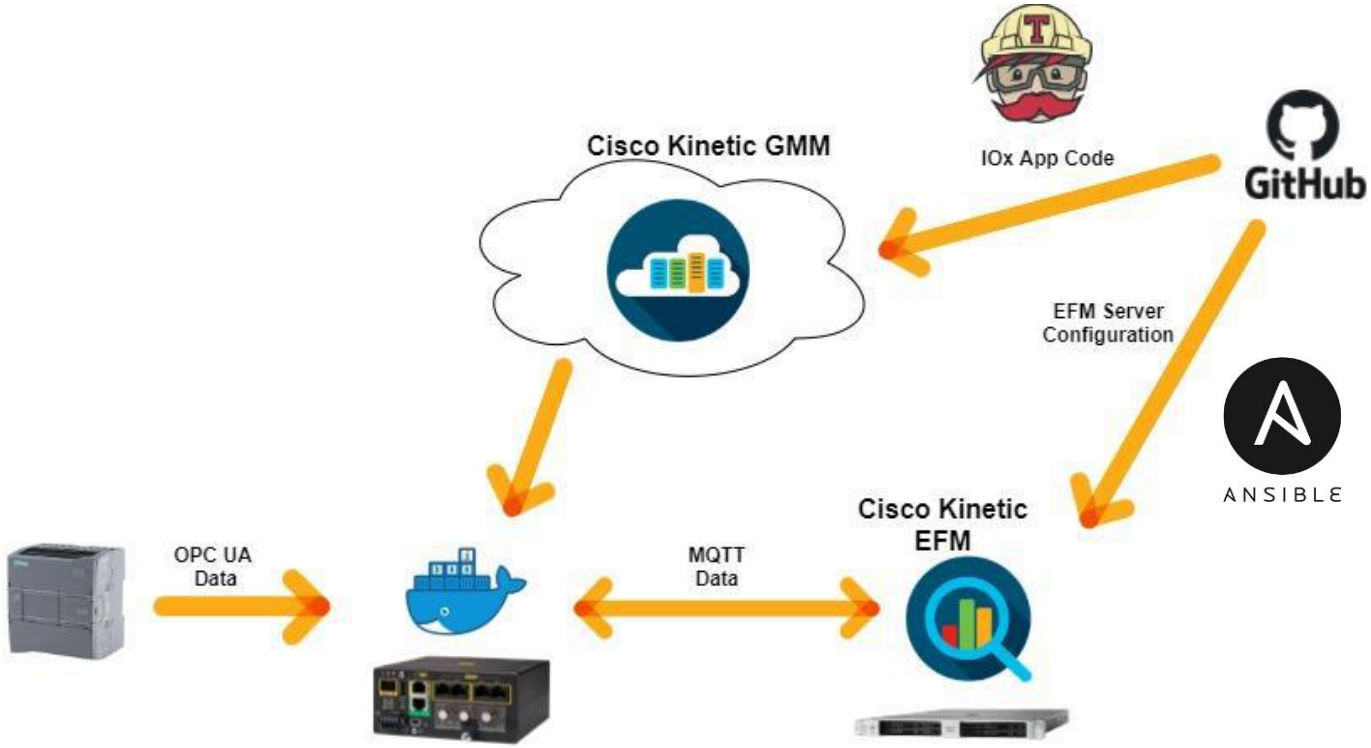
IR1101 GW is automatically configured based on Cisco Kinetic GMM policies

3 **See Realtime Data**

Gathered data by IR1101 router is visualized by Cisco Kinetic EFM deployed in DC







CISCO

Run KVM app

Syslog Server

Step 1: Build a CENTOS VM

Step 2: Install Syslog Application on VM

Step 3: Create a OVA Package and Install it on Router

Step 4: Configure Router (Mandate Configuration)

Installing Syslog

```
[root@localhost ~]# yum install rsyslog
Loaded plugins: fastestmirror
Loading mirror speeds from cached hostfile
 * base: centos.mirror.snu.edu.in
 * extras: centos.mirror.snu.edu.in
 * updates: centos.mirror.snu.edu.in
Resolving Dependencies
--> Running transaction check
---> Package rsyslog.x86_64 0:8.24.0-16.el7_5.4 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

================================================================================
 Package         Arch           Version                   Repository       Size
================================================================================
Installing:
 rsyslog         x86_64         8.24.0-16.el7_5.4         updates         607 k

Transaction Summary
================================================================================
Install  1 Package

Total download size: 607 k
Installed size: 1.9 M
Is this ok [y/d/N]:
```

Installing Syslog

```
Is this ok [y/d/N]: y
Downloading packages:
rsyslog-8.24.0-16.el7_5.4.x86_64.rpm                          | 607 kB   00:01
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
  Installing : rsyslog-8.24.0-16.el7_5.4.x86_64                              1/1
  Verifying  : rsyslog-8.24.0-16.el7_5.4.x86_64                              1/1

Installed:
  rsyslog.x86_64 0:8.24.0-16.el7_5.4

Complete!
```

Installing Syslog

Use vi /etc/rsyslog.conf to Edit syslog settings

```
# rsyslog configuration file

# For more information see /usr/share/doc/rsyslog-*/rsyslog_conf.html
# If you experience problems, see http://www.rsyslog.com/doc/troubleshoot.html

##### MODULES ####

# The imjournal module bellow is now used as a message source instead of imuxsocc
k.
$ModLoad imuxsock # provides support for local system logging (e.g. via logger cc
ommand)
$ModLoad imjournal # provides access to the systemd journal
#$ModLoad imklog # reads kernel messages (the same are read from journald)
#$ModLoad immark  # provides --MARK-- message capability

# Provides UDP syslog reception
$ModLoad imudp
$UDPServerRun 514

# Provides TCP syslog reception
$ModLoad imtcp
$InputTCPServerRun 514

-- INSERT --
```

```
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# systemctl restart rsyslog.service
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
```

Installing Syslog

Enabling Firewall to Allow port 514

```
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]#
[root@localhost ~]# firewall-cmd --permanent --zone=public --add-port=514/tcp
success
[root@localhost ~]# firewall-cmd --permanent --zone=public --add-port=514/udp
success
[root@localhost ~]# firewall-cmd --reload
success
[root@localhost ~]#
```

Verifying port 514 connection status

```
umohanty@ubuntu:~$
umohanty@ubuntu:~$ telnet 192.168.122.75 514
Trying 192.168.122.75...
Connected to 192.168.122.75.
Escape character is '^]'.
```

Create a OVA Package and Install it on Router

```
root@ubuntu:~#
root@ubuntu:~#
root@ubuntu:~# ./create_ova.sh -mts 200000 -mfs 100000 container-build
create_ova.sh v1.0(Linux) - Create a virtual-service OVA package

User inputs:
  Compress=(files > '100000M' if total
            file size > '200000M')
  Directory=container-build

Package name :  SyslogServer
 Generating SHA1 on files...
Running SHA1 over all files in '/home/umohanty/container-build' and
    creating manifest file ' SyslogServer.mf', please wait...

Done creating ' SyslogServer.mf' file
 ...Done Generating SHA1 on files
Creating ' SyslogServer.ova' please wait...
centos7.0.qcow2
package.yaml
SyslogServer.mf
version.ver

'/home/umohanty/container-build/ SyslogServer.ova' created

Manifest Contents:
SHA1(centos7.0.qcow2)= 96f29aba58779c44073b943bda3da9bfeb260625
SHA1(package.yaml)= a9c216bfa9bb056c0f5d8e27c49a1e2884cb9387
SHA1(version.ver)= 61652cd1568dcf2614df833eba241755eee34e89
```

Steps to Install

STEP 1 :- Installing the Service Container:

Copy the SyslogServer.ova file onto a USB stick, insert it into the router and type:

copy usb0:SyslogServer.ova harddisk:

or

Copy the SyslogServer.ova file onto a tftp/ftp Server and use the below command :

copy tftp: harddisk:

```
BGL14-1.D.14-ISR4451#copy tftp: harddisk:
Address or name of remote host [10.76.76.160]?
Source filename [SyslogServer.ova]?
Destination filename [SyslogServer.ova]?
Accessing tftp://10.76.76.160/SyslogServer.ova...
Loading SyslogServer.ova from 10.76.76.160 (via GigabitEthernet0): !!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 668364800 bytes]
```

STEP 2 :- Setting up Virtual Service

```
BGL14-1.D.14-ISR4451-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
BGL14-1.D.14-ISR4451(config)#interface VirtualPortGroup1
BGL14-1.D.14-ISR4451(config-if)#ip address 10.0.0.1 255.255.255.0
BGL14-1.D.14-ISR4451(config-if)#
BGL14-1.D.14-ISR4451(config-if)#virtual-service
BGL14-1.D.14-ISR4451(config-virt-serv-global)#signing level unsigned
% Package signing level already set to allow 'unsigned'
BGL14-1.D.14-ISR4451(config-virt-serv-global)#
BGL14-1.D.14-ISR4451(config-virt-serv-global)#virtual-service centos
BGL14-1.D.14-ISR4451(config-virt-serv)#vnic gateway VirtualPortGroup1
BGL14-1.D.14-ISR4451(config-virt-serv-vnic)#
BGL14-1.D.14-ISR4451(config-virt-serv-vnic)#
```

STEP 3 :- Creating DHCP pool for the container

Create a DHCP pool so that the service container/Linux instance can acquire an IP address

```
BGL14-1.D.14-ISR4451-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
BGL14-1.D.14-ISR4451(config)#ip dhcp excluded-address 10.0.0.1
BGL14-1.D.14-ISR4451(config)#ip dhcp excluded-address 10.0.0.254
BGL14-1.D.14-ISR4451(config)#!
BGL14-1.D.14-ISR4451(config)#ip dhcp pool centos-pool
BGL14-1.D.14-ISR4451(dhcp-config)#import all
BGL14-1.D.14-ISR4451(dhcp-config)#network 10.0.0.0 255.255.255.0
BGL14-1.D.14-ISR4451(dhcp-config)#default-router 10.0.0.1
BGL14-1.D.14-ISR4451(dhcp-config)#lease 0 5
BGL14-1.D.14-ISR4451(dhcp-config)#
```

STEP 4 :- Installing the Virtual Service

virtual-service install name SyslogServer package harddisk:SyslogServer.ova

```
BGL14-1.D.14-ISR4451#$l name SyslogServer package harddisk:SyslogServer.ova
Installing package 'harddisk:/SyslogServer.ova' for virtual-service 'SyslogServer'. Once t
he install has finished, the VM may be activated. Use 'show virtual-service list' for prog
ress.

BGL14-1.D.14-ISR4451#
*Dec 12 06:39:35.260: %VMAN-5-PACKAGE_SIGNING_LEVEL_ON_INSTALL:  SIP1: vman:  Package 'Sys
logServer.ova' for service container 'SyslogServer' is 'unsigned', signing level cached on
 original install is 'unsigned'
BGL14-1.D.14-ISR4451#
*Dec 12 06:39:43.824: %VIRT_SERVICE-5-INSTALL_STATE: Successfully installed virtual servic
e SyslogServer
BGL14-1.D.14-ISR4451#
*Dec 12 06:39:43.846: %ONEP_BASE-6-SS_ENABLED: ONEP: Service set Base was enabled by Defau
lt
```

STEP 6 :- Activating Virtual Service

Once that command shows the service is in Installed state, you can configure in IOS-XE for the service to be activated:

virtual-service SyslogServer
activate

Check the state using the same command as before:

show virtual-service list

```
BGL14-1.D.14-ISR4451(config)#virtual-service SyslogServer
BGL14-1.D.14-ISR4451(config-virt-serv)#act
BGL14-1.D.14-ISR4451(config-virt-serv)#activate
% Activating virtual-service 'SyslogServer', this might take a few minutes. Use 'show virt
ual-service list' for progress.

BGL14-1.D.14-ISR4451(config-virt-serv)#
*Dec 12 06:41:59.817: %VIRT_SERVICE-5-ACTIVATION_STATE: Successfully activated virtual ser
vice SyslogServer
BGL14-1.D.14-ISR4451(config-virt-serv)#end
BGL14-1.D.14-ISR4451#
*Dec 12 06:42:09.548: %SYS-5-CONFIG_I: Configured from console by console
BGL14-1.D.14-ISR4451#show virtual-service list
Virtual Service List:


Name                    Status            Package Name
-----------------------------------------------------------------------------
SyslogServer            Activated         SyslogServer.ova
```

You should be able to successfully ping the service container

```
BGL14-1.D.14-ISR4451#ping 10.0.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
BGL14-1.D.14-ISR4451#
BGL14-1.D.14-ISR4451#
BGL14-1.D.14-ISR4451#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
BGL14-1.D.14-ISR4451(config)#logging host 10.0.0.2
BGL14-1.D.14-ISR4451(config)#
*Dec 12 06:44:23.971: %SYS-6-LOGGINGHOST_STARTSTOP: Logging to host 10.0.0.2 port 514 star
ted - CLI initiated
BGL14-1.D.14-ISR4451(config)#exit
```

!!! Let’s Login and Check the Logs on our own SyslogServer !!!

```
BGL14-1.D.14-ISR4451#virtual-service connect name SyslogServer console
Connected to appliance. Exit using ^C^C^C

CentOS Linux 7 (Core)
Kernel 3.10.0-862.el7.x86_64 on an x86_64

localhost login: root
Password:
Login incorrect

localhost login: root
Password:
Last failed login: Wed Dec 12 01:47:32 EST 2018 on ttyS0
There was 1 failed login attempt since the last successful login.
Last login: Tue Dec 11 12:06:54 on tty1
[root@localhost ~]#
[root@localhost ~]# tailf /var/log/messages
Dec 12 01:45:54 gateway 95: *Dec 12 06:45:54.371: %LINEPROTO-5-UPDOWN: Line protocol on In
terface GigabitEthernet0/0/1, changed state to down
Dec 12 01:45:58 gateway 96: *Dec 12 06:45:57.926: %LINK-3-UPDOWN: Interface GigabitEtherne
t0/0/1, changed state to down
Dec 12 01:46:03 gateway 97: *Dec 12 06:46:01.983: %LINK-3-UPDOWN: Interface GigabitEtherne
t0/0/1, changed state to up
Dec 12 01:46:03 gateway 98: *Dec 12 06:46:02.984: %LINEPROTO-5-UPDOWN: Line protocol on In
terface GigabitEthernet0/0/1, changed state to up
Dec 12 01:46:34 gateway 99: *Dec 12 06:46:32.963: %SYS-5-CONFIG_I: Configured from console
 by console
```

Use Cases

gRPC Dial Out Configured Telemetry

CLI

...or with... + Ansible

YANG

Cisco IOS XE 16.10+

gRPC Dial-Out

Receiver
Decodes to text

telegraf

Collector
Time Series Database

InfluxDB

Monitoring and Visualizations

Grafana

CISCO