# explain the concept of EVPN, VxLAN, leaf-spine architecture in terms of routing and switching for a legacy networker engineer who has the old concept of router and switch networking

# Model

# Bridging the Gap: Understanding EVPN, VXLAN, and Leaf-Spine for Legacy Networkers

# Imagine you're accustomed to the old ways of routing and switching – distinct devices with clear roles. Now, let's translate these new concepts into familiar terms:

# **VXLAN (Virtual Extensible LAN): Extending Layer 2 Beyond Limits**

# Think of VXLAN as building a network of invisible tunnels over your existing network. These tunnels carry Ethernet frames (Layer 2) across the underlying network (Layer 3), allowing you to extend your LAN segments beyond physical boundaries.

# **Analogy:** Imagine having several separate islands (VLANs) that need to communicate. VXLAN creates bridges (tunnels) between these islands, enabling communication as if they were all part of the same landmass.

# **EVPN (Ethernet VPN): The Intelligent Traffic Director**

# EVPN acts as the control center for these VXLAN tunnels. It provides information about MAC addresses and IP addresses within each segment, allowing intelligent routing and forwarding decisions. EVPN ensures that traffic flows efficiently between segments, preventing unnecessary broadcasts and optimizing network performance.

# **Analogy:** Think of EVPN as a traffic controller who knows the location of every house (MAC address) and street (IP subnet) on each island. It directs traffic efficiently, ensuring everyone reaches their destination quickly.

# **Leaf-Spine Architecture: A Scalable Highway System**

# Leafspine architecture is like a modern highway system for your data. Leaf switches connect to servers and devices (like on-ramps), while spine switches connect all the leaf switches together (like major highways). This creates a highly scalable and resilient network, preventing bottlenecks and ensuring smooth traffic flow.

# **Analogy:** Imagine a city with multiple small roads (leaf switches) connecting to houses (devices). These roads then connect to major highways (spine switches) allowing efficient travel across the city.

# **Putting it all together:**

# **VXLAN** creates tunnels to extend Layer 2 connectivity.

# **EVPN** manages these tunnels and provides intelligent routing information.

# **Leaf-spine architecture** provides a scalable and efficient network infrastructure.

# **Benefits for the Legacy Networker:**

# **Scalability:** Build larger, more flexible networks that adapt to growing demands.

# **Flexibility:** Move workloads freely across the network without being limited by physical boundaries.

# **Performance:** Optimize traffic flow and improve application performance.

# **Resilience:** Eliminate single points of failure and create a more robust network.

# **Remember:** These new technologies build upon existing networking principles. While the terminology and implementation may differ, the core concepts of routing and switching remain relevant. Embracing these advancements can empower you to build more powerful and efficient networks for the modern world.

# User

# what would be a good approach to study this technology and become a network engineer serving this part on cloud side

# Model

# Mastering EVPN, VXLAN, and Leaf-Spine for Cloud Networking: A Learning Roadmap

# Transitioning from legacy networking to cloud-focused technologies like EVPN, VXLAN, and leaf-spine architectures requires a structured approach. Here's a roadmap to guide your journey:

# **Step 1: Foundational Knowledge**

# **Networking Fundamentals:** Ensure you have a solid understanding of fundamental networking concepts like OSI model, TCP/IP, routing protocols (OSPF, BGP), switching (VLANs, STP), and network security.

# **Linux Fundamentals:** Familiarize yourself with basic Linux commands and navigation as many cloud networking tools utilize a Linux environment.

# **Step 2: Virtualization and Cloud Concepts**

# **Virtualization:** Understand the principles of server virtualization and how it forms the basis of cloud computing. Explore technologies like hypervisors (KVM, VMware) and virtual machines.

# **Cloud Platforms:** Gain a high-level understanding of major cloud platforms like AWS, Azure, and GCP, including their core services and networking capabilities.

# **Step 3: Dive into EVPN and VXLAN**

# **VXLAN Deep Dive:** Learn about VXLAN tunnel establishment, encapsulation, and packet forwarding. Understand the role of VTEPs (VXLAN Tunnel Endpoints) and how they facilitate communication between segments.

# **EVPN Deep Dive:** Explore the functionalities of EVPN, including control plane learning, MAC and IP address distribution, and various EVPN route types (Type 2, Type 3, etc.).

# **Hands-on Practice:** Utilize network simulators or emulation tools like GNS3, Eve-NG, or vendor-specific virtual labs to practice configuring VXLAN tunnels and EVPN on virtual network devices.

# **Step 4: Understanding Leaf-Spine Architecture**

# **Design Principles:** Learn the core principles of leaf-spine architecture, including its scalability, redundancy, and low-latency characteristics.

# **Fabric Technologies:** Explore technologies like Cisco ACI, VMware NSX, or Juniper Contrail that implement and manage leaf-spine fabrics in data centers.

# **Automation and Orchestration:** Understand how automation tools like Ansible or Puppet can be used to configure and manage leaf-spine networks.

# **Step 5: Gain Cloud-Specific Knowledge**

# **Choose Your Cloud:** Focus on one or two major cloud platforms like AWS, Azure, or GCP and delve deeper into their native networking services like VPCs, VPNs, load balancers, and network security groups.

# **Cloud Networking Certifications:** Consider pursuing cloud-specific networking certifications such as:

# **AWS:** AWS Certified Advanced Networking - Specialty

# **Azure:** Azure Solutions Architect Expert

# **GCP:** Google Cloud Certified Professional Cloud Network Engineer

# **Additional Resources:**

# **Vendor Documentation:** Consult official documentation from vendors like Cisco, Juniper, Arista, and Cumulus Networks for in-depth technical details.

# **Online Courses:** Platforms like Udemy, Coursera, and Pluralsight offer various courses on EVPN, VXLAN, and cloud networking.

# **Industry Blogs and Forums:** Stay updated on the latest trends and best practices by following industry blogs and participating in online forums.

# **Remember:** This is a continuous learning journey. Stay curious, practice regularly, and actively engage with the cloud networking community to refine your skills and become a valuable cloud network engineer.

# User

# further explain step 3 and step 4 in some details related to design and arch. Compare providers.

# Model

# Deeper Dive into Step 3 and 4: Design and Architecture with EVPN, VXLAN, and Leaf-Spine

# Let's delve into the specifics of steps 3 and 4, focusing on design and architecture considerations, along with a comparison of vendors :

# **Step 3: EVPN and VXLAN Design Considerations**

# **VXLAN Tunnel Endpoints (VTEPs):**

# **Deployment Options:** VTEPs can be implemented on hardware switches, virtual switches within hypervisors, or even in software on servers. The choice depends on your environment and scalability needs.

# **Hardware VTEPs:** Vendors like Arista, Cisco, Juniper offer high-performance hardware VTEPs within their data center switches, providing efficient tunnel encapsulation and decapsulation.

# **Software VTEPs:** Solutions like Open vSwitch (OVS) offer software-based VTEPs that can be deployed on commodity servers, providing flexibility and cost savings.

# **EVPN Control Plane:**

# **Multiprotocol BGP (MP-BGP):** EVPN leverages MP-BGP for exchanging MAC and IP reachability information between VTEPs. This enables efficient routing and avoids flooding within the VXLAN overlay network.

# **Route Types:** Understand the different EVPN route types like Type 2 (MAC/IP advertisement), Type 3 (inclusive multicast), and Type 5 (IP prefix) and their roles in building and maintaining the overlay network.

# **VXLAN Network Identifier (VNI):**

# **Segmentation:** VNIs act as virtual network identifiers, similar to VLAN IDs, to segregate traffic within the VXLAN overlay. Each VNI represents a unique broadcast domain.

# **Planning:** Careful planning is required to allocate VNIs efficiently and prevent overlap or conflicts between different segments.

# **Step 4: Leaf-Spine Architecture Design and Vendor Comparison**

# **Spine Layer:**

# **High-performance Switches:** Spine switches should be high-performance devices capable of handling large amounts of traffic with low latency.

# **Redundancy:** Implement redundant spine switches to ensure network availability in case of failures.

# **Vendor Options:** Arista, Cisco, Juniper, and Mellanox offer high-performance spine switches with features like large buffers, high port density, and advanced traffic management capabilities.

# **Leaf Layer:**

# **Access Switches:** Leaf switches provide connectivity to servers, storage, and other devices.

# **Port Density:** Choose leaf switches with sufficient port density to accommodate your current and future needs.

# **Vendor Options:** Arista, Cisco, Juniper, and Dell offer a wide range of leaf switches with varying port speeds, densities, and features.

# **Fabric Management:**

# **Controller-Based Fabrics:** Solutions like Cisco ACI and VMware NSX utilize a centralized controller to manage and automate fabric configuration and operations.

# **Standards-Based Fabrics:** EVPN/VXLAN fabrics can be built and managed using open standards and protocols, allowing for greater flexibility and vendor interoperability.

# **Arista Comparison:** Arista is known for its high-performance data center switches with a focus on open standards and automation. Arista EOS (Extensible Operating System) provides a robust and programmable platform for building and managing leaf-spine fabrics.

# **Key Design Considerations:**

# **Scalability:** Design the fabric to accommodate future growth in terms of bandwidth, devices, and network services.

# **Resilience:** Implement redundancy at both the spine and leaf layers to prevent single points of failure.

# **Performance:** Choose switches and fabric technologies that can deliver low latency and high throughput for your workloads.

# **Management and Automation:** Consider using automation tools to simplify fabric configuration and management, especially in large-scale deployments.

# **By carefully considering these design factors and choosing the right vendor solutions, you can build a robust and scalable leaf-spine architecture that leverages the power of EVPN and VXLAN for efficient and flexible cloud networking.**

**Lab**

After preparing the topology on Eve-ng or GNS3 with 3 nexus switches follow the steps below to enable the service on leaves as VTEP’s running EVPN (MP BGP) and exchanging mac addresses

  **Enable Necessary Features and Protocols:**

* On both Leaf1 and Leaf2, enable features for VXLAN, OSPF, BGP, and VLAN-based VN-segmentation.
* On Spine1, enable OSPF and BGP for underlay connectivity and EVPN for VXLAN overlay control plane.

 **Configure VLAN and VN-Segment:**

* On Leaf1 and Leaf2, define VLAN 10 and associate it with VN-Segment 5000, which will be used for VXLAN encapsulation.

 **Set Up NVE Interfaces:**

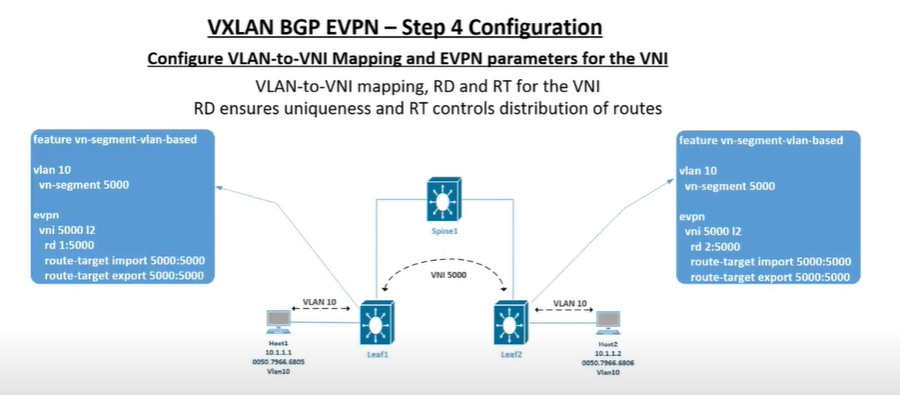
* On Leaf1 and Leaf2, configure the NVE interface, which is the logical interface for VXLAN encapsulation and decapsulation.
* Specify the source interface (loopback1) and enable host-reachability protocol BGP, which will advertise MAC address reachability information.

 **Configure Underlay and Overlay Networking:**

* Assign IP addresses to physical interfaces and loopback interfaces on Leaf1, Leaf2, and Spine1 for OSPF routing in the underlay network.
* Configure BGP on Leaf1, Leaf2, and Spine1 with EVPN address family to establish BGP neighbor relationships for the overlay network.

 **Establish EVPN Control Plane:**

* On Leaf1 and Leaf2, configure EVPN settings for VNI 5000, including route distinguisher (RD) and route targets (RT) for importing and exporting routes.
* On Spine1, configure BGP EVPN as a route reflector to facilitate the exchange of EVPN routes between the leaf switches.



**///////////////Configurations////////////////**

**//////////////Leaf1**

nv overlay evpn

feature ospf

feature bgp

feature vn-segment-vlan-based

feature nv overlay

vlan 10

vn-segment 5000

interface nve1

no shutdown

host-reachability protocol bgp

source-interface loopback1

member vni 5000

ingress-replication protocol bgp

interface Ethernet1/1

no switchport

ip address 11.1.1.0/31

ip ospf network point-to-point

ip router ospf 1 area 0.0.0.0

no shutdown

interface Ethernet1/2

switchport access vlan 10

interface loopback0

ip address 100.1.1.1/32

ip router ospf 1 area 0.0.0.0

interface loopback1

ip address 101.1.1.1/32

ip router ospf 1 area 0.0.0.0

router ospf 1

router bgp 65001

router-id 100.1.1.1

address-family l2vpn evpn

retain route-target all

neighbor 100.1.1.3

remote-as 65001

update-source loopback0

address-family l2vpn evpn

send-community

send-community extended

evpn

vni 5000 l2

rd 1:5000

route-target import 5000:5000

route-target export 5000:5000

**//////////////Leaf2**

nv overlay evpn

feature ospf

feature bgp

feature vn-segment-vlan-based

feature nv overlay

vlan 10

vn-segment 5000

interface nve1

no shutdown

host-reachability protocol bgp

source-interface loopback1

member vni 5000

ingress-replication protocol bgp

interface Ethernet1/1

no switchport

ip address 12.1.1.0/31

ip ospf network point-to-point

ip router ospf 1 area 0.0.0.0

no shutdown

interface Ethernet1/2

switchport access vlan 10

interface loopback0

ip address 100.1.1.2/32

ip router ospf 1 area 0.0.0.0

interface loopback1

ip address 101.1.1.2/32

ip router ospf 1 area 0.0.0.0

router ospf 1

router bgp 65001

router-id 100.1.1.2

address-family l2vpn evpn

retain route-target all

neighbor 100.1.1.3

remote-as 65001

update-source loopback0

address-family l2vpn evpn

send-community

send-community extended

evpn

vni 5000 l2

rd 2:5000

route-target import 5000:5000

route-target export 5000:5000

**//////////////Spine1**

nv overlay evpn

feature ospf

feature bgp

interface Ethernet1/1

no switchport

ip address 11.1.1.1/31

ip ospf network point-to-point

ip router ospf 1 area 0.0.0.0

no shutdown

interface Ethernet1/2

no switchport

ip address 12.1.1.1/31

ip ospf network point-to-point

ip router ospf 1 area 0.0.0.0

no shutdown

interface loopback0

ip address 100.1.1.3/32

ip router ospf 1 area 0.0.0.0

router ospf 1

router bgp 65001

router-id 100.1.1.3

address-family l2vpn evpn

neighbor 100.1.1.1

remote-as 65001

update-source loopback0

address-family l2vpn evpn

send-community

send-community extended

route-reflector-client

neighbor 100.1.1.2

remote-as 65001

update-source loopback0

address-family l2vpn evpn

send-community

send-community extended

route-reflector-client

