The bridge to possible

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

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# Cisco Webex App

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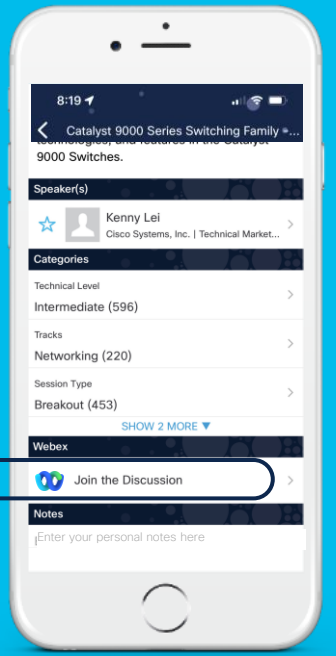
## Webex spaces will be moderated until February 24, 2023.



# Agenda

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

# Introducing Cisco Catalyst 8000V Edge Software

cisco Live!

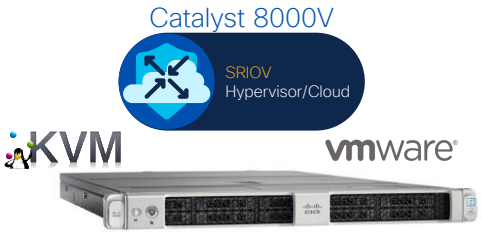
# Cisco Catalyst 8000V Edge Software

Pervasive WAN Deployment

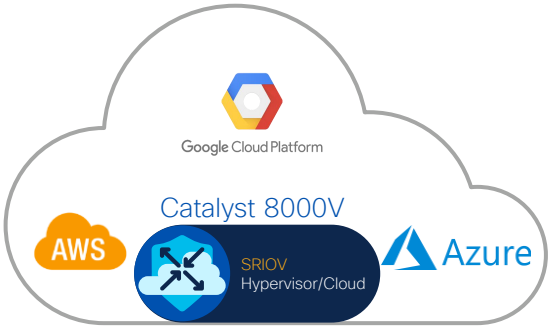
Seamless SD-WAN Extension in cloud

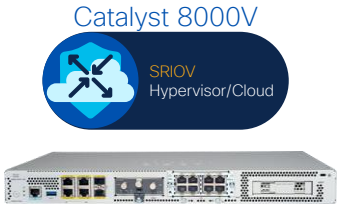
Infrastructure Agnostic

Service Richness



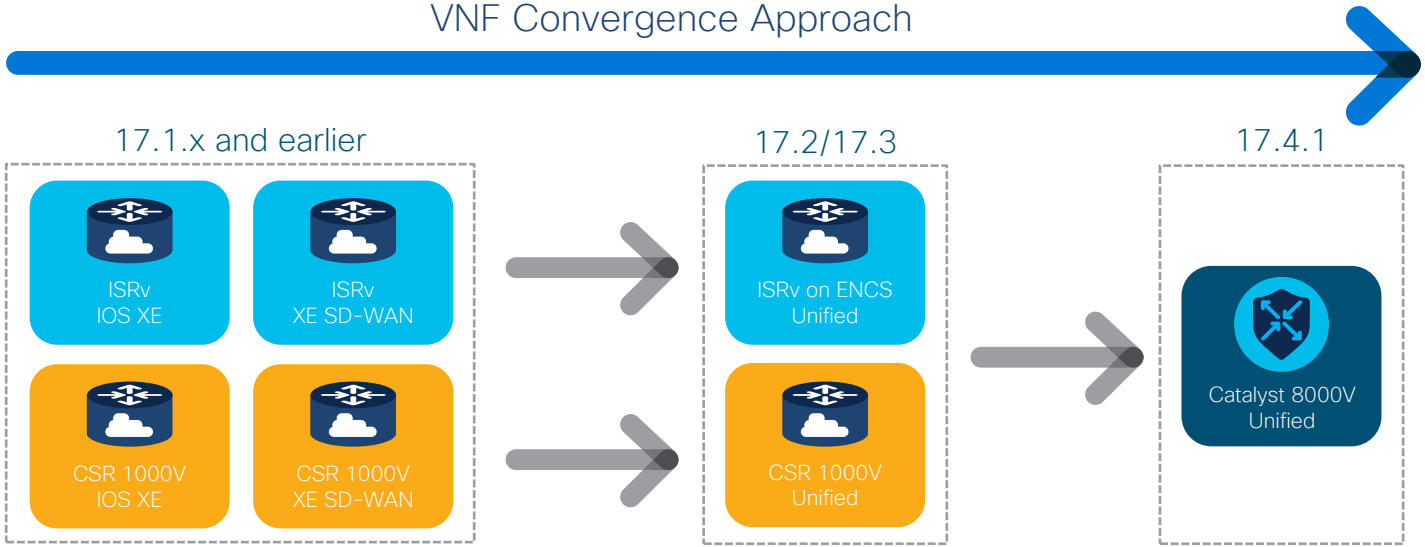

Hypervisor
On x86 server




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

# 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



Enterprise Linux 7.5
Enterprise Linux 7.7
Enterprise Linux 8.4

Ubuntu 16.04 LTS


ESXi 6.5 Update 2
ESXi 6.7 Update 3
ESXi 7.0


Openstack TRAIN
RHEL 8.2
CVIM 3.4


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

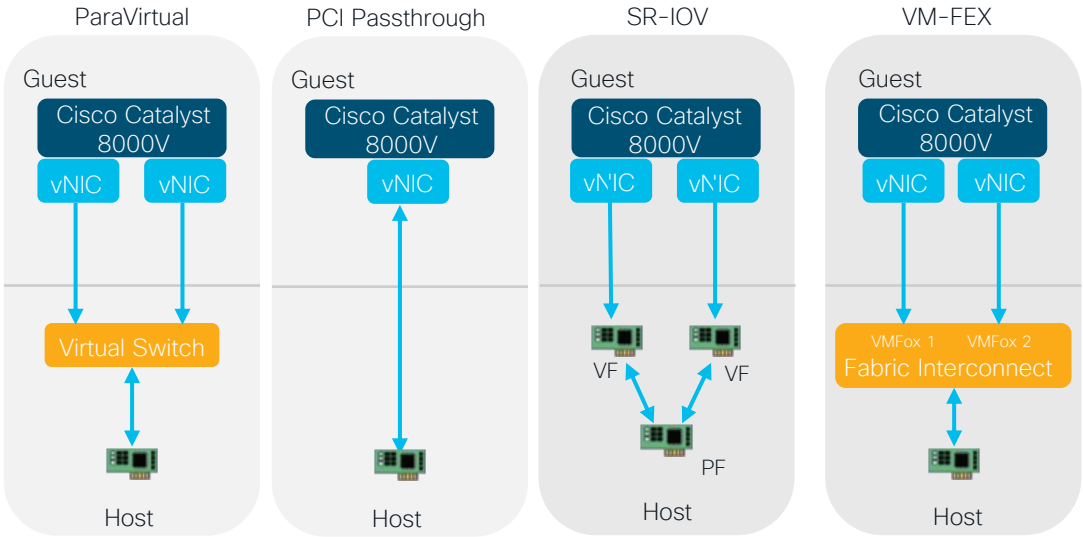
```
C8KV(config)#int GigabitEthernet1
C8KV (config-if)#speed ?
  1000   Force 1000 Mbps operation
  10000  Force 10000 Mbps operation
  25000  Force 25000 Mbps operation
```


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

# 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



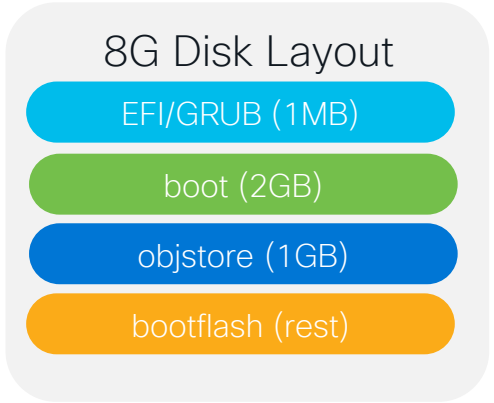
# Tips of the day - #1
## know my vnic driver


```
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

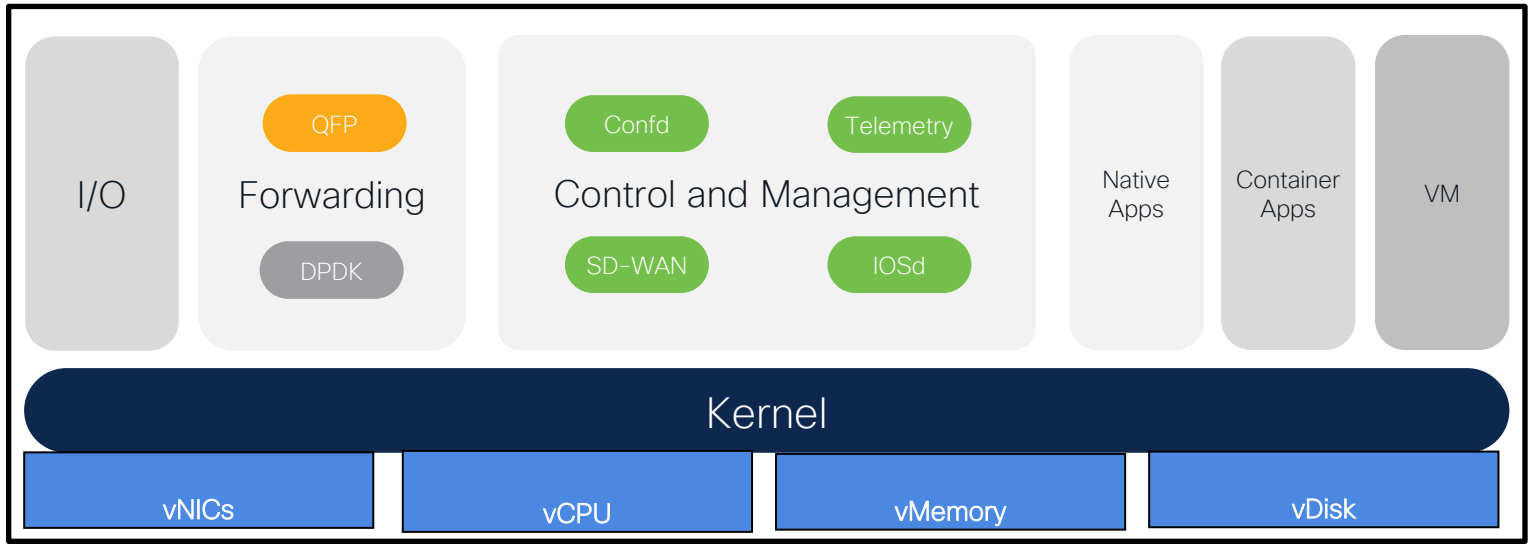
- Storage partitions for NVRAM, licensing and other data are now created as Object stores
- Individual Object stores are encrypted to ensure data security
- Cisco Secure Development lifecycle (CSDL) compliant
- 16G disk cycle profile support



# 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 |

NOTE: vCPU allocations subject to change without further notice

# Platform Resource Profile

- C8KV(config)#platform resource ?

```
app-heavy                    Use App Heavy template
control-plane-extra-heavy    Use Control Plane Extra Heavy template
control-plane-heavy          Use Control Plane Heavy template
data-plane-heavy             Use Data Plane Heavy template
data-plane-normal            Use Data Plane Normal template
service-plane-heavy          Use Service Plane Heavy template
service-plane-medium         Use Service Plane Medium template
```

SD-WAN TCP Optimization with DRE external service node

For control plane heavy deployment such as Route Reflector, 10K FlexVPN

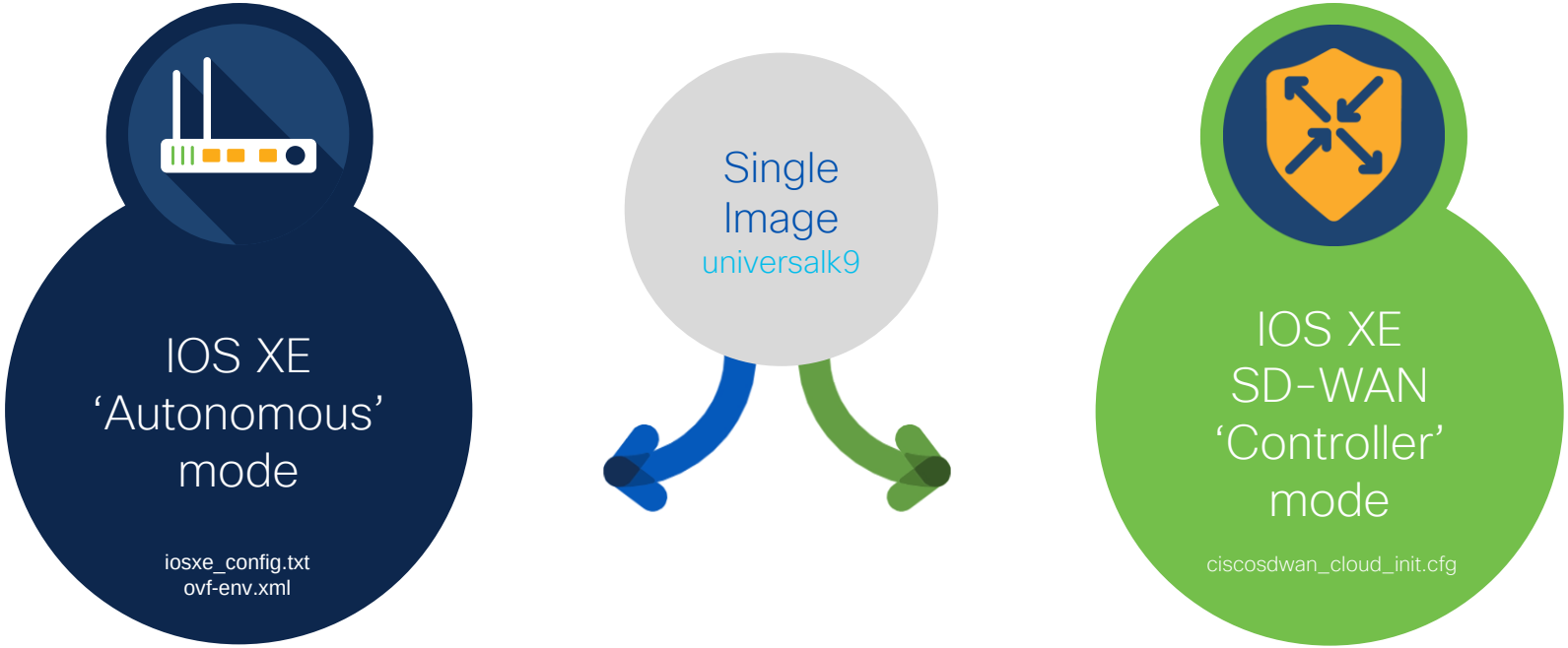
Default template, give u the best data plane performance

# Tips of the day - #2
## 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

NBARv2
HQoS
AppQoE

NAT
SD-Access

### Cloud Connectivity

SD-WAN Integration:
- AWS TGW
- Azure vWAN

Autonomous Mode:
HA Solution
TGW

### Automation

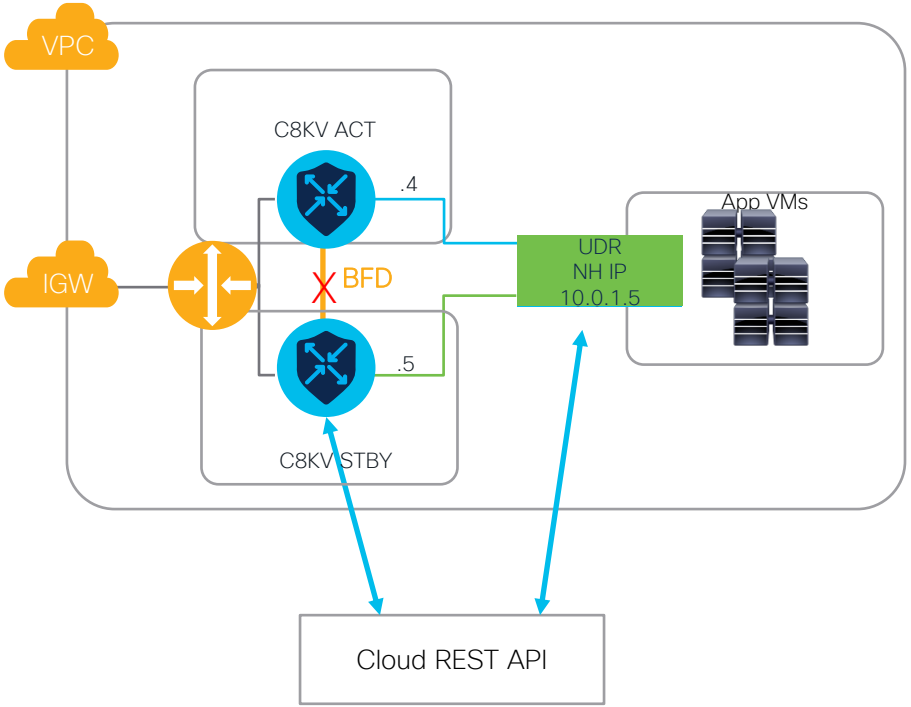
CloudFormation
Azure Resource Manager
Terraform
Netconf
Restconf

# 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 - #3
## 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
```

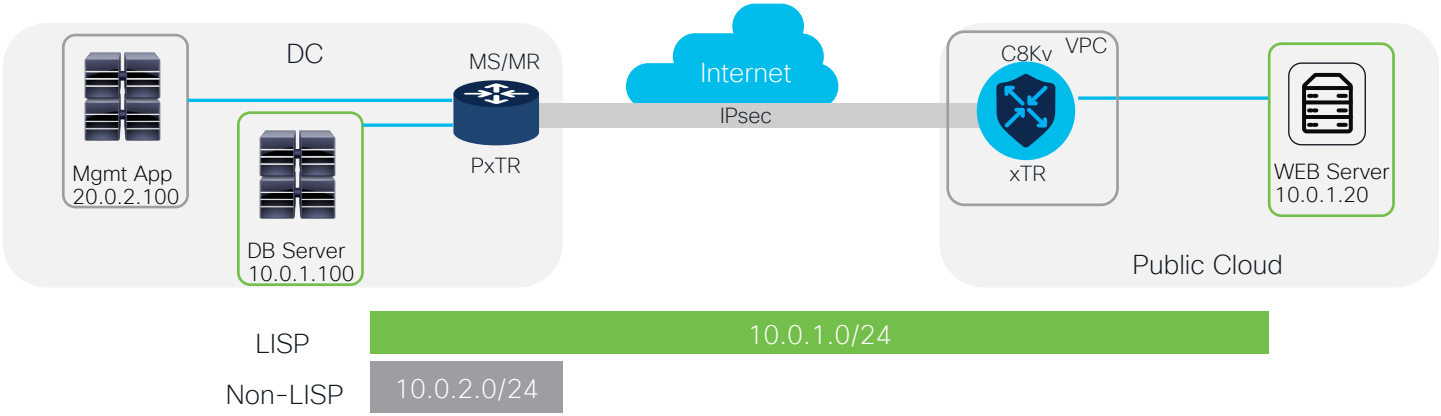
```
Step3[guestshell@guestshell ~]$ create_node.py -i 100 -p azure -s <subscriptionId> -g test -t haprivate-
rt -n 10.0.1.4 -m primary
```

```
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

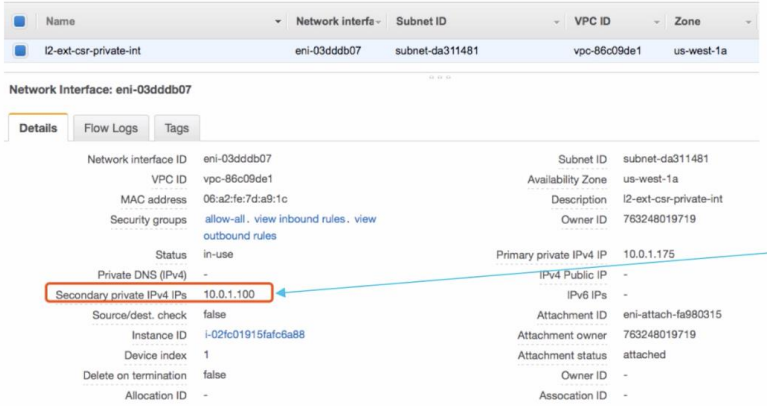
# IP mobility into Public Clouds

- 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 - #4

## configure DC server IP as secondary ip on AWS console




Don't need to be configured on C8KV

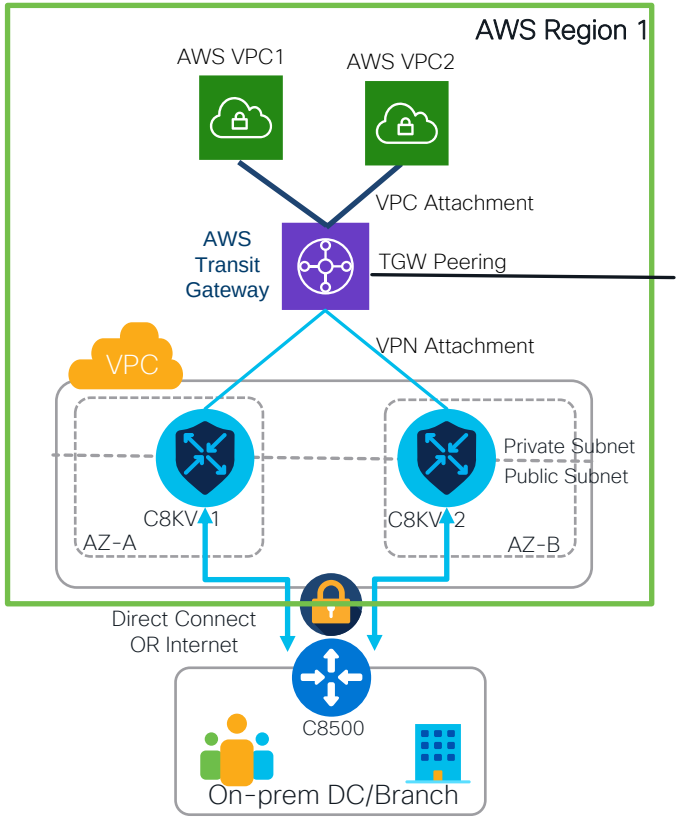
How many host can be supported?

```
-----------------------------------------
|          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

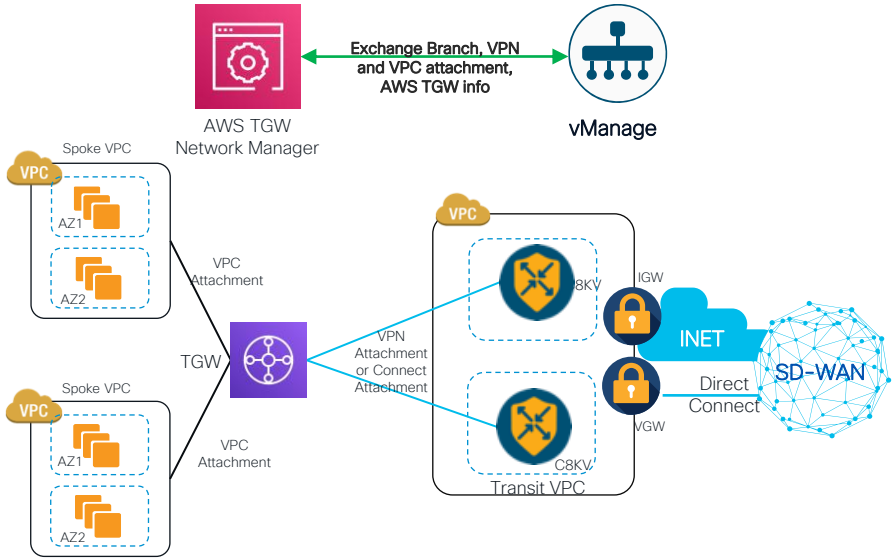
# AWS TGW Integration

- 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 - #5

## 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 17.7 C8KV is able to use 8 Tx queues in both SD-WAN mode and autonomous mode
- Starting in IOS XE 17.9, C8KV is able to use 12 Tx queues in c5n.18xl/9xl instance
- Traffic are hashed into Tx queues by src/dst ip/port & CRC hashing, in case of tunnels it will be tunnel outer IP 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
```

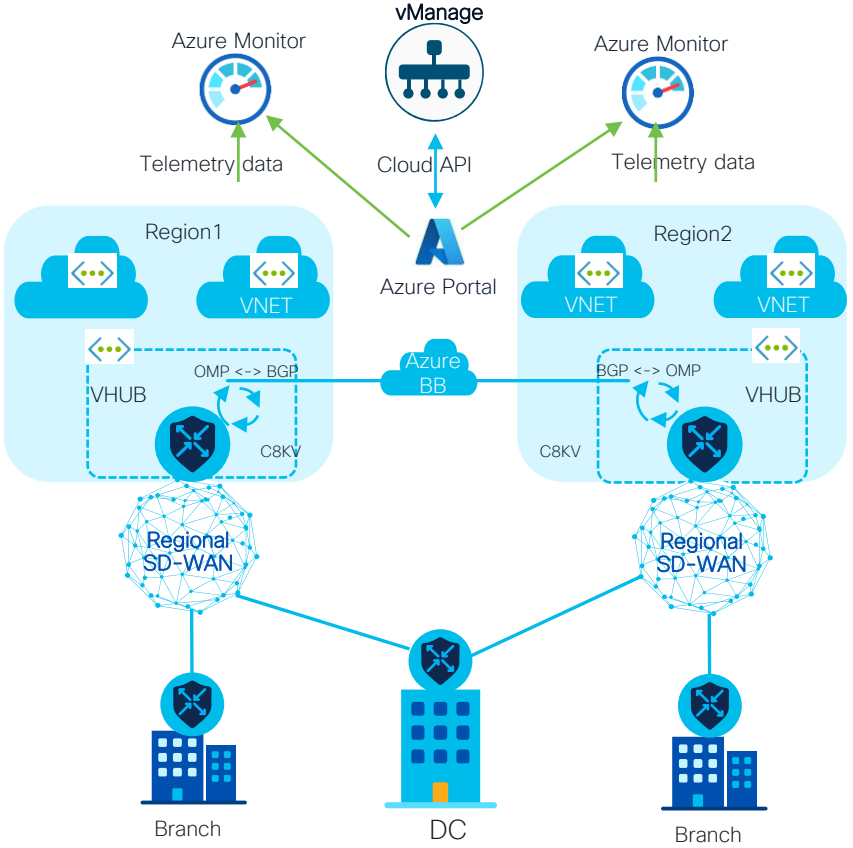
| Tunnel source | Tunnel destination |
|---|---|
| 192.168.0.113 | 172.26.0.247 |
| 192.168.0.32 | 172.26.0.247 |
| 192.168.0.130 | 172.26.0.247 |
| 192.168.0.45 | 172.26.0.247 |
| 192.168.0.127 | 172.26.0.247 |
| 192.168.0.139 | 172.26.0.247 |
| 192.168.0.147 | 172.26.0.247 |
| 192.168.0.231 | 172.26.0.247 |
| 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

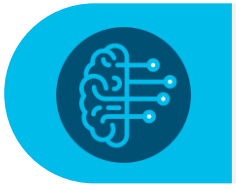
## Native integration with Azure Virtual WAN

- **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



# 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

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The bridge to possible

# Thank you


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ALL IN