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The bridge to possible

Extending Enterprise Network into Public Cloud with Cisco Catalyst 8000V Edge Software

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CCIE#10467, AWS Certified Advanced Networking Specialty

BRKXAR-2003

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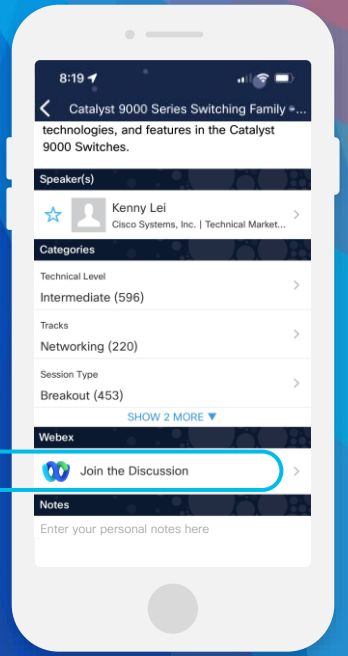

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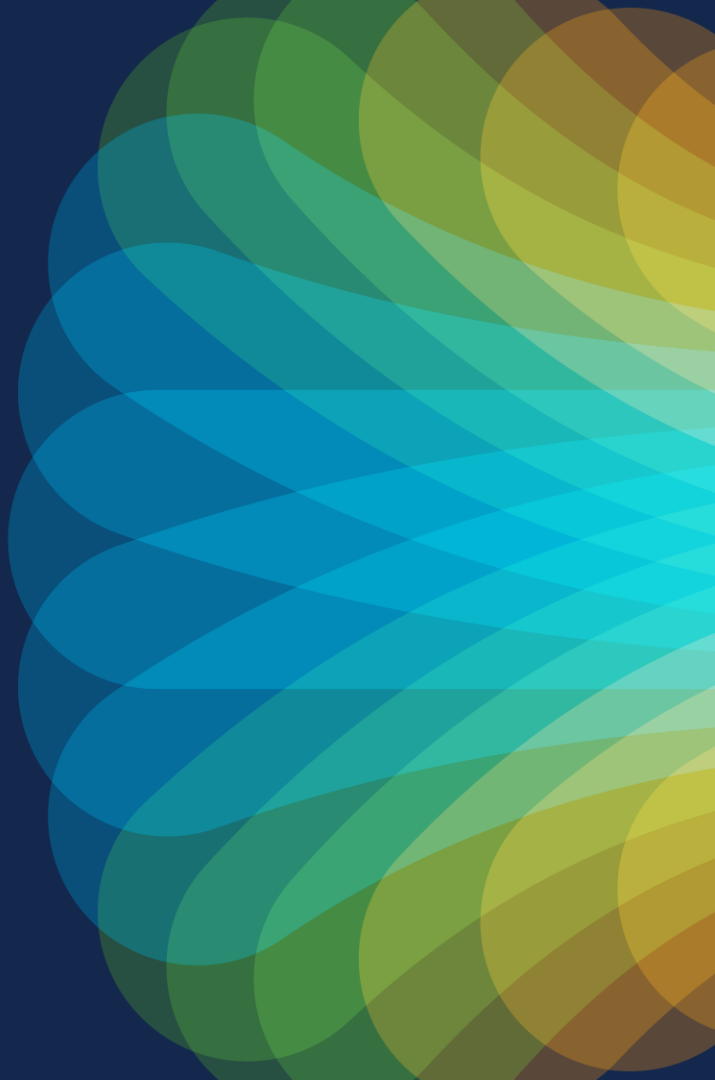
Agenda

- Platform Overview
- Software Architecture
- Catalyst 8000V Edge in Public Cloud use cases
- Conclusion

Introducing Cisco Catalyst 8000V Edge Software



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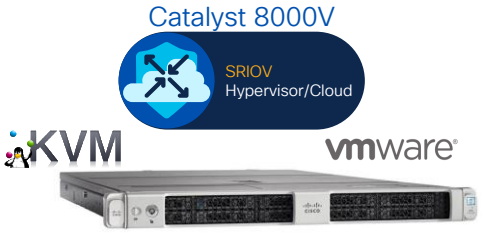
Cisco Catalyst 8000V Edge Software

Pervasive WAN Deployment

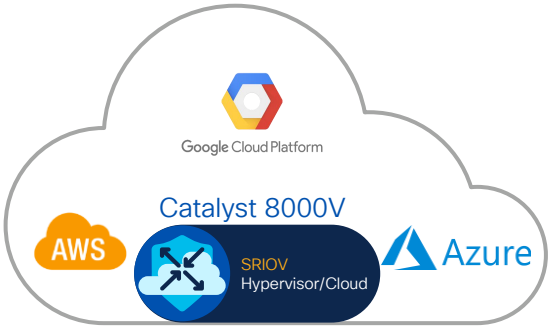
Seamless SD-WAN Extension in cloud

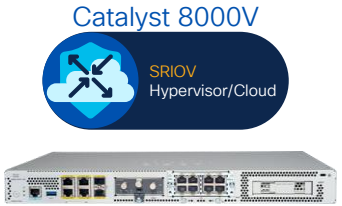
Infrastructure Agnostic

Service Richness



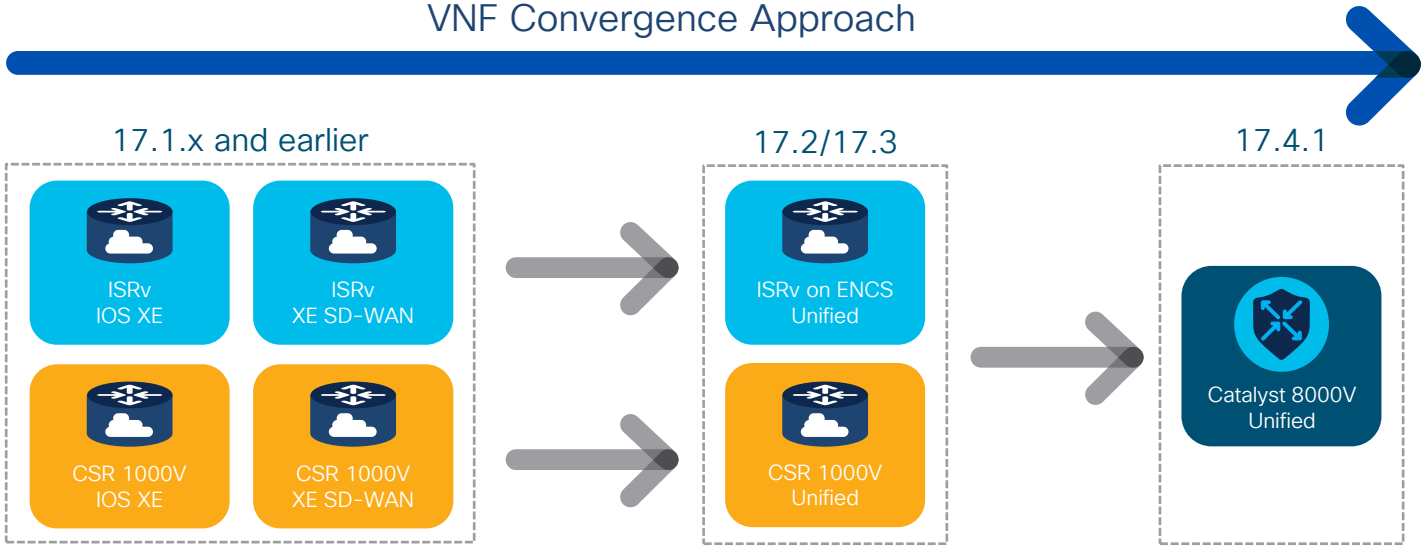
Hypervisor
On x86 server





NFVIS on
ENCS and C8200-uCPE

Virtual Router Convergence



CSR to Cat8KV upgrade in Autonomous Mode and Controller Mode:
https://www.youtube.com/watch?v=pIMIXFXdwvw
https://www.youtube.com/watch?v=S1sRVQLkJhM
17.9.x is the last release to support direct CSR1Kv to C8KV upgrade

Available in all major cloud marketplaces

C5n class, C5 class,
T3.medium

F32s_v2, F16s_v2,
DS4_v2, DS3_v2, DS2_v2

N1-standard-8, 4, 2

Catalyst 8000V supports more than 20 different instance profiles across the three clouds

Effortlessly deploy on x86 hypervisors

KVM

Red Hat

Enterprise Linux 7.5
Enterprise Linux 7.7
Enterprise Linux 8.4

Ubuntu 16.04 LTS

vmware

ESXi 6.5 Update 2
ESXi 6.7 Update 3
ESXi 7.0

OPENSTACK TRAIN

Openstack TRAIN
RHEL 8.2
CVIM 3.4

CISCO

NFVIS on
C8200-uCPE
ENCS 5000
CSP 5000

Elastic resource allocation

Physical Hardware:

- CPU – Intel or AMD
- CPU with clock frequency >= 2.0
- 1GE, 10GE and 25GE

```
C8KV(config)#int GigabitEthernet1
C8KV (config-if)#speed ?
  1000   Force 1000 Mbps operation
  10000  Force 10000 Mbps operation
  25000  Force 25000 Mbps operation
```

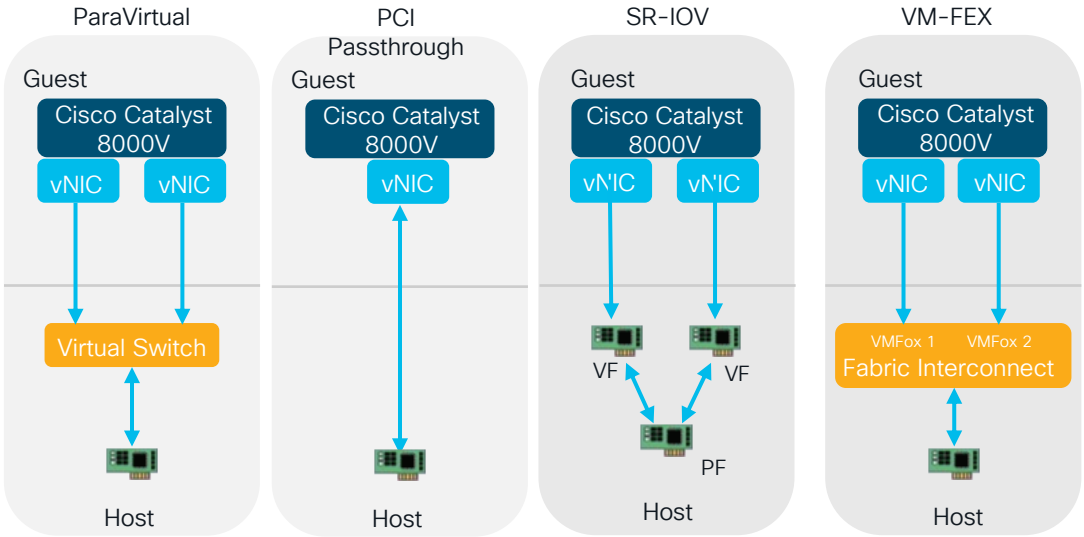
Catalyst 8000V Virtual Machine specs:

- CPU: 1 to 16 virtual CPUs*
- Memory: 4 GB to 16 GB
- Disk space: 8 GB or 16GB
- Virtual Network Interface Cards (vNICs):
  - ESXI – support maximum of 8 vNICs
  - KVM – support maximum of 26 vNICs

*16vCPU supported in KVM, 18vCPU supported in AWS & Azure

Extended I/O support

- Paravirtual (VMXNET3, Virtio)
- PCI Passthrough (ixgbe)
- Single-root I/O virtualization (SR-IOV)
  - ixgbeVF, i40eVF, ConnectX-5VF
  - Accelerated Networking Azure
  - Enhanced Networking amazon web services
- Cisco Virtual Machine Fabric Extender (VM-FEX)
- DPDK support using poll-mode drivers



Tips of the day - #1
know my hosting platform

```
C8KV-AWS#sh platform software system all
Processor Details
=================
Number of Processors : 24

processor : 0
vendor_id : GenuineIntel
cpu MHz  : 3400.095
cache size : 25344 KB
Crypto Supported : Yes
model name : Intel(R) Xeon(R) Platinum 8124M CPU @ 3.00GHz

<snipped>

cpu MHz  : 3399.997
cache size : 25344 KB
processor : 23
vendor_id : GenuineIntel
Crypto Supported : Yes
model name : Intel(R) Xeon(R) Platinum 8124M CPU @ 3.00GHz

cpu MHz  : 3399.896
cache size : 25344 KB
Crypto Supported : Yes
model name : Intel(R) Xeon(R) Platinum 8124M CPU @ 3.00GHz

Memory Details
==============
Physical Memory : 96636388KB

VNIC Details
============
Name              Mac Address     Driver Name      Status  Platform MTU
GigabitEthernet1    061d.029b.c9a4  net_ena          UP      1500


Hypervisor Details
==================
Hypervisor: AMI
Manufacturer: Amazon EC2
Product Name: c5n.9xlarge
Serial Number: ec27cf9a-6d87-9fbf-0de8-4a8c8133e292
UUID: ec27cf9a-6d87-9fbf-0de8-4a8c8133e292
Image Variant: None
```

```
<cont'd>

Cloud Metadata
------------------
Region: us-east-2
Zone: us-east-2b
Instance ID: i-051ec864558006b53
Instance Type: c5n.9xlarge
Version: 2017-09-30
Image ID: ami-00bc0a0b8b804c85e
Product Code: cmhzse1i97ex4pkmb26dxhz2j

Interface Info
------------------
Interface Number : 0
   IPv4 Public IP: 3.18.55.160
   IPv4 Private IP: 10.0.0.176
   IPv4 Subnet Mask: 255.255.255.0
   IPv4 Network: 10.0.0.0
   IPv4 Gateway: 10.0.0.1
   MAC Address: 06:1d:02:9b:c9:a4

Interface Number : 1
   IPv4 Public IP: None
   IPv4 Private IP: None
   IPv4 Subnet Mask: None
   IPv4 Network: None
   IPv4 Gateway: None
   MAC Address: None

Boot Details
====================
Boot mode: BIOS
Bootloader version: 3.3

Platform licensing details
==========================
None
------------------------------------------------------------
```

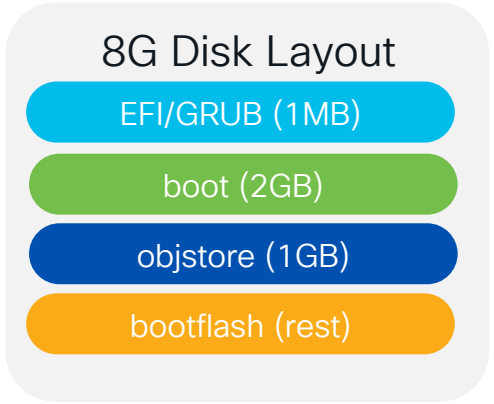
Tips of the day - #2
know my vnic driver

```
C8KV-AWS#show platform software vnic interface-mapping
-------------------------------------------------------------
 Interface Name        Driver Name        Mac Addr
-------------------------------------------------------------
 GigabitEthernet1      net_ena          061d.029b.c9a4
-------------------------------------------------------------
```

```
C8KV-Azure#show platform software vnic interface-mapping
-------------------------------------------------------------
 Interface Name        Driver Name        Mac Addr
-------------------------------------------------------------
 GigabitEthernet1      mlx4_en          000d.3a5b.2760
 GigabitEthernet2      mlx5_core        000d.3a5b.eea3
-------------------------------------------------------------
```

Enhanced software security
Secure Object Store

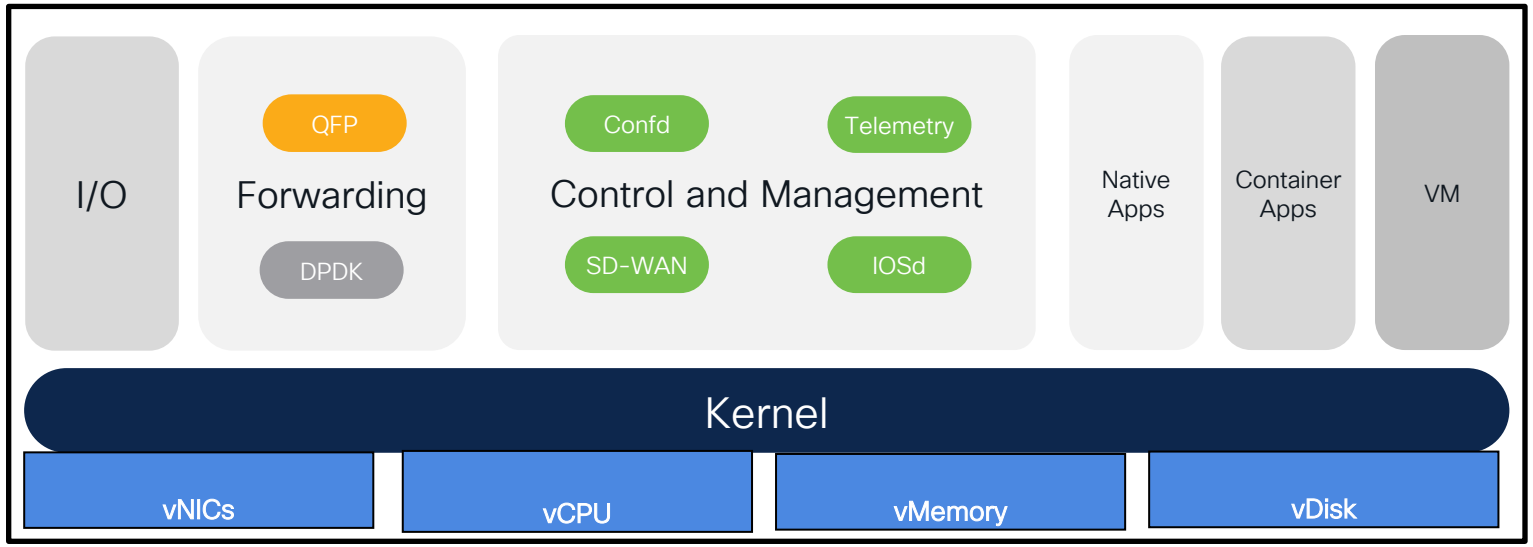
- Storage partitions for NVRAM, licensing and other data are now created as Object stores
- Individual Object stores are encrypted to ensure data security
- Cisco Secure Development lifecycle (CSDL) compliant
- 16G disk cycle profile support



Catalyst 8000V Edge Software Architecture

Virtualized IOS XE in Virtual Machine

Open and Extensible
IOS XE



TCO Savings | Automation | Continuous Innovation

Catalyst 8000V IOS XE Threads to vCPU Associations

- IOS XE processing threads in the Guest OS are statically mapped to vCPUs threads
- vCPU threads in turn are allocated to physical cores by the hypervisor scheduler
- PPE : Packet Processing Engine
- HQF: Hierarchical Queuing Framework

Catalyst 8000V footprint	Control Plane	Data Plane PPE	Data Plane HQF	Data Plane Rx processing
1	vCPU 0			
2	vCPU 0	vCPU 1		
4	vCPU 0	vCPU 1 & 2	vCPU 3	
8	vCPU 0	vCPU 1-5	vCPU 6	vCPU 7
16	vCPU 0-1	vCPU 2-13	vCPU 14	vCPU 15

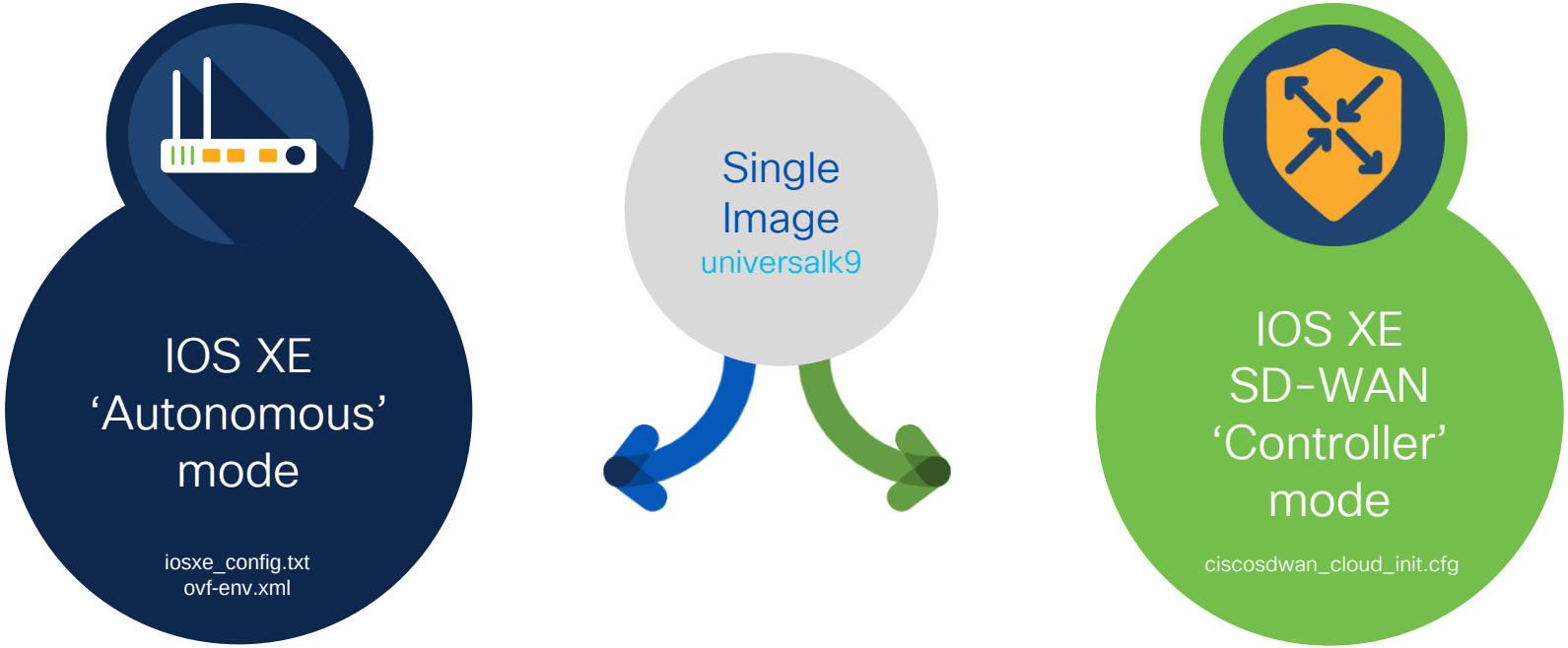
NOTE: vCPU allocations subject to change without further notice

Tips of the day - #3
know my CPU alloc and usage

```
C8KV#show platform software cpu alloc
CPU alloc information:
  Control plane cpu alloc: 0-1
  Data plane cpu alloc: 2-17
  Service plane cpu alloc: 0-1

C8KV#show platform hardware qfp active datapath infrastructure sw-cio
<snipped>
Core Utilization over preceding 13.7132 seconds
-----------------------------------------------
ID:    0     1     2     3     4     5     6     7     8     9    10    11    12    13    14    15
% PP: 85.80 85.74 85.91 85.72 85.75 85.65 85.81 85.72 85.76 85.69 85.78 85.79 85.69 85.62 0.00  0.00
% RX: 0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  18.01
% TM: 0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  0.00  48.10 0.00
% IDLE: 14.20 14.26 14.09 14.28 14.25 14.35 14.19 14.28 14.24 14.31 14.22 14.21 14.31 14.38 51.90 81.99
```

Easy Operations with Single Image



Accelerate SD-WAN

Simplify Deployments

Cloud-scale Applications

Cisco Catalyst 8000V Edge Software
Features & Technology

Routing & Multicast

SD-WAN routing (OMP)
IPv4/v6 routing protocols,
Multicast routing
PIM-SM/MLD
Policy-based routing (PBR)
First-Hop redundancy

Adv Security

SVTI
IPsecoGRE
DMVPN
FlexVPN

FW App Aware
Umbrella SIG
UTD
Trustsec

Application Services

NAT
SD-Access
HQoS

NBARv2
AppQoE

Cloud Connectivity

SD-WAN Integration:
- AWS TGW
- Azure vWAN

Autonomous Mode:
HA Solution
TGW

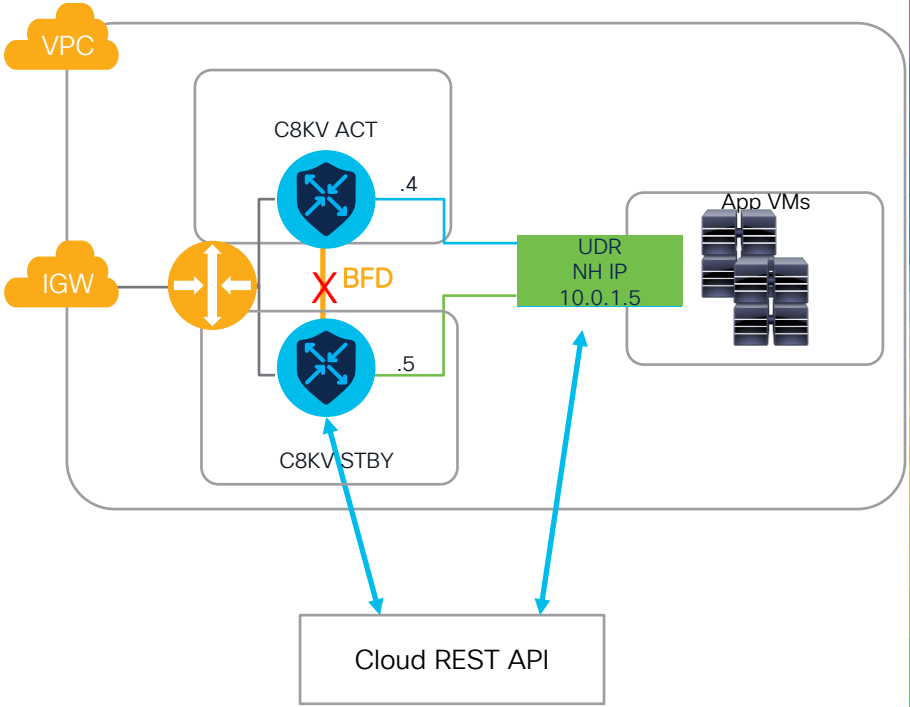
Automation

CloudFormation
Azure Resource Manager
Terraform
Netconf
Restconf

Catalyst 8000V in Public Cloud use cases

Catalyst 8000V High Availability on Cloud
AWS/Azure/GCP

- No virtual IP as with HSRP, since Cloud Provider doesn't allow multicast or broadcast.
- Deploy a pair of C8KV, one of them serve as the NH for the route table
- BFD and EIGRP over IPsec tunnel is enabled between two Catalyst 8000V to detect failure
- Upon failure detection of C8KV Active, C8KV STBY calls Cloud Provider's REST API to update RT's NH to it's own



Before HA Failover / After HA Failover

Tips of the day - #4
4 simple steps to deploy HA

```
Step1[guestshell@guestshell ~]$ pip3 install csr_azure_ha --user
```

```
Step2(config)#interface Tunnel11
Step2(config-if)#ip address 192.168.101.1 255.255.255.252
Step2(config-if)#load-interval 30
Step2(config-if)#bfd interval 100 min_rx 100 multiplier 3
Step2(config-if)#tunnel source GigabitEthernet1
Step2(config-if)#tunnel mode ipsec ipv4
Step2(config-if)#tunnel destination a.b.d.c
Step2(config-if)#tunnel protection ipsec profile vti-1
Step2(config)#router eigrp 1
Step2(config-router)#bfd all-interfaces
Step2(config-router)#network 192.168.101.0 0.0.0.255
```

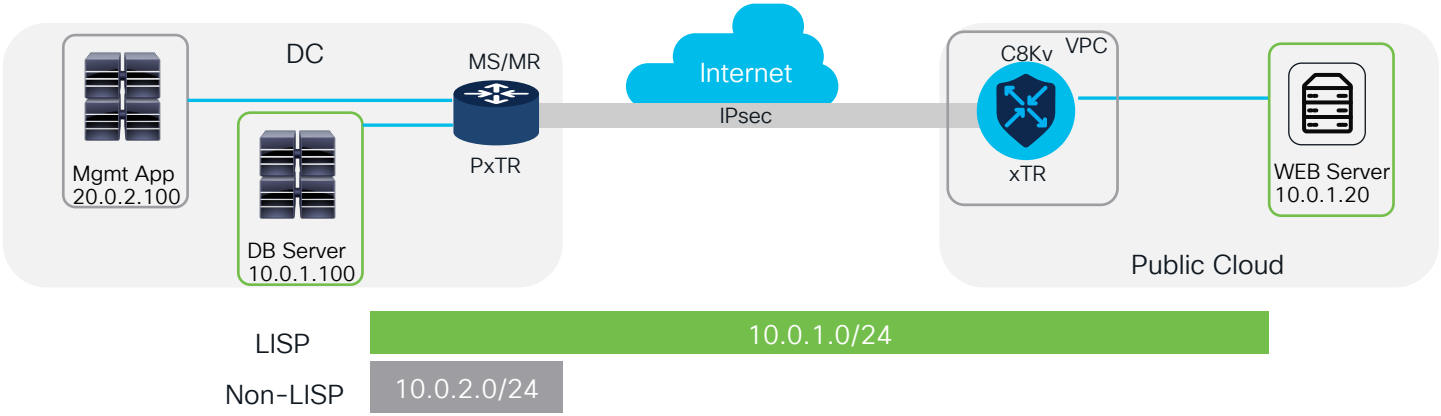
```
Step3[guestshell@guestshell ~]$ create_node.py -i 100 -p azure -s <subscriptionId> -g test -t haprivate-rt -n 10.0.1.4 -m primary
```

```
Step4 Authorize C8KV to update route-table in cloud
```

HA deployment on AWS: https://youtu.be/eHPLQAcge1w
HA deployment on Azure: https://youtu.be/nX0qYw7NTkk

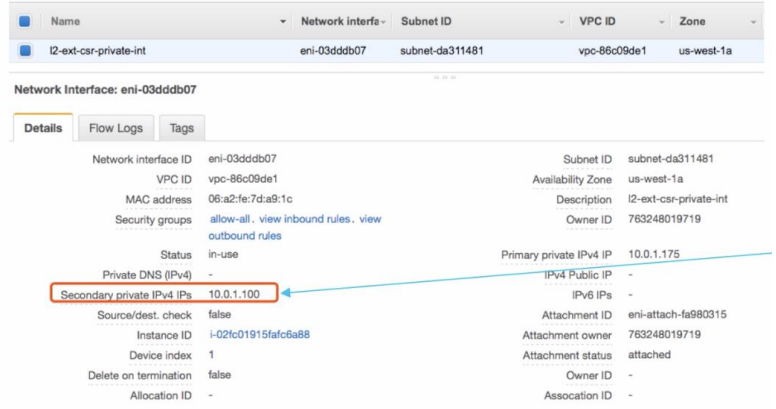
IP mobility into Public Clouds

- LISP is used to extend enterprise datacenter host mobility to cloud.
- Extension to AWS, Azure and GCP is supported.
- IPsec tunnel is established between C8000V on cloud and router at the DC
- LISP encapsulated traffic is protected by the IPsec tunnel



Tips of the day - #5

configure DC server IP as secondary ip on AWS console



Don't need to be configured on C8KV

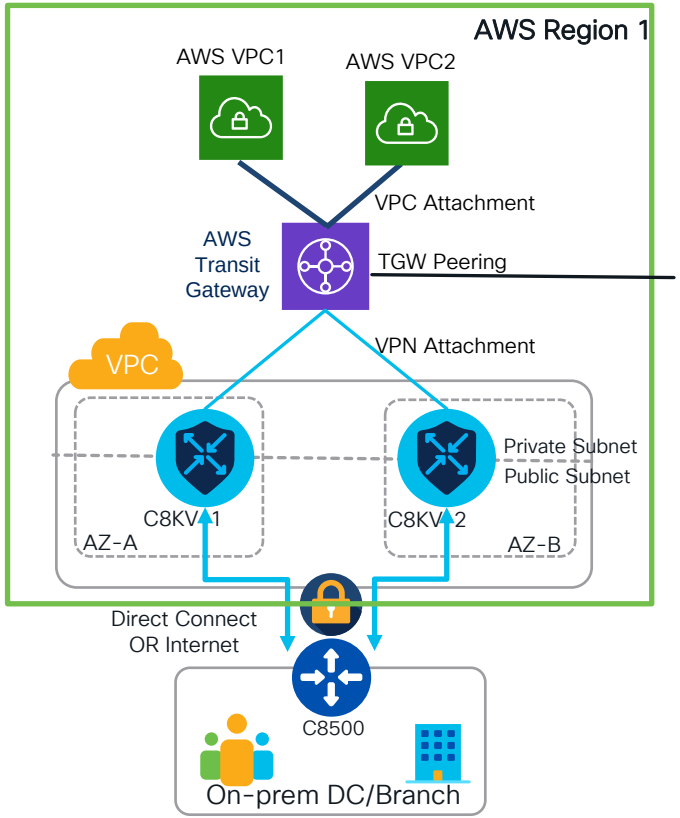
How many host can be supported?

```
-----------------------------------------
|          DescribeInstanceTypes        |
+----------+----------+-----------------+
| IPv4addr | MaxENI   |      Type       |
+----------+----------+-----------------+
|  15      |  4       |  c5n.2xlarge    |
|  10      |  3       |  c5n.large      |
|  30      |  8       |  c5n.4xlarge    |
|  30      |  8       |  c5n.9xlarge    |
|  15      |  4       |  c5n.xlarge     |
+----------+----------+-----------------+
```

https://youtu.be/_FIBGOy2_DM

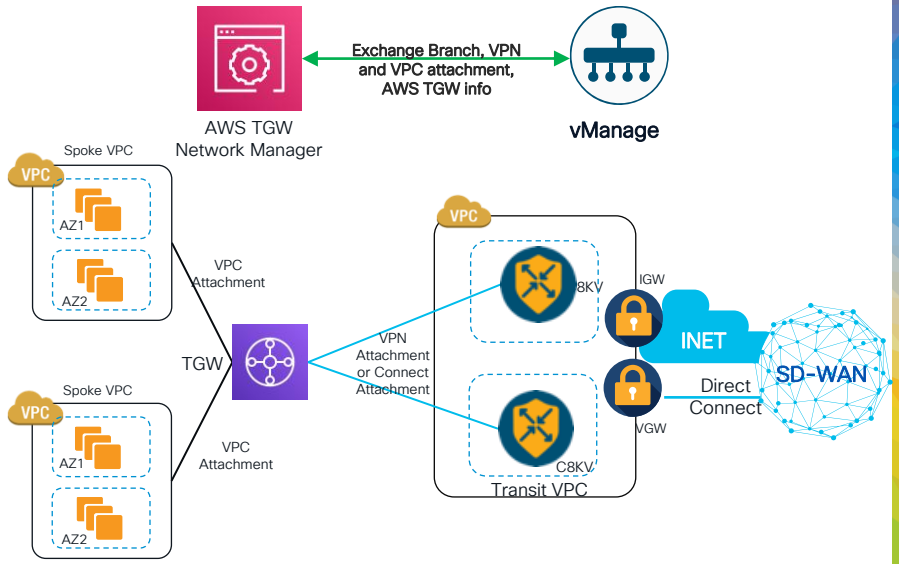
AWS TGW Integration

- Dedicated VPC: Simplifies routing by not combining with other shared services.
- Catalyst 8000V provides
  1. Flexibility and operation consistency to extend existing VPN (DMVPN, FlexVPN) to cloud
  2. Sophisticated routing and path selection between on-prem and cloud
  3. App aware visibility for cloud connection
  4. Rich services such as ZBFW and NAT
  5. Pair deployment for HA, active/active via BGP
  6. Scale out C8KV as throughput demand increase



SD-WAN Cloud onRamp for MultiCloud
AWS TGW Integration

- Automated provisioning of SD-WAN Transit VPC and TGW, route exchange for site to cloud and site to site traffic over AWS backbone
- Full Visibility into inter-regional transit traffic and telemetry with TGW Network Manager
- Consistent Policy and Segmentation across branch and cloud for enterprise class security
- Cloud onRamp saves much time and cost for building cloud connectivity!



Extend SD-WAN | Policy Framework | Unified Control | Cost Effective

Tips of the day - #6

Use Multiple Tunnels to get the most C8KV perf out of AWS instance

- AWS instance has multiple PMD Transmit queues per interface
- Starting in IOS XE 17.9, C8KV support up to 12 Tx queues per interface
- Traffic use CRC hash of src/dst IP, TCP/UDP port# into Tx queues, in case of tunnels it will be tunnel outer IP header address
- Using Multi-TxQ in C8KV throughput can be improved up to 3x

```
C8KV-sdwan-17.9#show platform hardware qfp active datapath
infrastructure sw-nic  | i device Gi|pri-
pmd c1707480 device Gi2
      pri-0: pkts 45583684  bytes 17125338137
      pri-1: pkts 45365941  bytes 17098013943
      pri-2: pkts 45009864  bytes 17053759052
      pri-3: pkts 45227640  bytes 17093583307
      pri-4: pkts 45204746  bytes 17040811794
      pri-5: pkts 45162141  bytes 17069035461
      pri-6: pkts 45121160  bytes 17095354448
      pri-7: pkts 44999631  bytes 17049248974
      pri-8: pkts 44975950  bytes 17040436780
      pri-9: pkts 44943622  bytes 17028828483
      pri-10: pkts 45136965  bytes 17059769532
      pri-11: pkts 45401967  bytes 17112174211
```

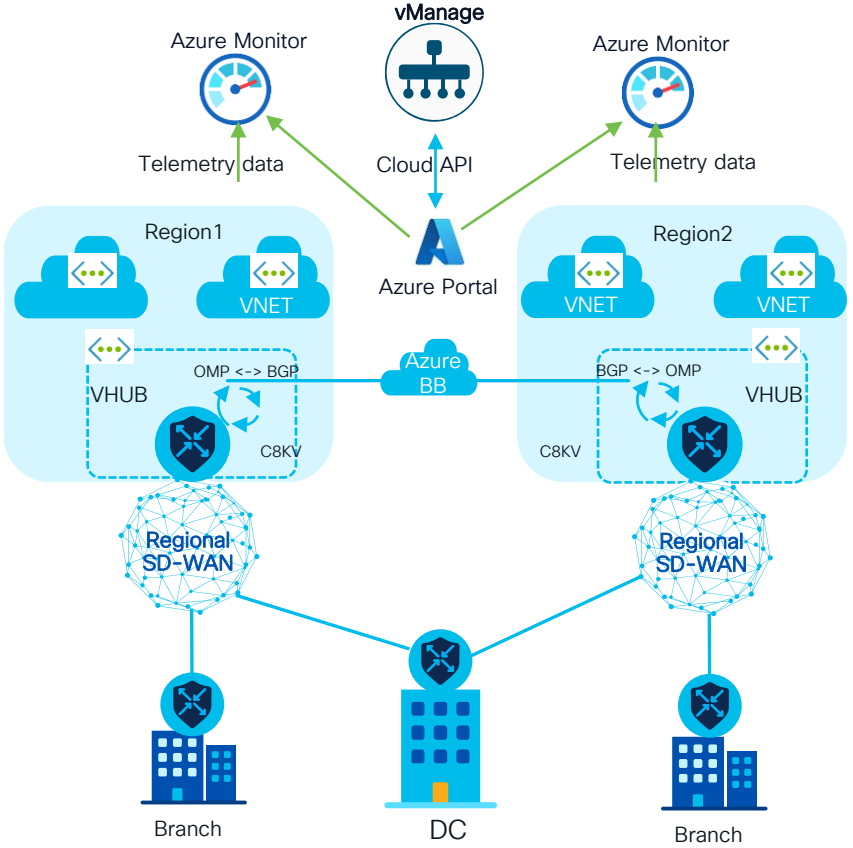
Tunnel source	Tunnel destination
192.168.0.113	172.26.0.247
192.168.0.32	172.26.0.247
192.168.0.130	172.26.0.247
192.168.0.45	172.26.0.247
192.168.0.127	172.26.0.247
192.168.0.139	172.26.0.247
192.168.0.147	172.26.0.247
192.168.0.231	172.26.0.247
192.168.0.154	172.26.0.247
192.168.0.182	172.26.0.247
192.168.0.195	172.26.0.247
192.168.0.213	172.26.0.247

Create 12 tunnels by using engineered IP pairs to ensure even hashing

SD-WAN Cloud onRamp for MultiCloud

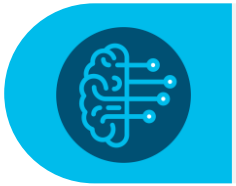
Native integration with Azure Virtual WAN

- Automated provisioning of Azure VWAN and VHUB infra
- Instantiate Cloud GW in VHUBs and extend SD-WAN fabric into the cloud via Internet and ExpressRoute
- Intent Management workflow enables connectivity between SD-WAN VPNs and VNets.
- Integrate with Azure Firewall
- Support 3 types of instances, deploy a pair of each:
  - D2_v2, D3_v2, D4_v2
- SKU scale up to 5Gbps
- Max 8 vHub per region



Key Takeaways

C8KV is the foundation for Secure Cloud networking



Fully Automated Deployment

- vManage Cloud onramp orchestration
- Cloudformation, ARM, terraform templates support
- Programmability NETCONF/RESTCONF

Ready for the Multicloud Journey

- Multi-cloud SD-WAN deployment
- TGW and Azure vWAN Integration
- HA and TGW solution

Agile and Elastic deployment

- Supports a large variety of cloud instance types
- Increase CPU and memory on demand
- Optimized IPsec performance in Cloud

Fill out your session surveys!

Attendees who fill out a minimum of four session surveys and the overall event survey will get **Cisco Live-branded socks** (while supplies last)!

Attendees will also earn 100 points in the **Cisco Live Challenge** for every survey completed.

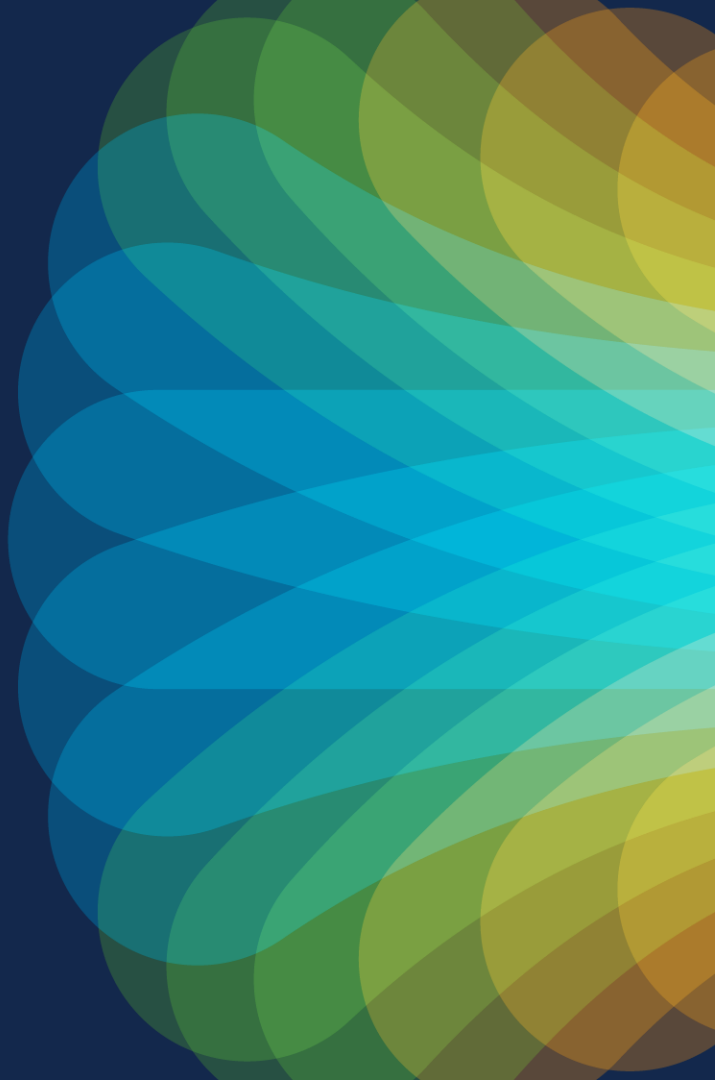
These points help you get on the leaderboard and increase your chances of winning daily and grand prizes

Continue your education

- Visit the Cisco Showcase for related demos
- Book your one-on-one Meet the Engineer meeting
- Attend the interactive education with DevNet, Capture the Flag, and Walk-in Labs
- Visit the On-Demand Library for more sessions at www.CiscoLive.com/on-demand

The bridge to possible

Thank you



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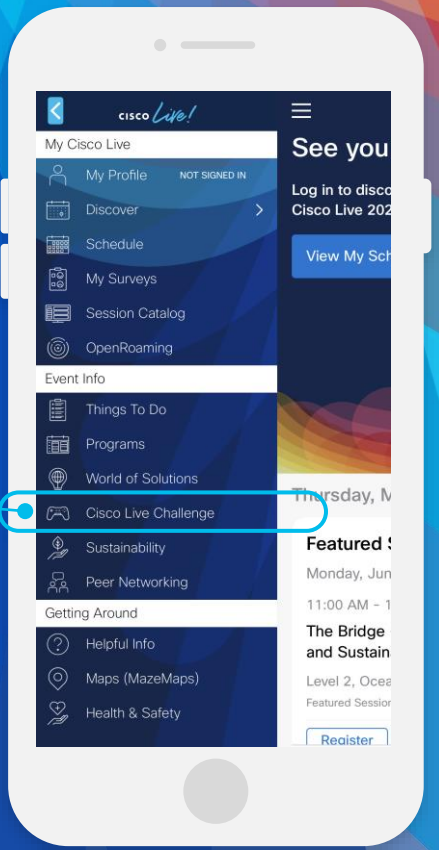
Challenge

Gamify your Cisco Live experience!

Get points for attending this session!

How:

1. Open the Cisco Events App.
2. Click on 'Cisco Live Challenge' in the side menu.
3. Click on View Your Badges at the top.
4. Click the + at the bottom of the screen and scan the QR code:

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