

Cisco Data Center Core: Implementing Automation

EXAMINING CISCO APPLICATION-CENTRIC INFRASTRUCTURE



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Overview



Examine how Cisco ACI provides centralized automation and implement policy and predictability using profiles

- ACI Fabric
- APIC

Demonstrate how to use Cisco APIC to configure and apply fabric policies



Cisco ACI Overview



Nexus 9000 Switches

Centralized policy
management with
APIC

Integrated physical
and virtual
infrastructure

Fully automated,
secure, redundant
network connectivity

Cisco ACI Building Blocks



**The network made
simple**

**Optimization and
automation**

**Multi-cloud
networking**

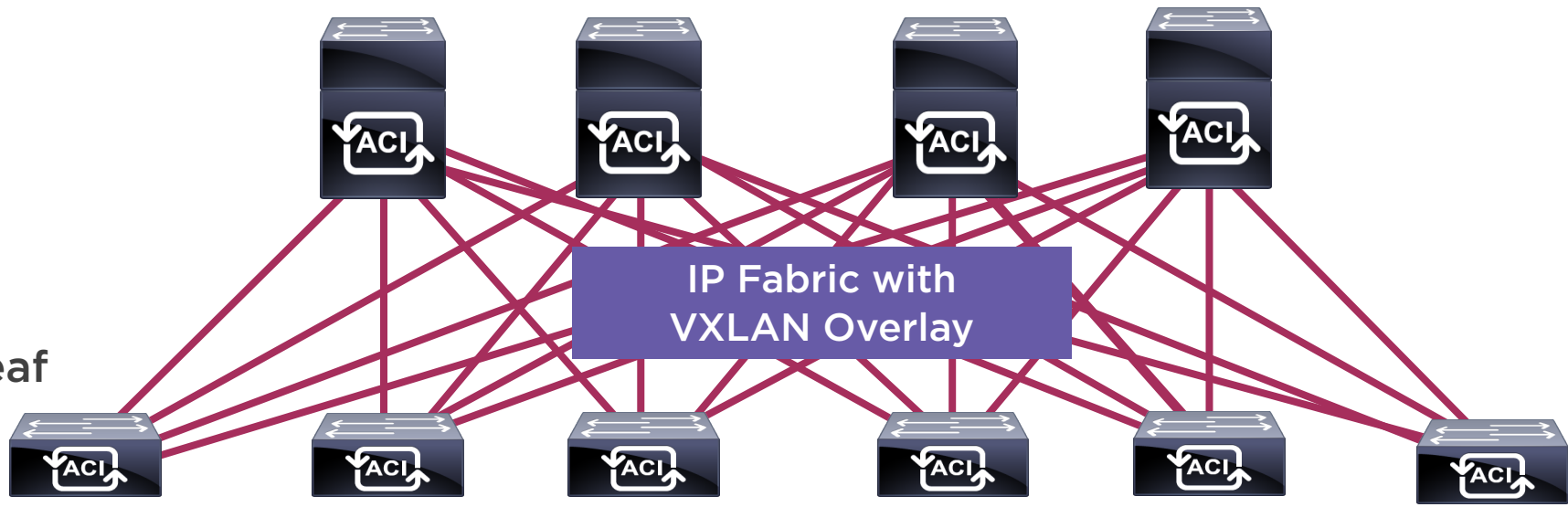
What is ACI?



Spine-Leaf Topology

Nexus 9000 Spine

Nexus 9000 Leaf



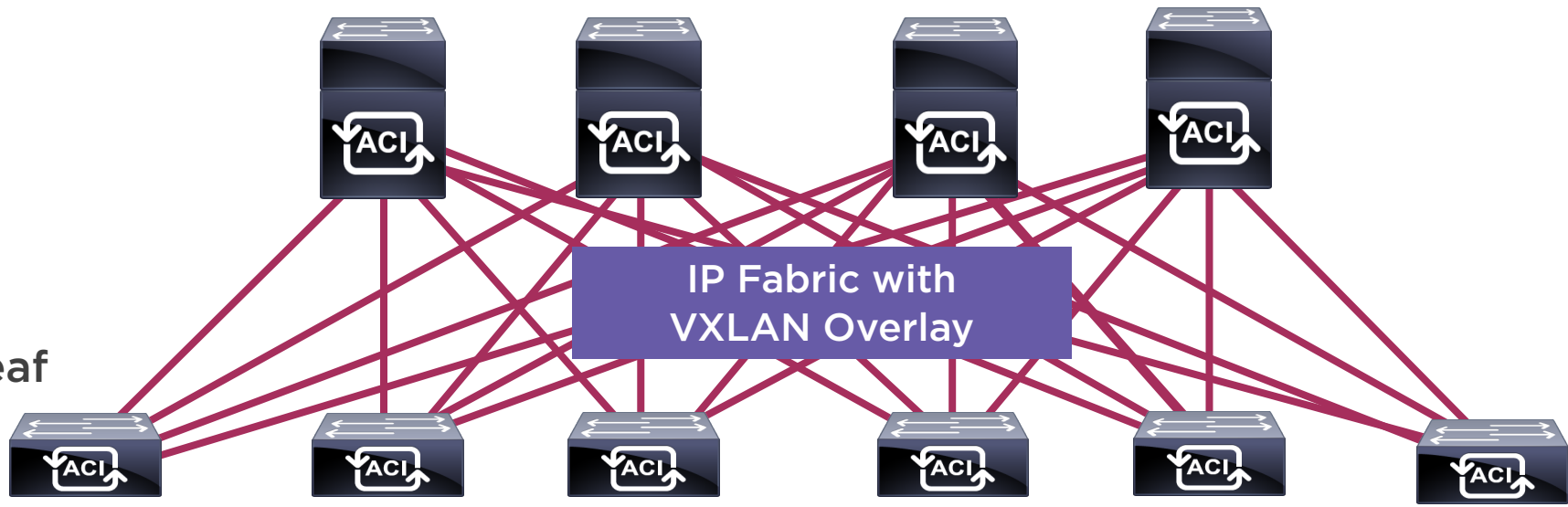
High-speed IP fabric
Minimum of two spines (1+1 redundancy)



Spine-Leaf Topology

Nexus 9000 Spine

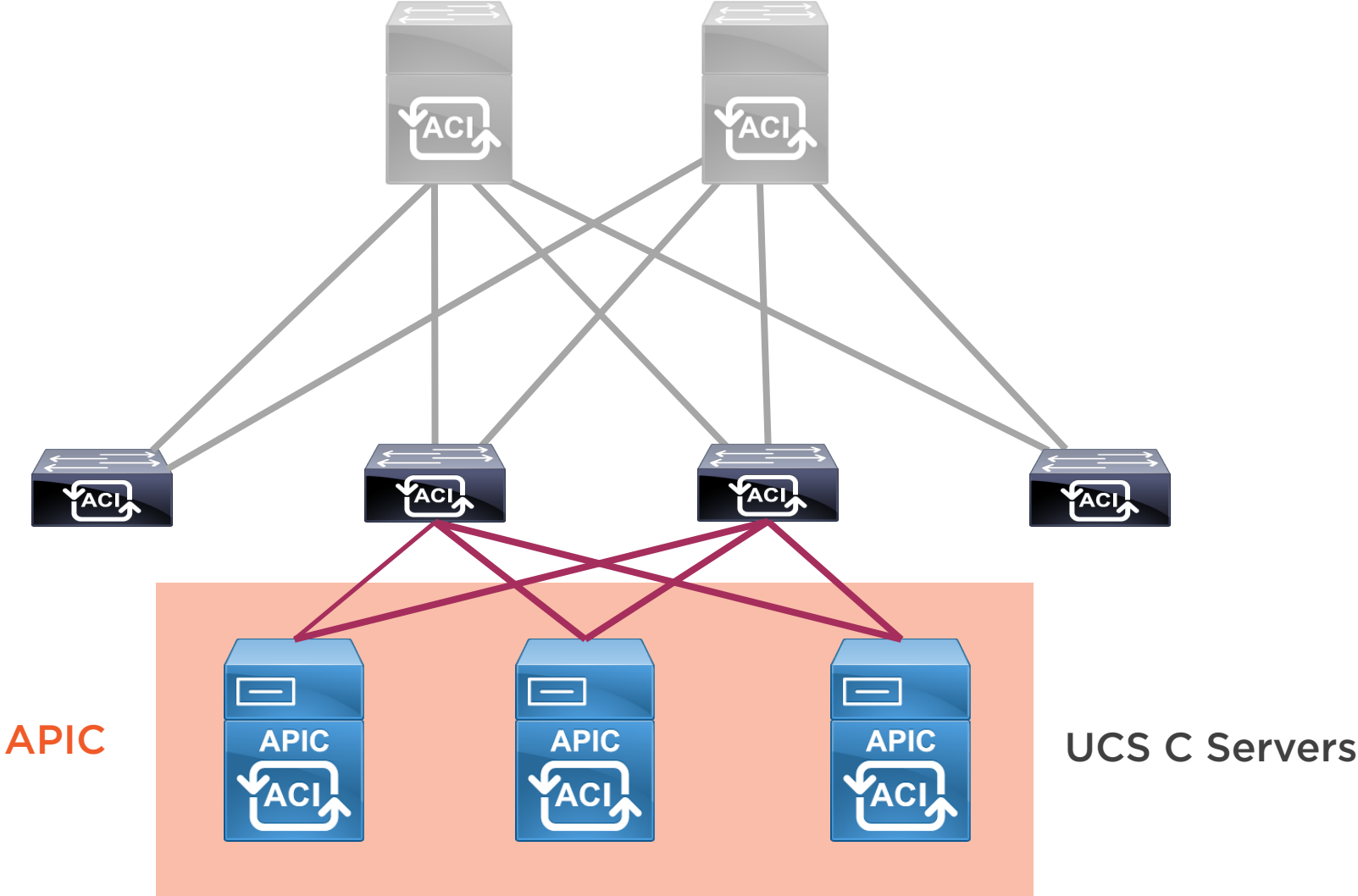
Nexus 9000 Leaf



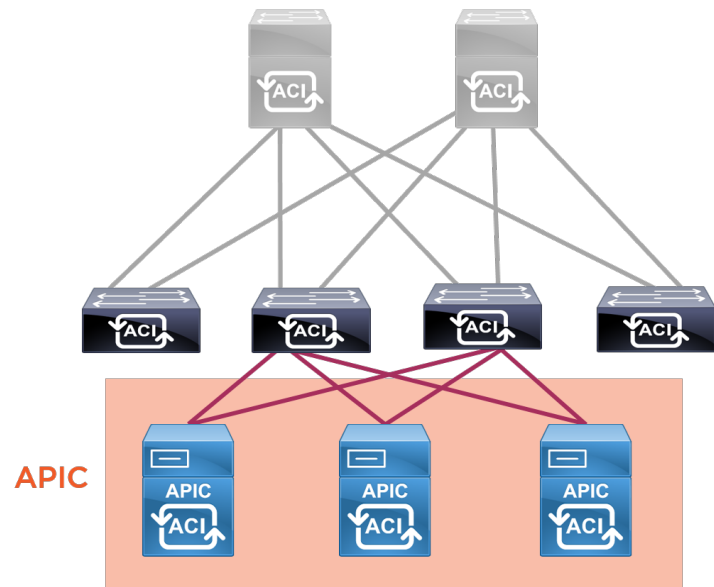
Leaf switches never connect to each other
End devices only connect to leaf switches



Cisco APIC



Cisco APIC Features



Policy controller

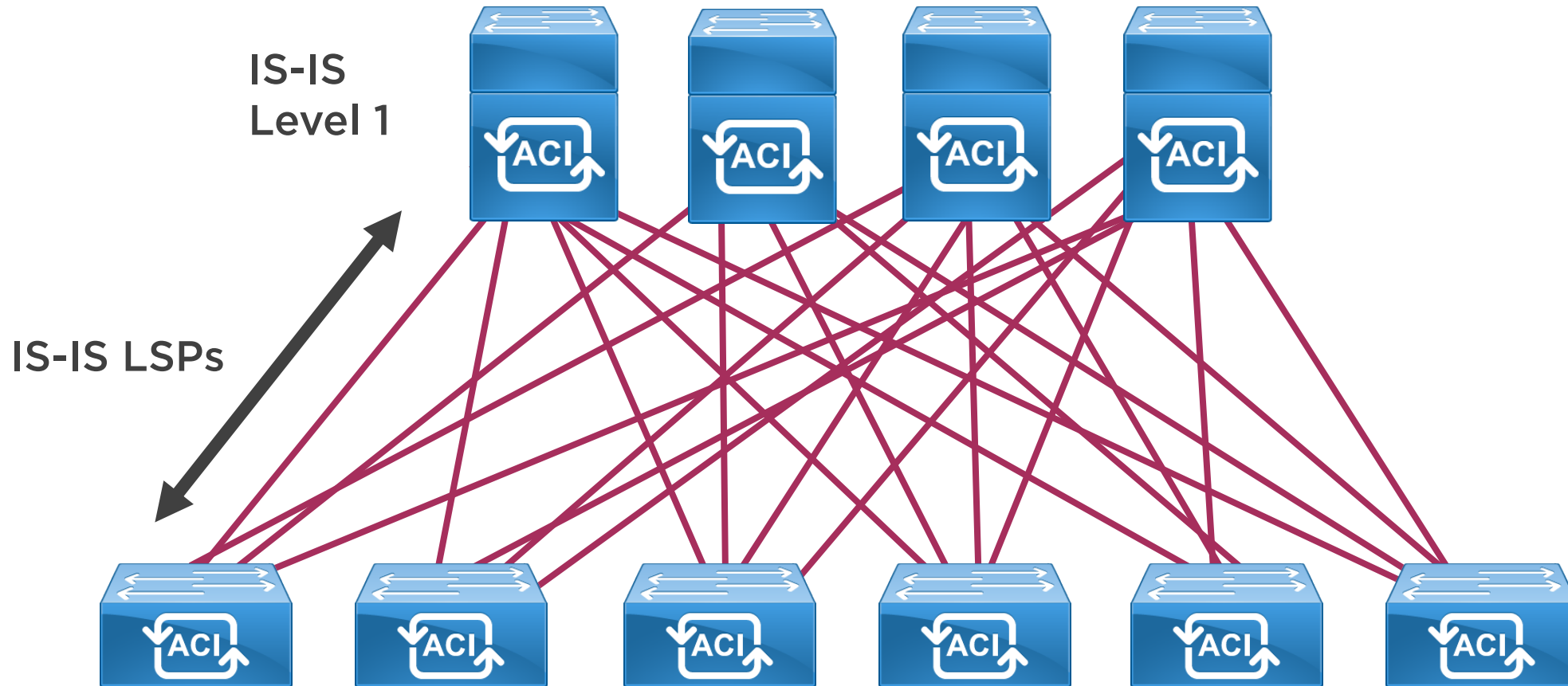
- Holds the defined policy
- Represents the management plane
- Implements the policy changes

Deployed as a redundant cluster of servers

- Use at least three servers
- Each server is dual-homed for resilience



IS-IS Fabric Infrastructure Routing



IS-IS Fabric Infrastructure Routing

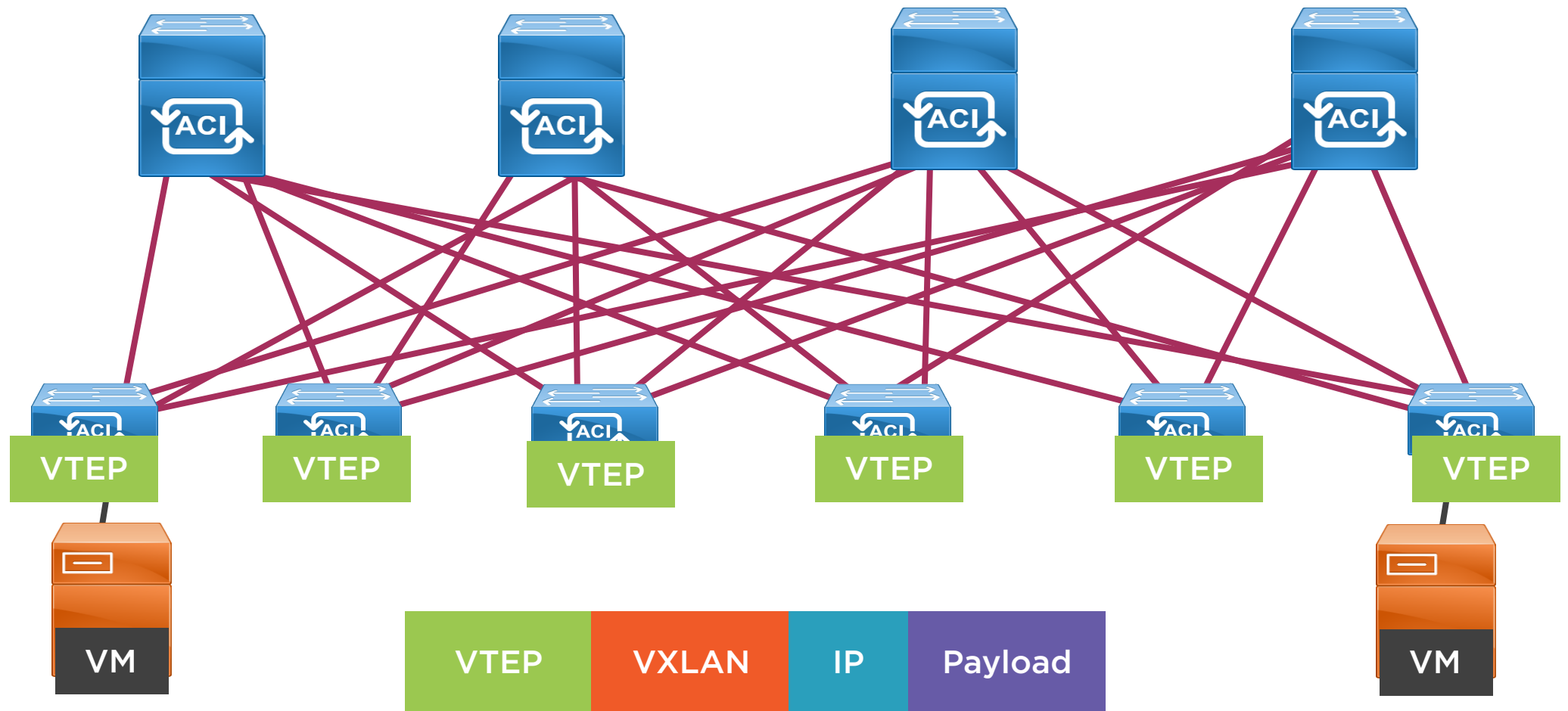
IS-IS is tuned for a densely connected fabric

IS-IS is responsible for connecting switches

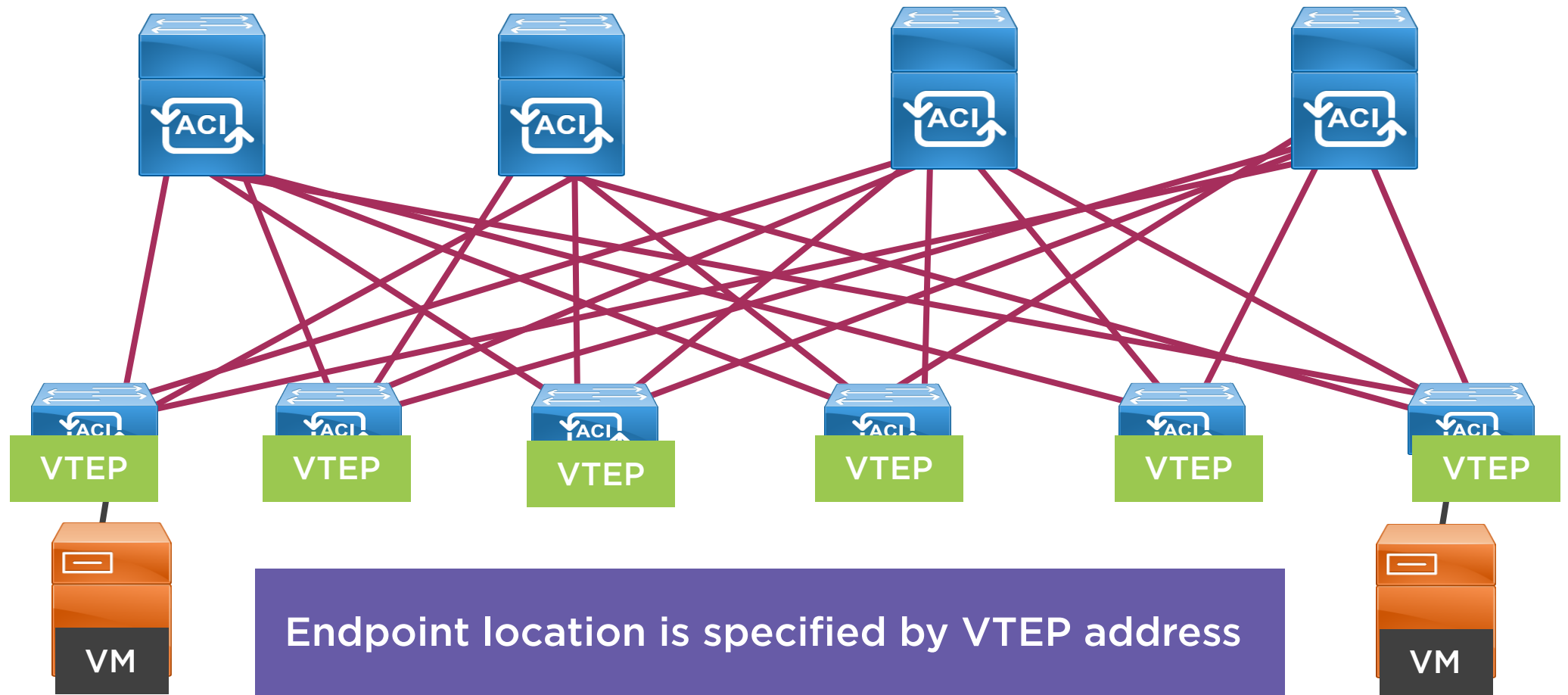
- Advertises VTEP addresses
- Computes multicast trees
- Announces tunnels from every leaf to all fabric nodes



VXLAN Transport



VXLAN Transport



Endpoint location is specified by VTEP address
Forwarding occurs between VTEPs



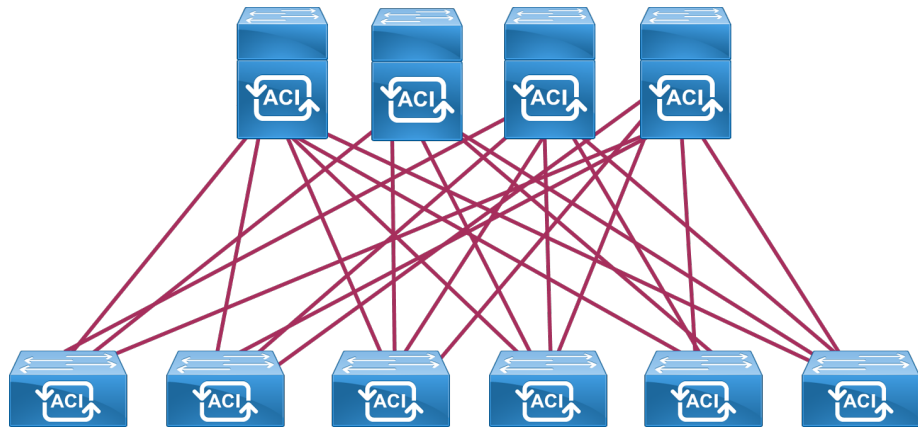
Spine-Leaf Topology Benefits



Each node will be assigned loopback addresses advertised through IS-IS



Spine-Leaf Topology Benefits



Fabric of spine-leaf topology is easier to build, test, and support

Simple and consistent topology

Using this design allows a high-bandwidth, low-latency, low oversubscription, and scalable solution at low cost

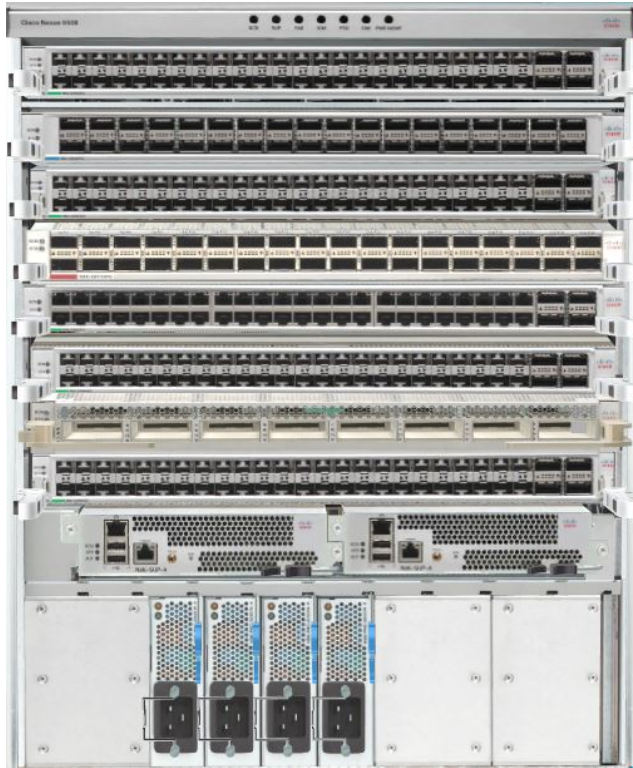
Add more leaf nodes for ports, add spines for more load capacity



Fabric Initialization and Discovery



Cisco Nexus 9500 Family



Next generation of data center switching

9500 modular chassis

- 4, 8, 16 slots
- Support for 10GE, 40GE, and 100GE modules

9500 Series line cards

- Nexus X9700 for ACI spine
- Nexus X9500 for ACI leaf
- Nexus X9400/X9600 for NX-OS



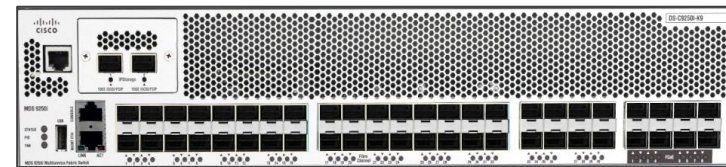
Cisco Nexus 9300 and 9200

Nexus 9300



ACI Spine or Leaf
1/10/40/100 and 400GE

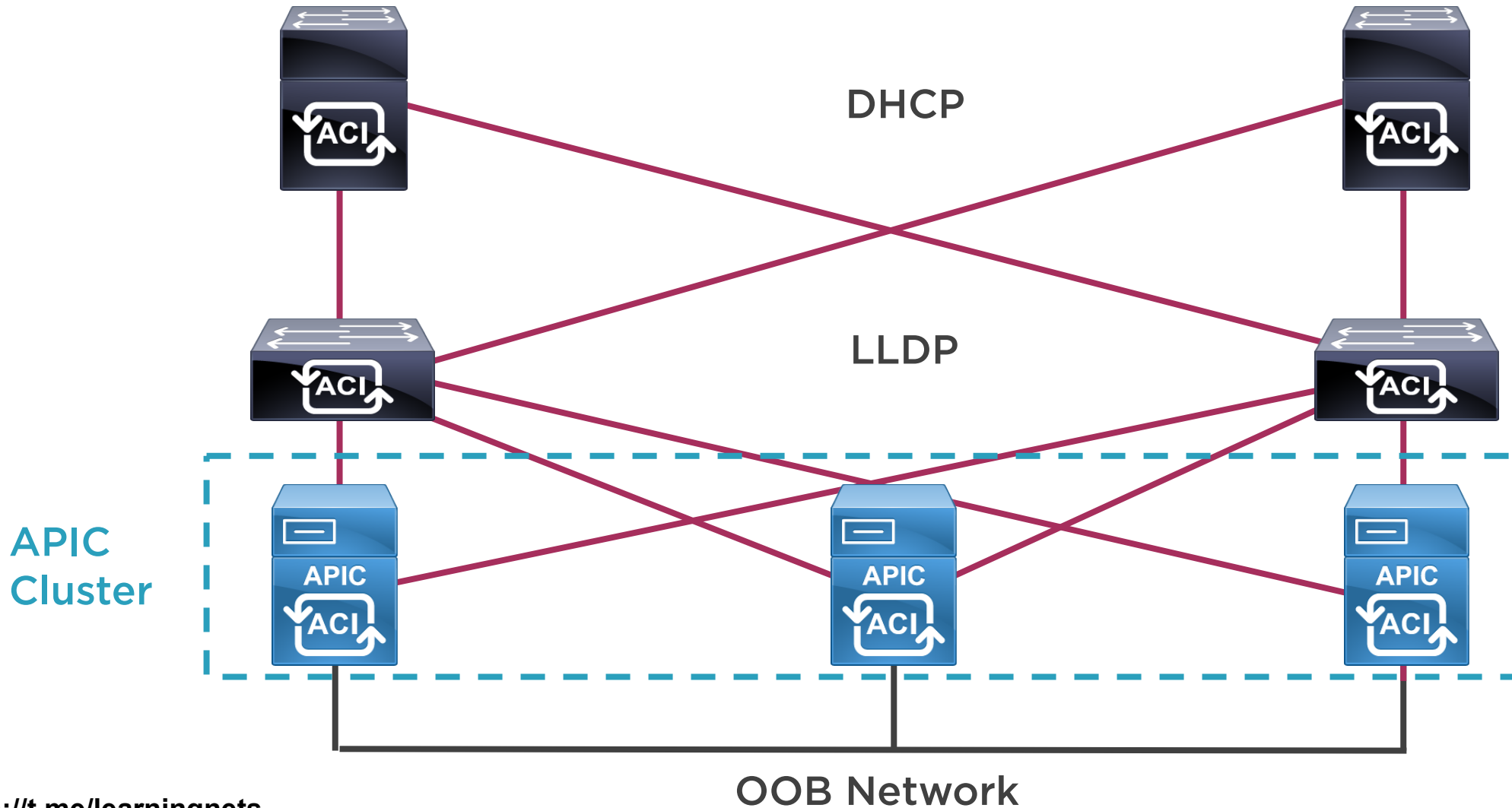
Nexus 9200



NX-OS only



ACI Fabric Discovery Requirements



ACI Fabric Discovery Prerequisites



Provide correct initial cabling of the Cisco ACI fabric



Create a Cisco APIC cluster over the out-of-band network



Cisco APIC nodes must run the same version of firmware



ACI Fabric Cabling Requirements



Leaves can only be connected to spines. There should be no cabling between the leaves



Spines can only be connected to leaves. Spines cannot be interconnected



A Cisco APIC must be attached to a leaf. Cisco APICs should be dual-homed for redundancy



Nothing should be connected to spines other than leaves



Setting Up Cisco APIC

Cluster configuration ...

Enter the fabric name [ACI Fabric1]:

Enter the fabric ID (1-128) [1]:

Enter the number of active controllers in the fabric (1-9) [3]:

Enter the POD ID (1-9) [1]:

Is this a standby controller? [NO]:



APIC OOB and Admin User Configuration

Out-of-band management configuration ...

Enable IPv6 for Out of Band Mgmt Interface? [N]:

Enter the IPv4 address [192.168.10.1/24]: 192.168.100.39/27

Enter the IPv4 address of the default gateway [None]: 192.168.100.33

Enter the interface speed/duplex mode [auto]:

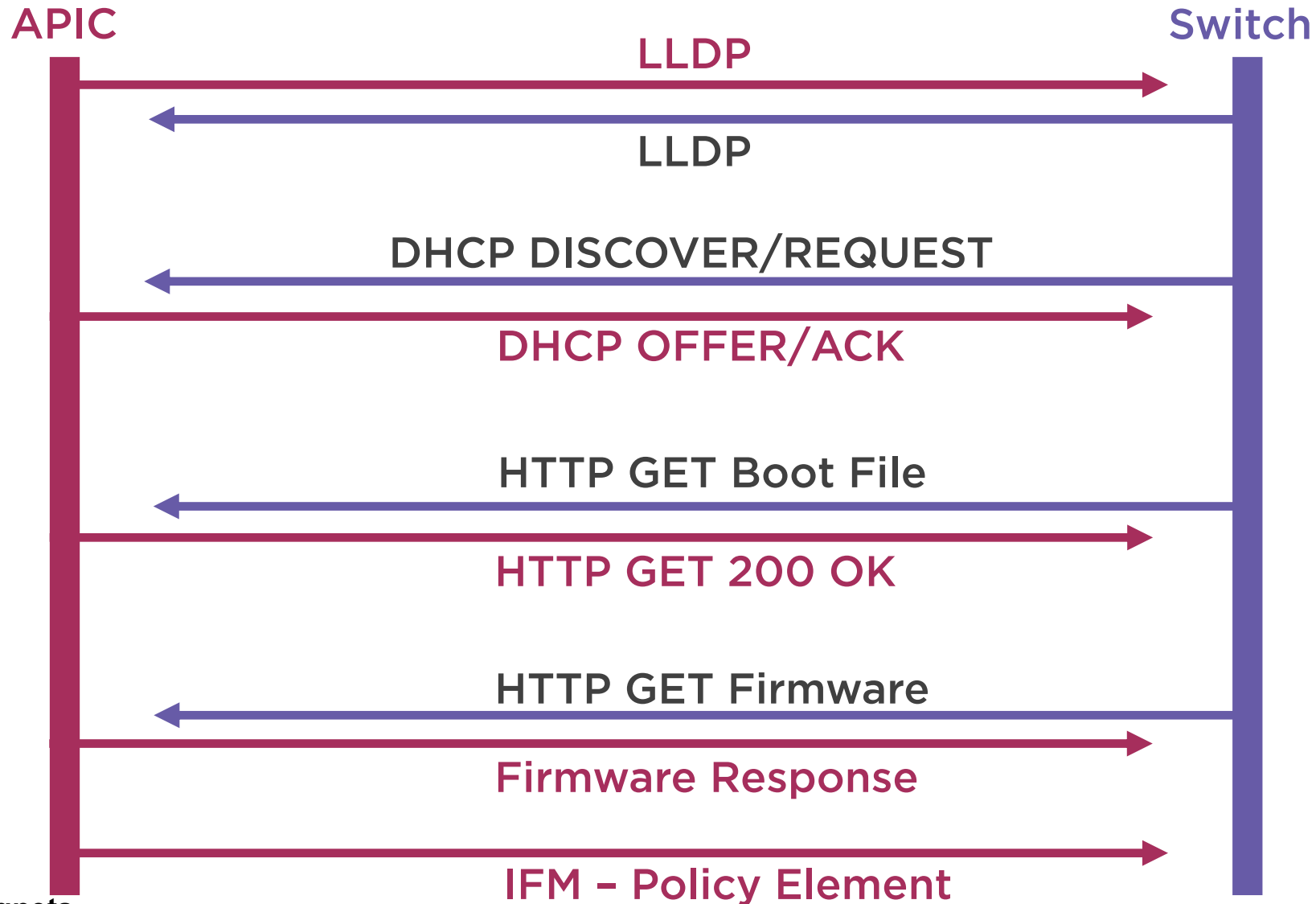
admin user configuration ...

Enable strong passwords? [Y]:

Enter the password for admin: [8 characters with one special character]



Cisco APIC Discovering Connect Switches

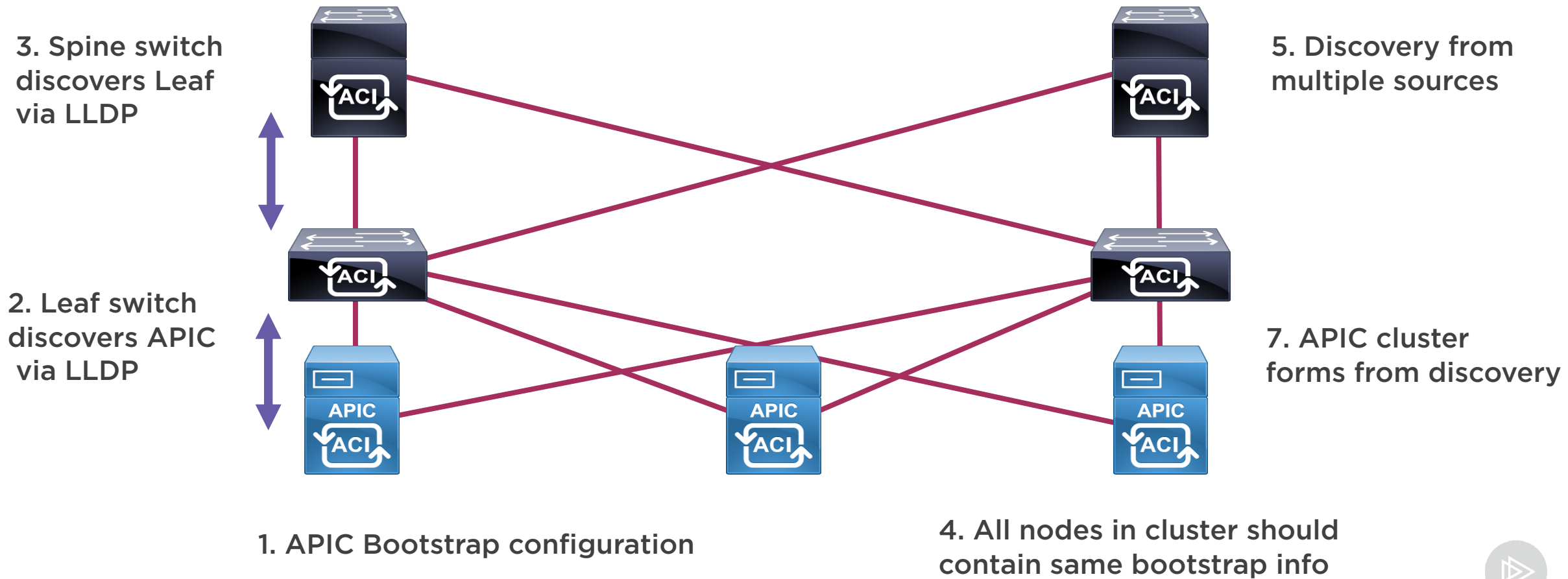


Once a switch is discovered in the ACI fabric discovery process, it is called a node

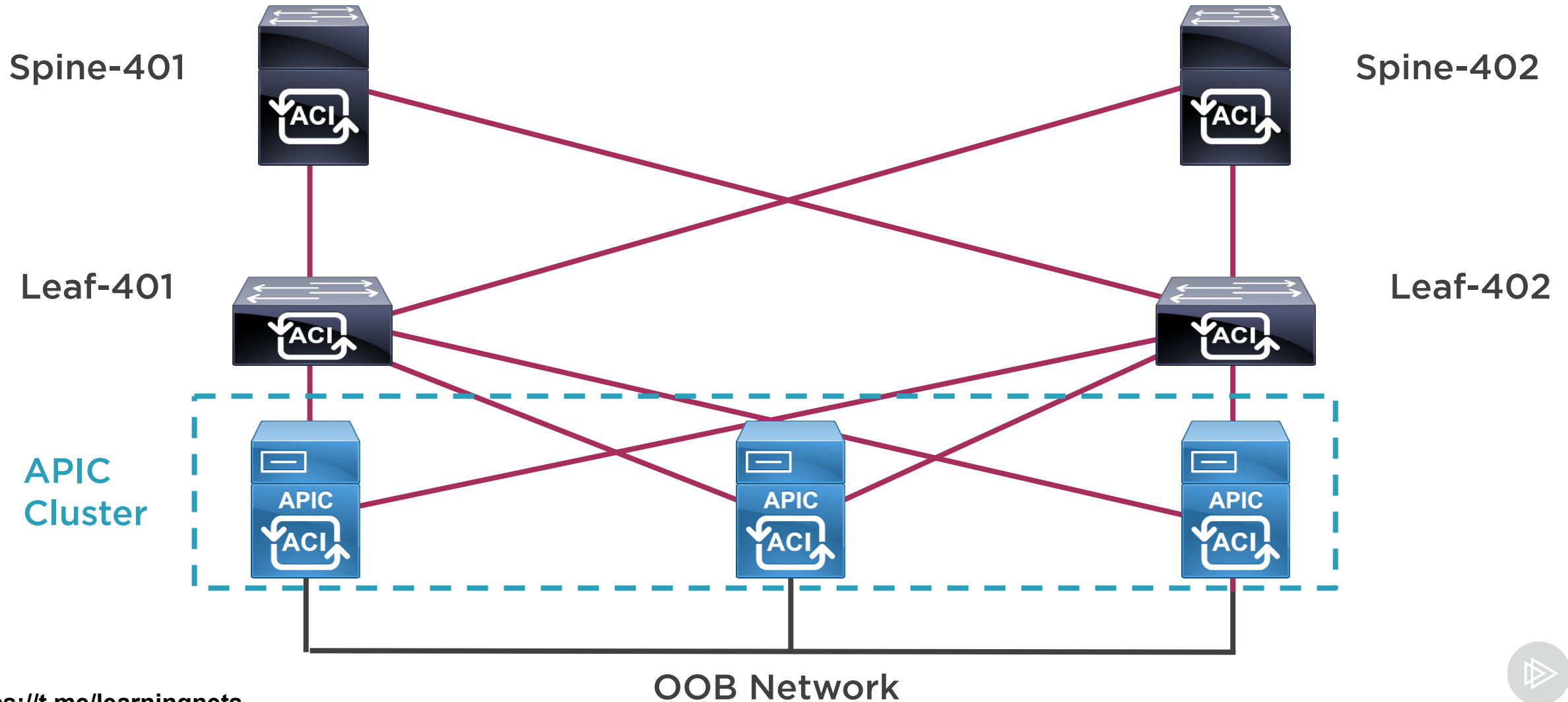


ACI Fabric Discovery: Leaf and Spine Switches

6. Fabric will self-assemble



APIC Cluster Discovery Process



APIC Cluster Discovery



APIC automatically learns about the other Cisco APIC controllers in Cisco ACI through switches



Use internal private IP addresses to communicate with ACI switches and other APIC servers



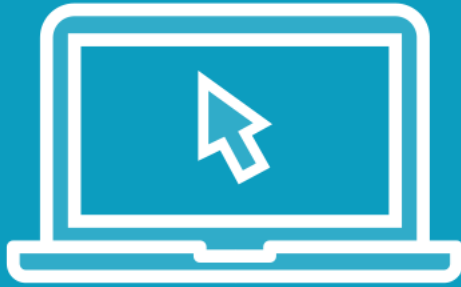
Discover the IP addresses of other Cisco APIC servers in the cluster through LLDP



Proceed to discover leaves, through LLDP, which in turn discover spines



Demo



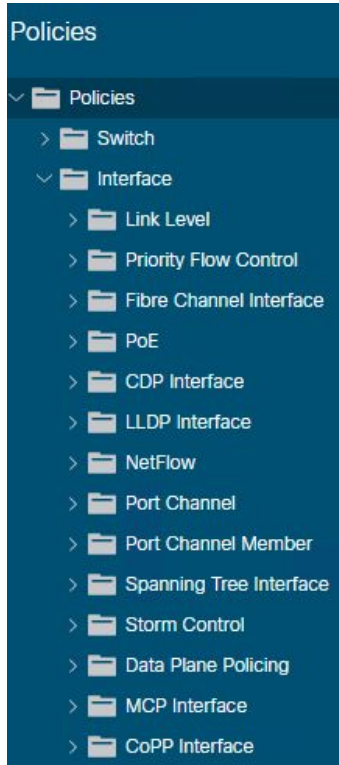
Examining Cisco APIC



ACI Fabric Access Policies



ACI Fabric Access Policies



Modular and reusable, define protocols and settings

Identify the access interfaces on leaf switches

Configure external-facing interfaces that connect to VMs, NAS, hosts, FEX

Enable configuration of port channels, LLDP, CDP, LACP, diagnostics, stats

Mandatory for attaching endpoints to leaf switches



ACI Access Policies

Switch
Policies

Switch profiles: Specify which switches to configure and the switch configuration policy

Module
Policies

Module profiles: Specify which leaf switch access cards and access modules to configure and the leaf switch configuration policy

Interface
Policies

Interface profiles: Specify which access interfaces to configure and the interface configuration policy

Global
Policies

Global policies: Enable the configuration of DHCP, QoS, and Attachable Access Entity Profile (AAEP)



ACI Access Policies

Pools

Pools: Specify VLAN, VXLAN, and multicast address pools

Physical and External Domains

Physical and external domains: Define external bridged domain, external routed domain, and physical domain policies

Monitoring and Troubleshooting Policies

Monitoring and troubleshooting policies: Specify what to monitor, the thresholds, how to handle faults and logs, and how to perform diagnostics



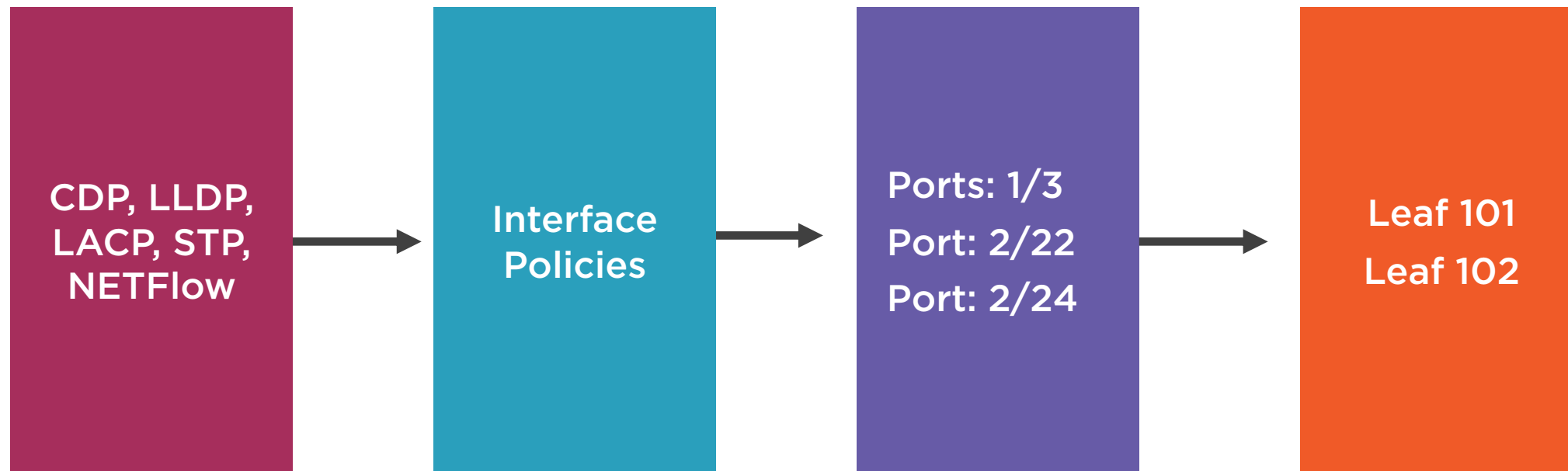
Fabric Access Policies

Interface Policies

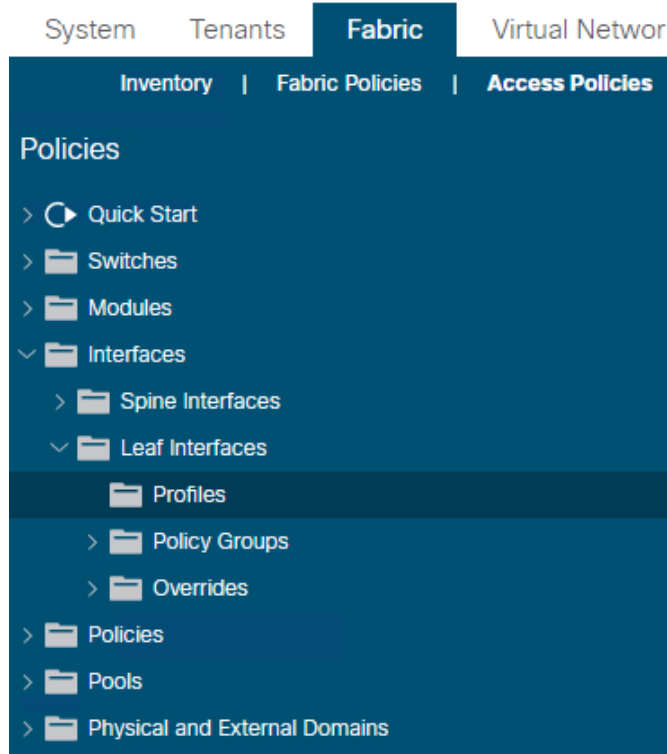
Policy Group

Interface Profile

Switch Profile



Switch and Interface Policies and Profiles



Interface policies

- Create protocol policies (CDP, LLDP)
- Choose port connection type with interface policy groups
- Group port with an interface profile

Switch policies:

- Group one or more leaf switches as one switch object
- Associate a switch profile with an interface policy



Interface Policy Groups

Policy group gathers interface policies into a bundle

- LLDP, LACP, CDP, etc.

Policy group is linked to

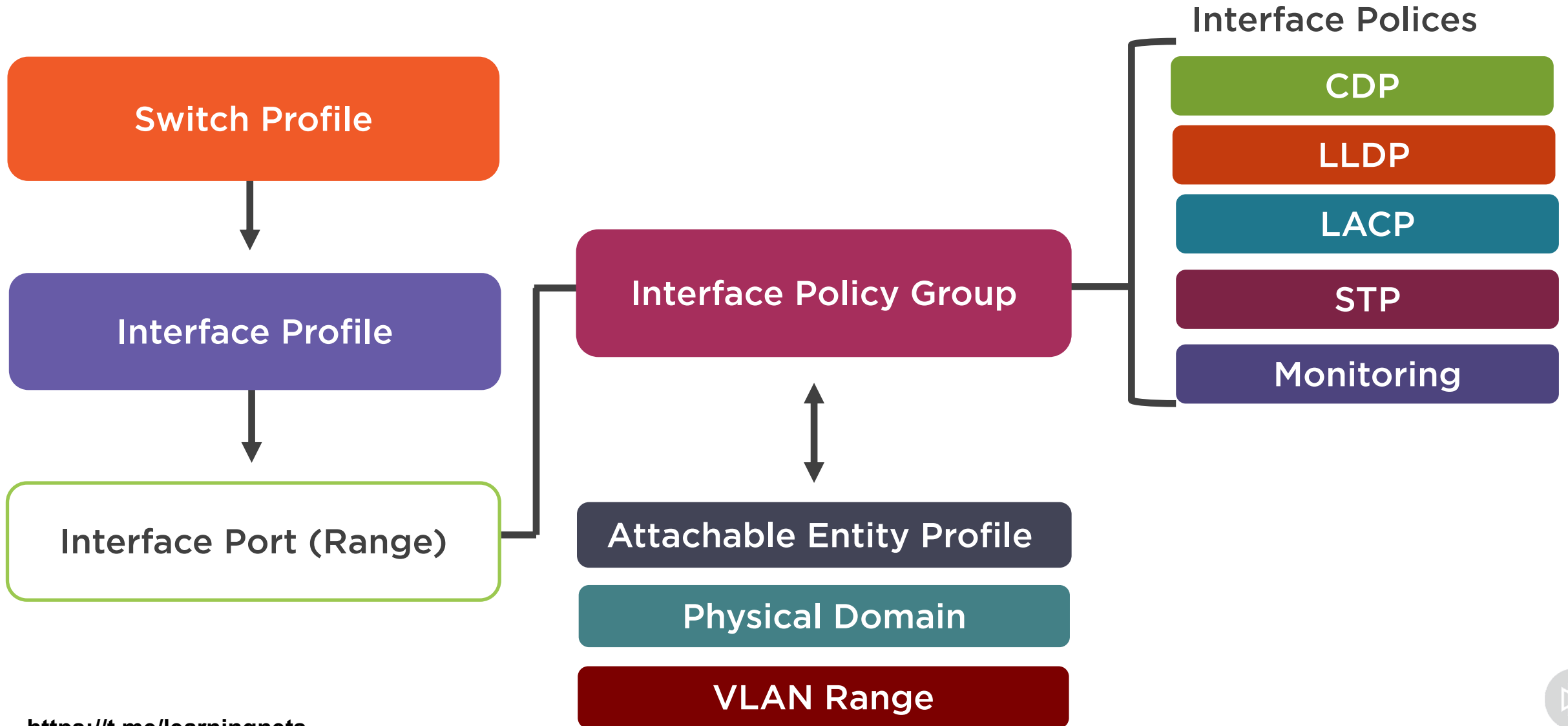
- Interface profile (specifies which interface to apply policies)
- Attachable Access Entity Profile (VLAN/VXLAN range)

Three types of policy groups

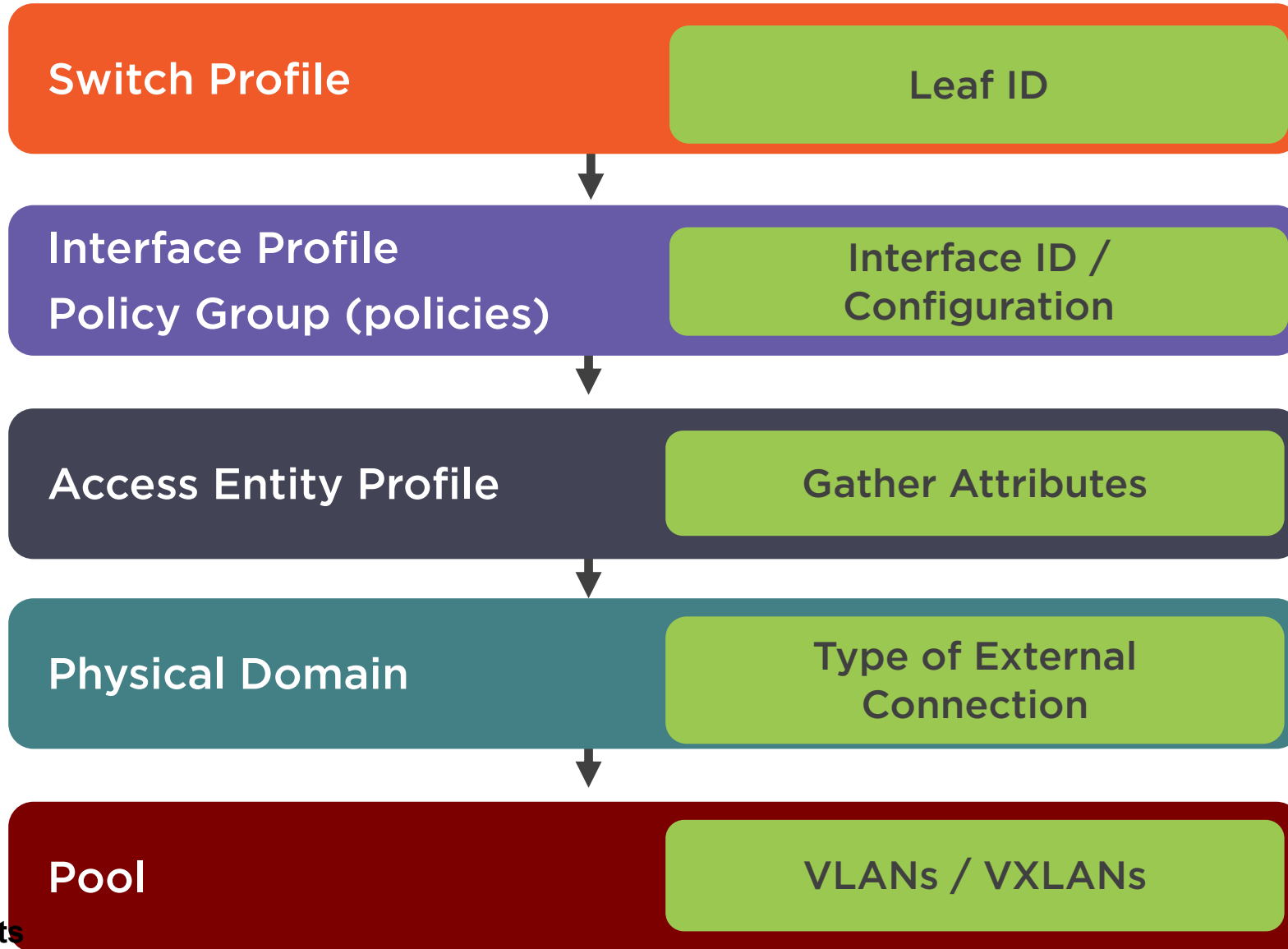
- Access port, PortChannel, vPC



Relationship Between Access Policies



Attaching a Hypervisor to Fabric



Attachable Access Entity Profiles



Configuration profile of the interface that gets applied when an entity attaches to the fabric

AEP are the “where”

Domains are the “how” device is connected to leaf

- Physical domains, External bridged domains, external routed domains, and VMM domains



Access Entity Profiles



AEPs are tied to interface policy groups

Domains are added to an AEP

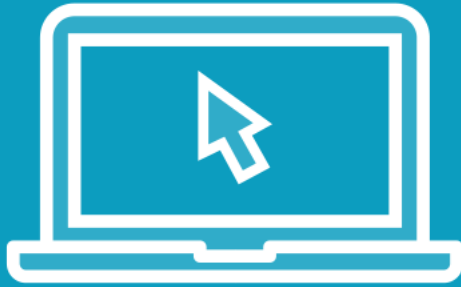
Pools specify VLAN, VXLAN, and multicast address pools in ACI

A domain is associated to a single VLAN pool

- Domains are added to an AEP



Demo



Configure Cisco APIC access policies



Demo



Configure Cisco APIC access policies

- Prepare the fabric for external device connections



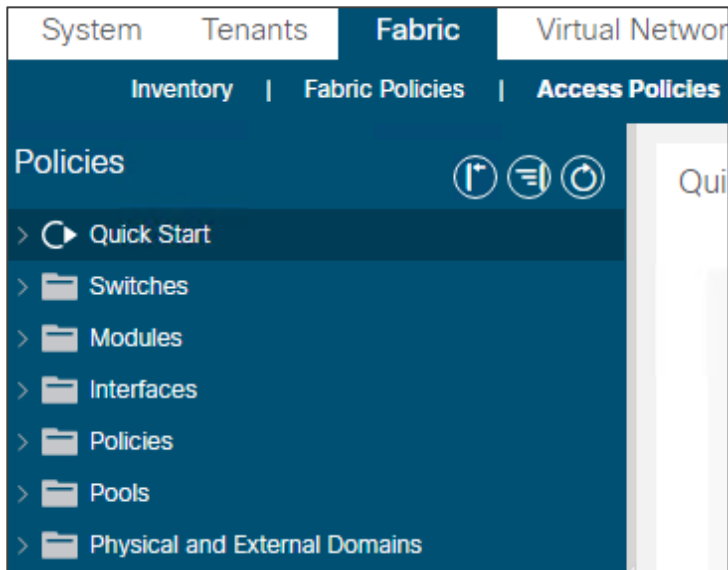
External Devices to ACI

Adding device to ACI:

- What types of devices are these?
- What are the allowed VLAN ranges for that connection?
- Which switch will this device be connected to?
- Which interface will this device be connected to?
- What link control policies and port speed should be applied on that interface?



ACI Physical Connection



To create a physical connection in ACI

- Domain
- VLAN/VSAN Pool
- AEP
- Interface Profile
- Interface Policy Group
- Switch Profile

**These policies are accessible via
Fabric > Access Policies**



Summary



Examine how Cisco ACI provides centralized automation and implement policy and predictability using profiles

- ACI Fabric
- APIC

Demonstrate how to use Cisco APIC to configure and apply policies

