VXLAN in Campus

Chiang Mai University Backbone

By Nawin Thammaragsa

Introduction

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ฝ่าย : โครงสร้างเทคโนโลยีสารสนเทศ (IT Infra)

สำนักบริการเทคโนโลยีสารสนเทศ (ITSC)

มหาวิทยาลัยเชียงใหม่ (CMU)

Networking Academy

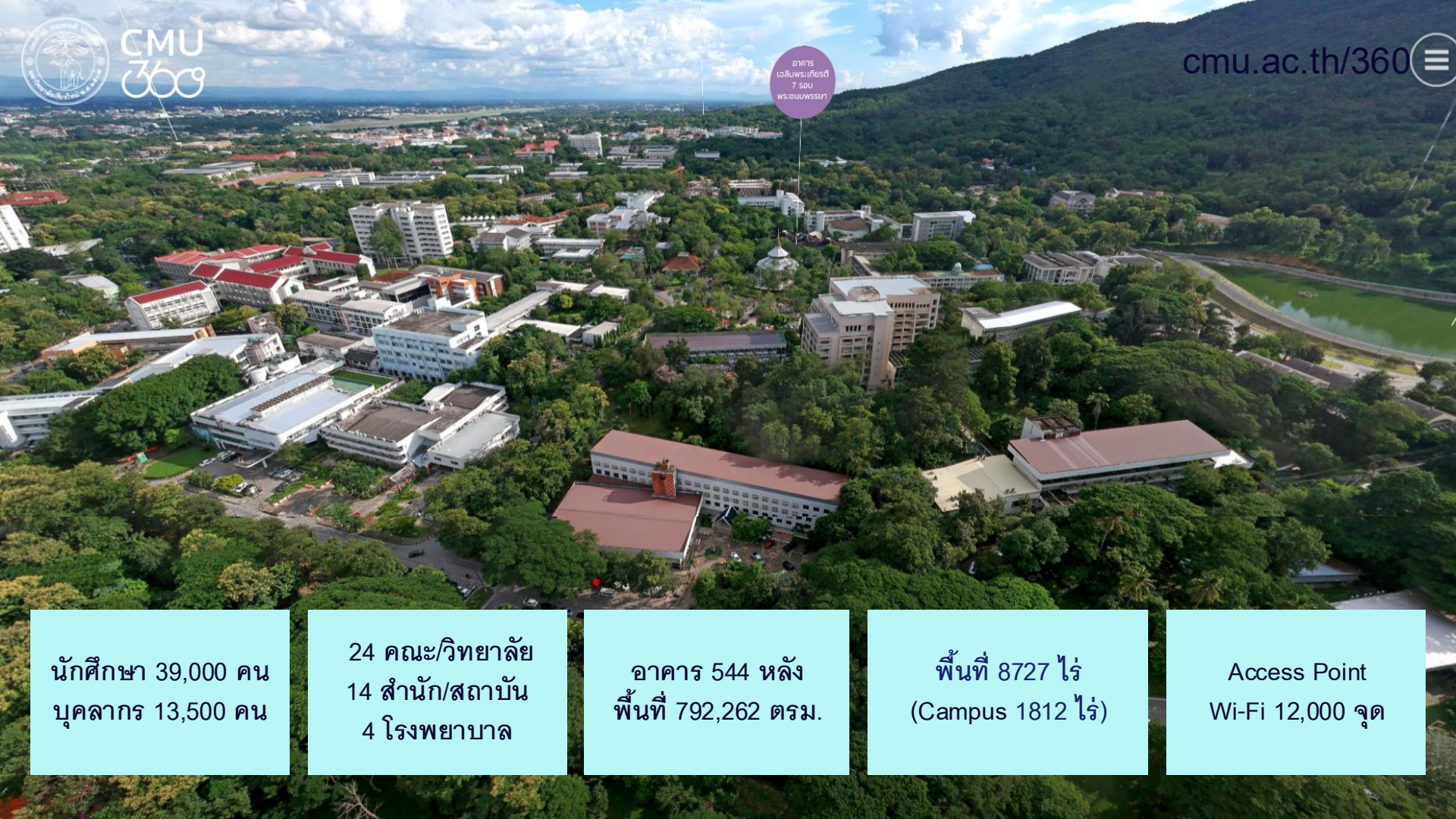
CISCO CERTIFIED CCNA

CISCO CERTIFIED CCNP

- CMU Backbone
- Network Transform (Underlay Network)
- Overlay Network

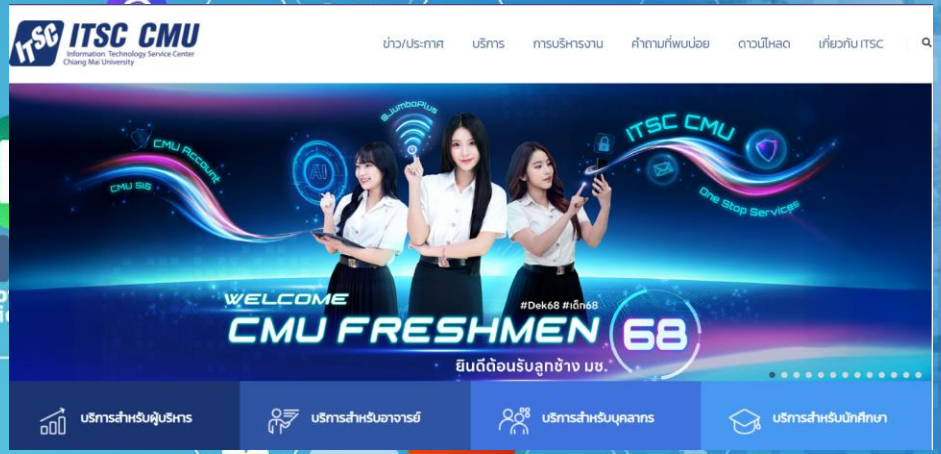
01

CMU Backbone



นักศึกษา 39,000 คน บุคลากร 13,500 คน	24 คณะ/วิทยาลัย 14 สำนัก/สถาบัน 4 โรงพยาบาล	อาคาร 544 หลัง พื้นที่ 792,262 ตรม.	พื้นที่ 8727 ไร่ (Campus 1812 ไร่)	Access Point Wi-Fi 12,000 จุด

Information Technology Service Center (ITSC)



https://www.itsc.cmu.ac.th

Information Technology Infrastructure Division

ฝ่ายโครงสร้างพื้นฐานเทคโนโลยีสารสนเทศ

1. งานระบบเครือข่ายคอมพิวเตอร์ (Computer Network)
2. งานระบบเครือข่ายไร้สาย (Wireless Network)
3. งานระบบเครื่องคอมพิวเตอร์แม่ข่าย (Computer Server)
4. งานระบบรักษาความมั่นคงปลอดภัยทางไซเบอร์ (Cyber Security)
5. งานระบบศูนย์ข้อมูล (Data Center)
6. งานระบบคอมพิวเตอร์สมรรถนะสูง (High Performance Computing)

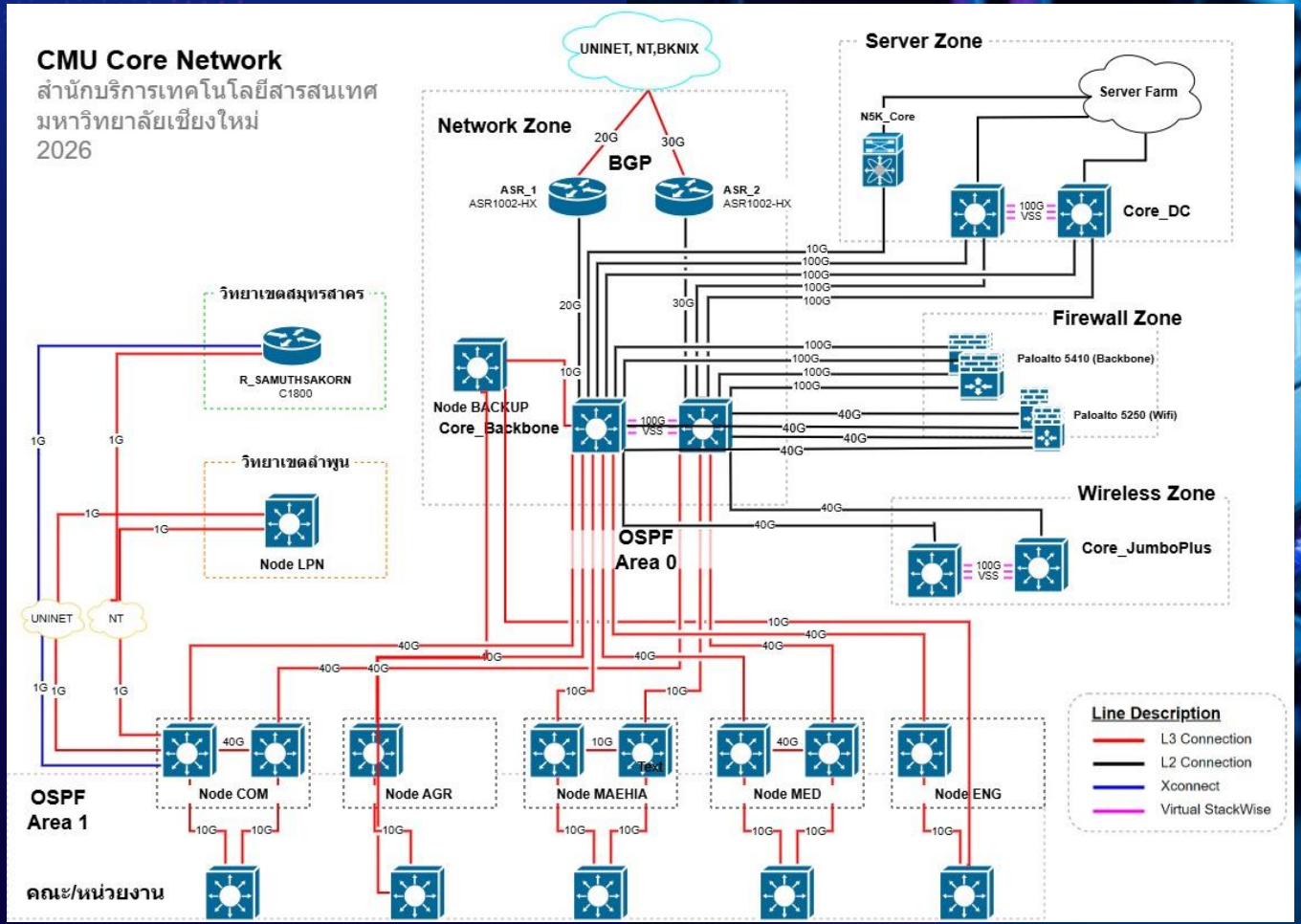
CMU-NET

The University Backbone

01

CMU Core Network

สำนักบริการเทคโนโลยีสารสนเทศ
มหาวิทยาลัยเชียงใหม่
2026



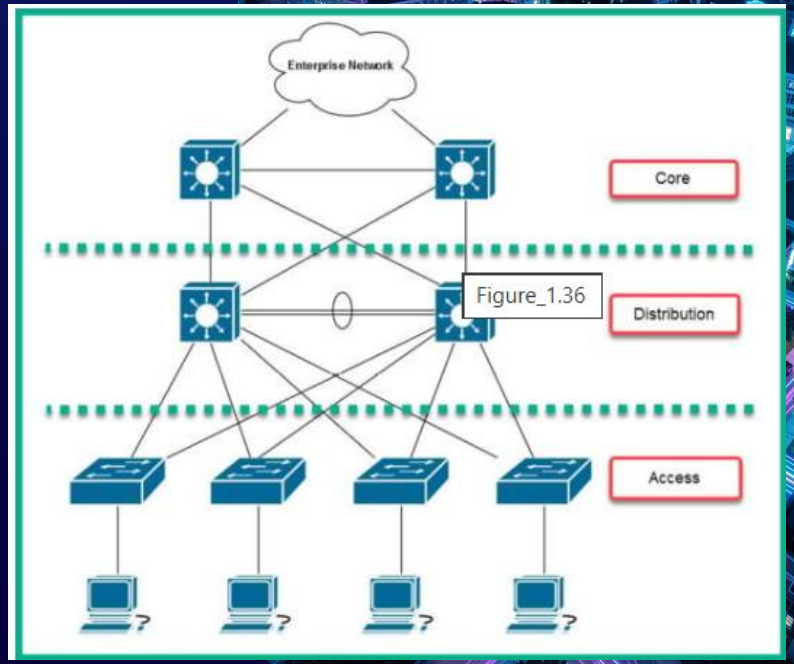
Three Tier Architecture

Why Choose Three-Tier?

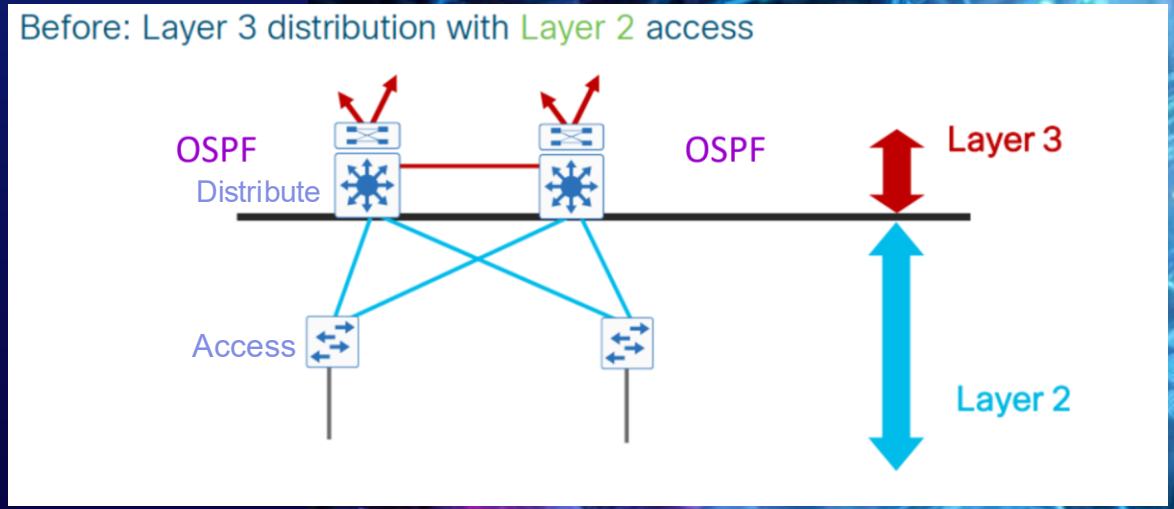
• Scalable: Easily supports network growth.

• More Reliable: Built-in redundancy keeps things running even if one part fails.

• Better Performance: The core layer speeds up data transfer and reduces congestion.



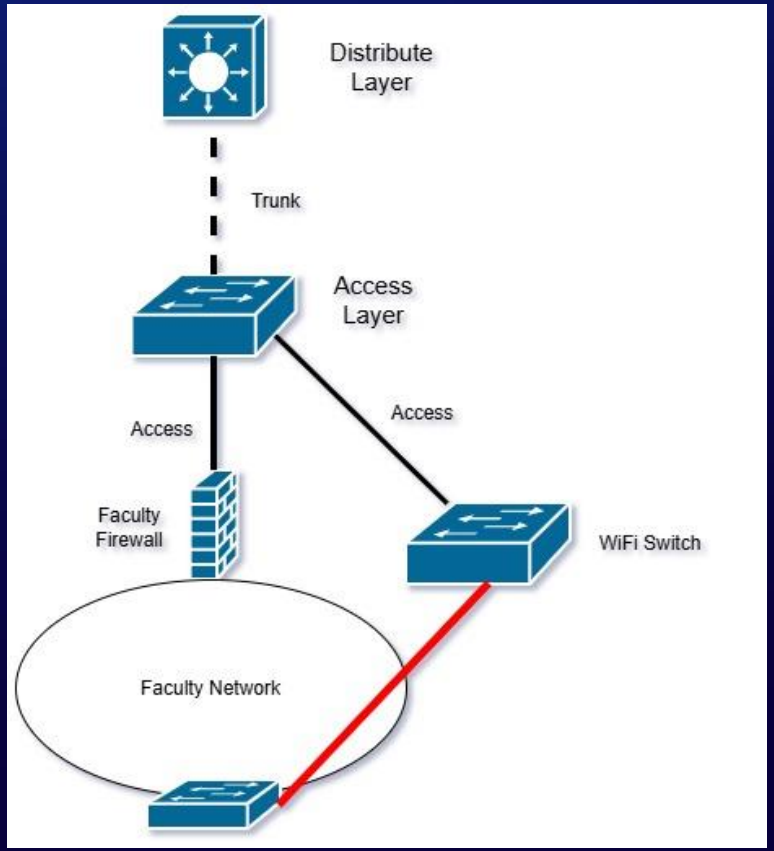
Layer 2 era



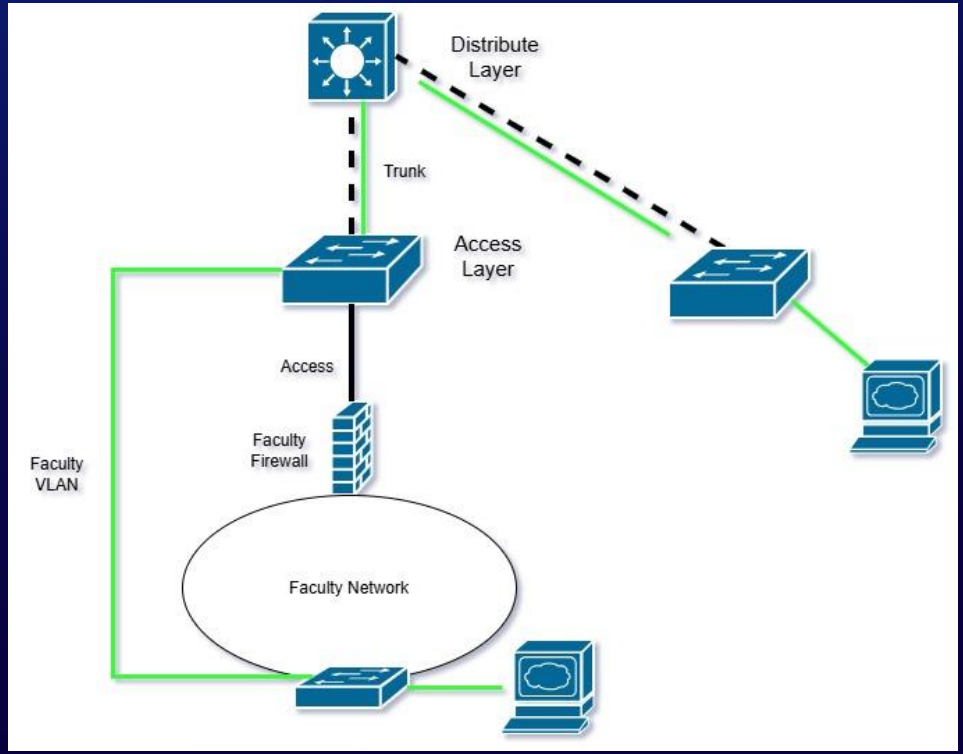
For ~10 years the campus relied on *Layer 2* switches and VLANs, creating large broadcast domains and Layer 2 problem.

https://www.cisco.com

VLAN Loop


Distribute Layer
Trunk
Access Layer
Access
Access
Faculty Firewall
WiFi Switch
Faculty Network

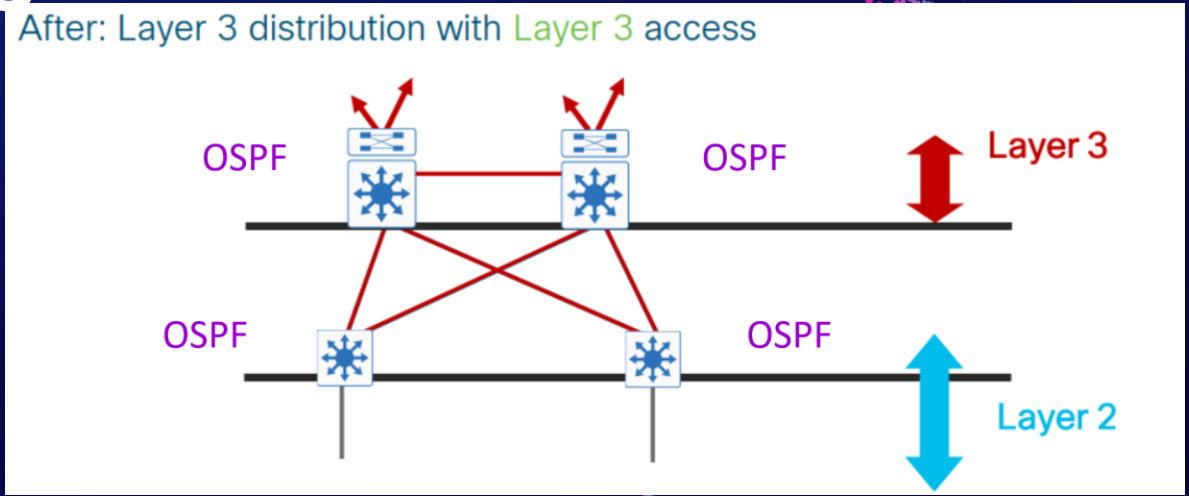
VLAN for Branch



02

Network Transform

2020 : Layer 3
OSPF upgrad

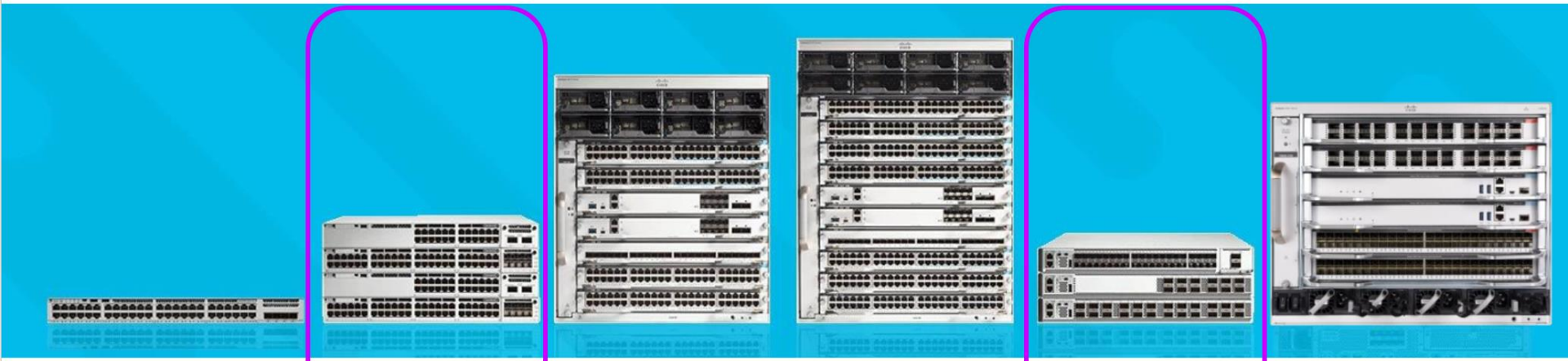


In 2020 we implemented a routed backbone with *OSPF* to flatten failure domains and enable hierarchical design.

This provided improved scalability, faster convergence, and clearer traffic engineering for campus aggregation.

https://www.cisco.com

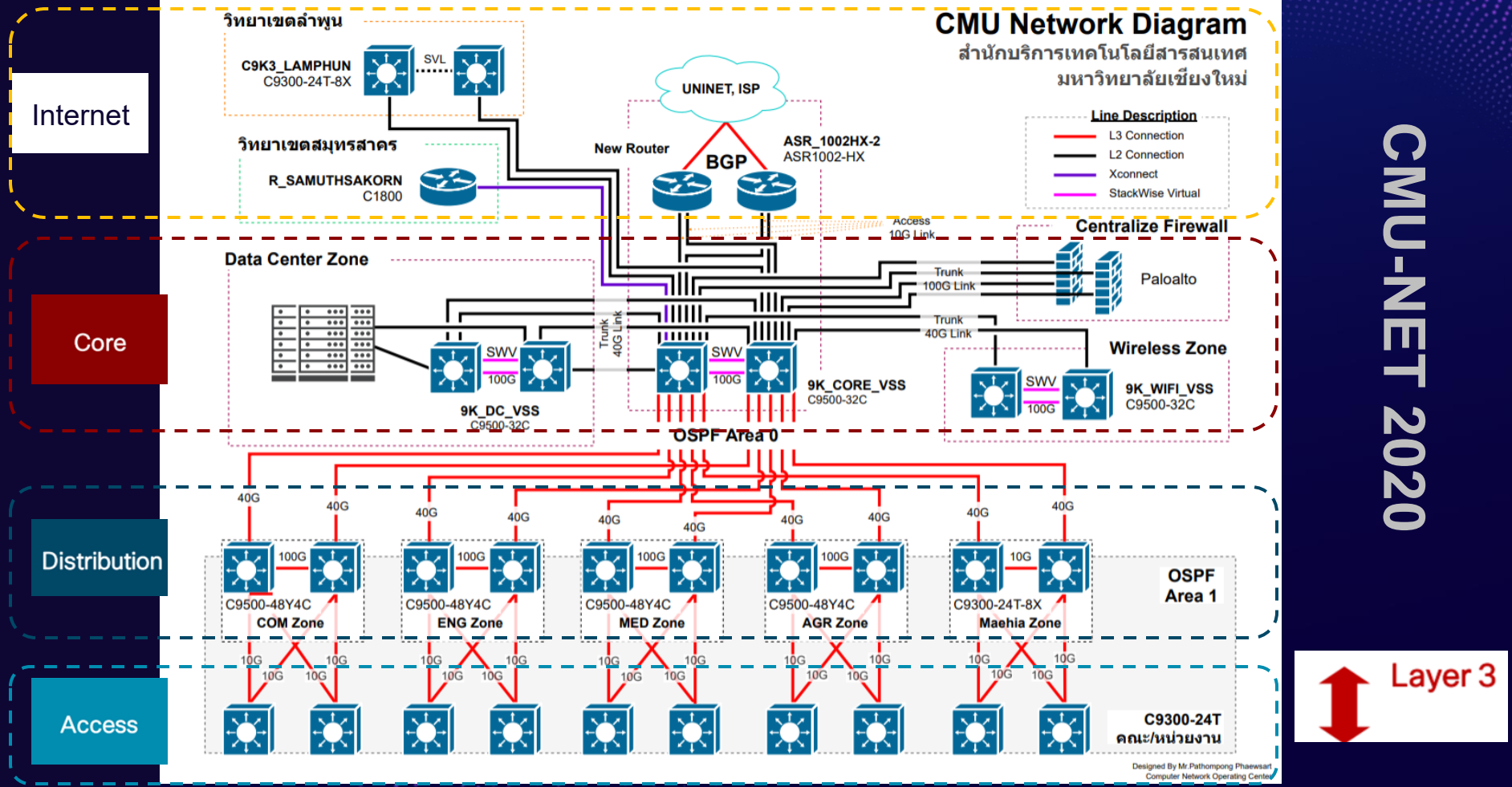
The Catalyst 9K Family



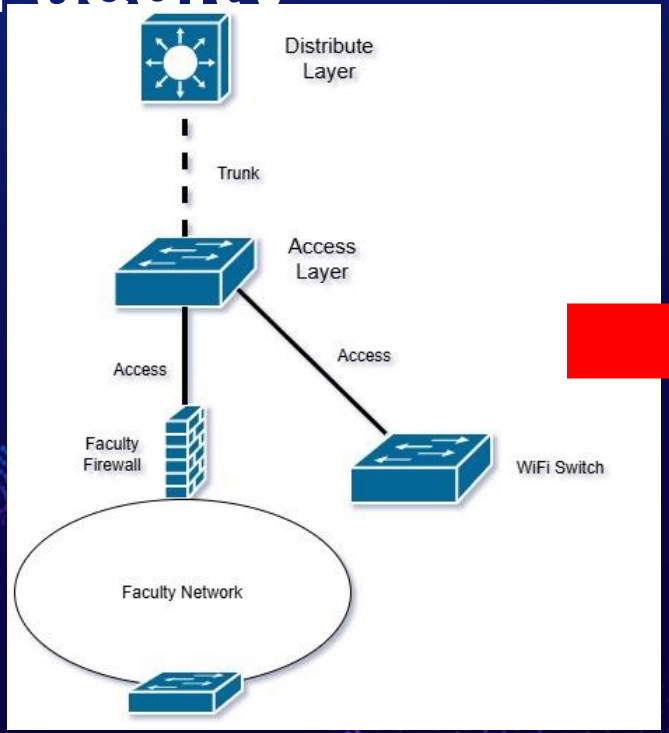
Catalyst 9200	Catalyst 9300	Catalyst 9400	Catalyst 9500	Catalyst 9600
Fixed Access Switches		Modular Access & Distribution Switches	Fixed Core & Distribution Switches	Modular Core & Distribution

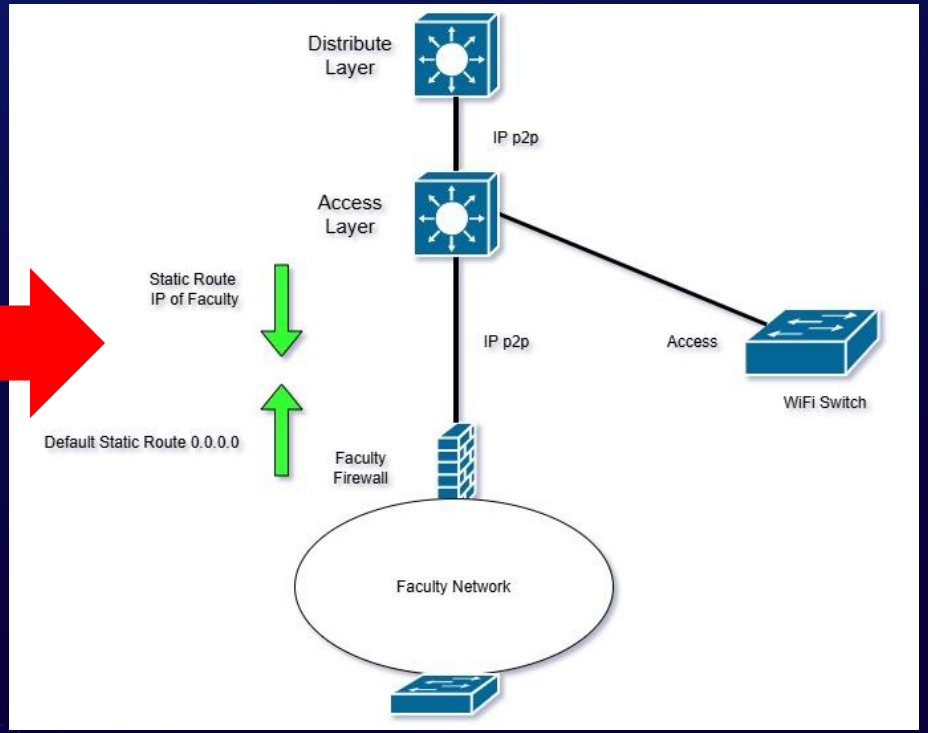
https://www.cisco.com

Built on Cisco's Innovative Hardware & Open IOS-XE


CMU Network Diagram
สำนักบริการเทคโนโลยีสารสนเทศ
มหาวิทยาลัยเชียงใหม่
Internet
Core
Distribution
Access
วิทยาเขตลำพูน
C9K3_LAMPHUN
C9300-24T-8X
SVL
วิทยาเขตสมุทรสาคร
R_SAMUTHSAKORN
C1800
UNINET, ISP
New Router
BGP
ASR_1002HX-2
ASR1002-HX
Line Description
L3 Connection
L2 Connection
Xconnect
StackWise Virtual
Access
10G Link
Centralize Firewall
Paloalto
Trunk
100G Link
Trunk
40G Link
Data Center Zone
SWV
100G
9K_DC_VSS
C9500-32C
9K_CORE_VSS
C9500-32C
Wireless Zone
9K_WIFI_VSS
C9500-32C
OSPF Area 0
40G
100G
10G
C9500-48Y4C
COM Zone
ENG Zone
MED Zone
AGR Zone
C9300-24T-8X
Maehia Zone
OSPF
Area 1
C9300-24T
คณะ/หน่วยงาน
Designed By Mr.Pathompong Phaewsart
Computer Network Operating Center
Layer 3
CMU-NET 2020
Faculty Network

Routing to Faculty





03

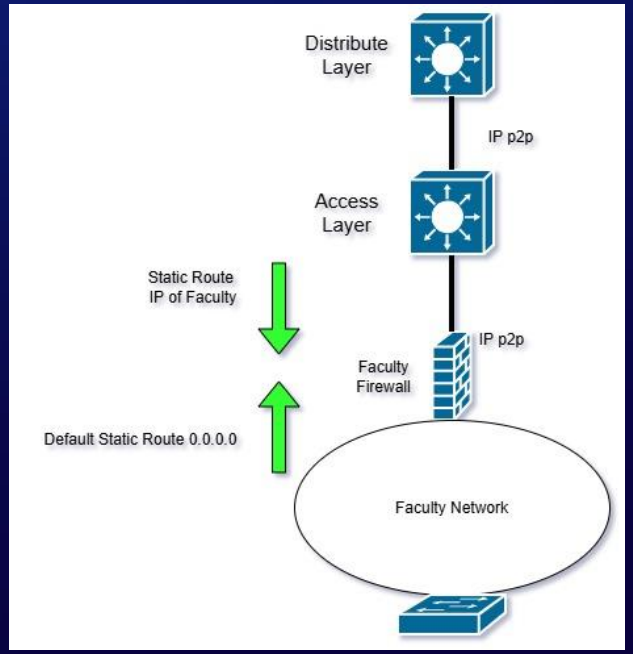
Overlay Network

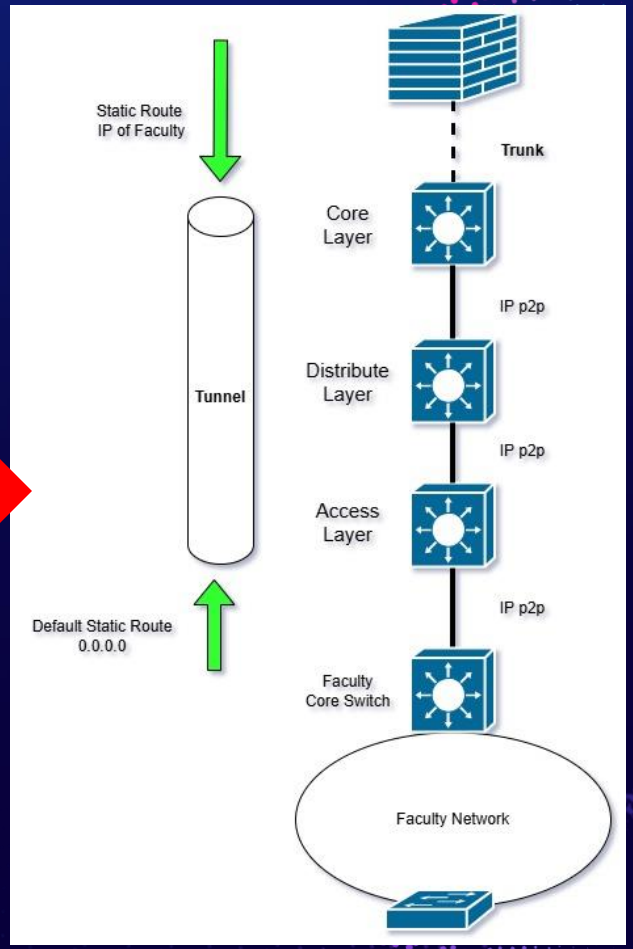
Move Forward : Overlay Network

- Centralized Firewall
- Reduce IT cost
- Simple Management

Palo Alto 5410

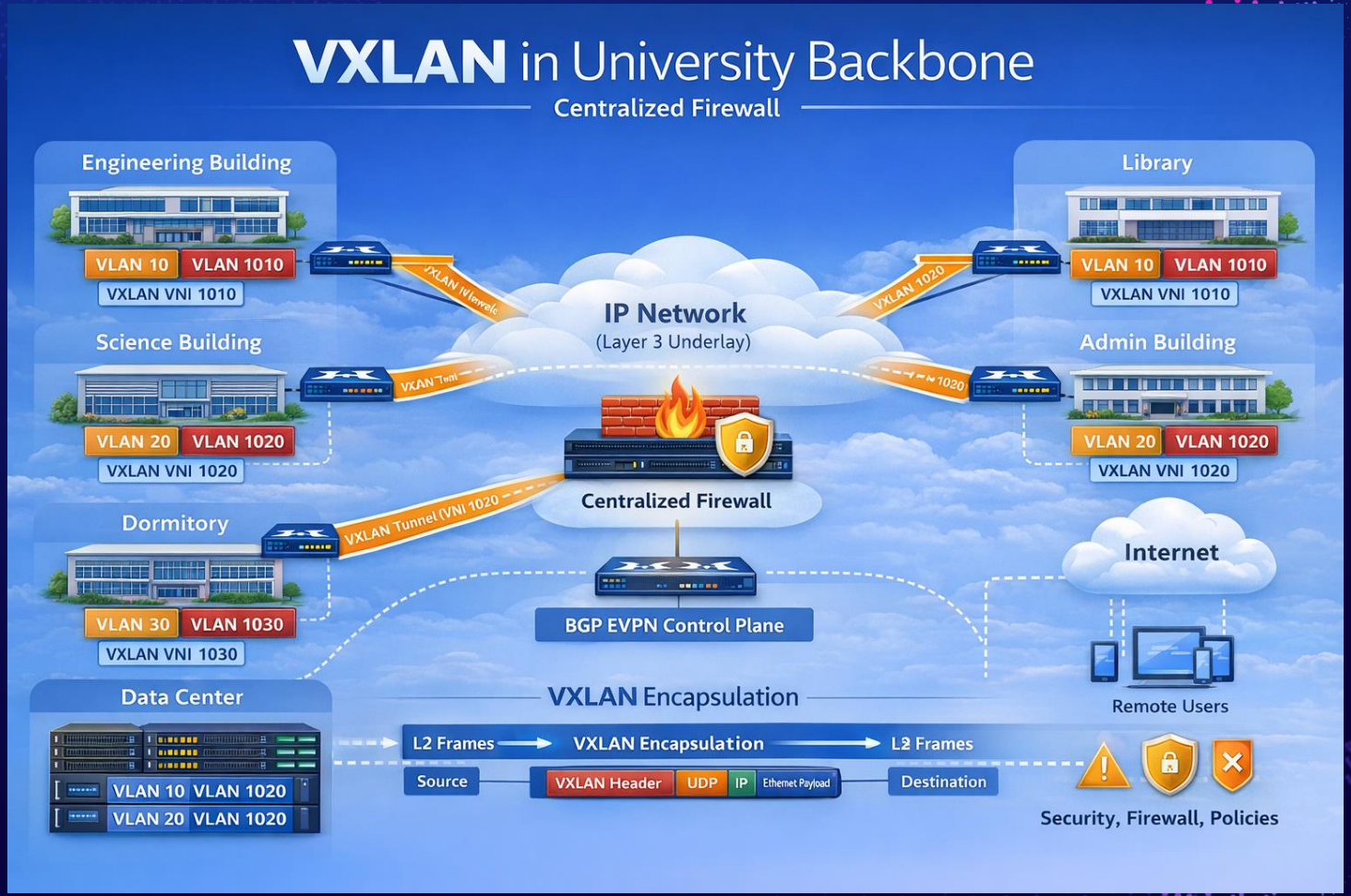
VLAN L2
Tunnel over IP





Overlay Tunneling Technologies

- VXLAN (Virtual Extensible LAN)
- GRE (Generic Routing Encapsulation)
- L2TPv3 (Layer 2 Tunneling Protocol v3)
- MPLS-based L2VPN

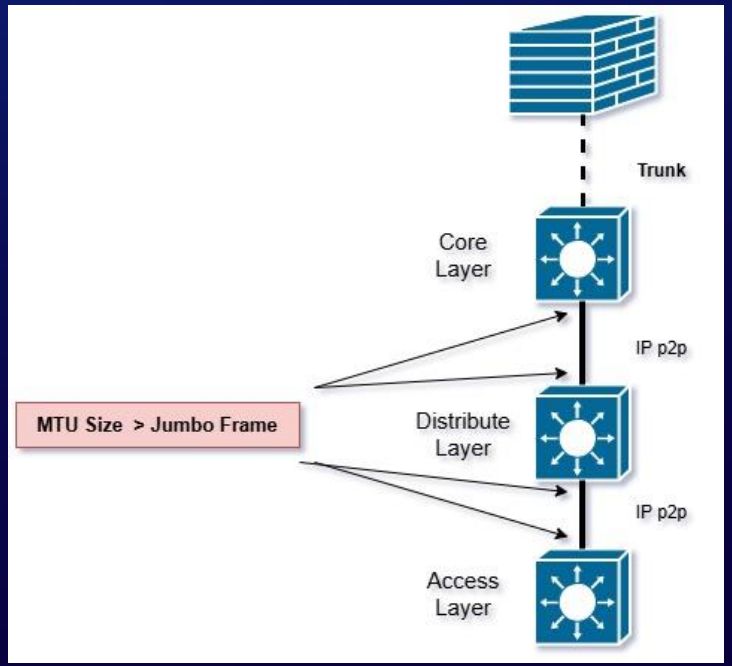

VXLAN in University Backbone
Centralized Firewall
Engineering Building
VLAN 10
VLAN 1010
VXLAN VNI 1010
Library
VLAN 10
VLAN 1010
VXLAN VNI 1010
IP Network
(Layer 3 Underlay)
Science Building
VLAN 20
VLAN 1020
VXLAN VNI 1020
Admin Building
VLAN 20
VLAN 1020
VXLAN VNI 1020
Centralized Firewall
Dormitory
VXLAN Tunnel (VNI 1020
VLAN 30
VLAN 1030
VXLAN VNI 1030
BGP EVPN Control Plane
Internet
Remote Users
Data Center
VLAN 10 VLAN 1020
VLAN 20 VLAN 1020
VXLAN Encapsulation
L2 Frames
VXLAN Encapsulation
L2 Frames
Source
VXLAN Header
UDP
IP
Ethernet Payload
Destination
Security, Firewall, Policies

VXLAN EVPN (Layer 2 VNI) Implementing

- Prepare Network
    - Underlay Configuration
    - Overlay Configuration
    - Firewall Configuration (except)
- Network Migration

• Prepare Network

• Underlay Configuration



- MTU -> Jumbo Frame Size 9000 – 9216 bytes

Example

```
interface TenGigabitEthernet1/1/1
 description ACCESS_SWITCH
 no switchport
 mtu 9198
 ip address 192.168.1.1 255.255.255.252
```

Clear process ospf to refresh

Prepare Network

- Overlay Configuration
  - Peering iBGP (Core – Access)
  - VXLAN

Peering iBGP(Core – Access)

CORE

```
router bgp 65001
bgp router-id 10.0.0.99
bgp log-neighbor-changes
neighbor 10.0.0.1 remote-as 65001
neighbor 10.0.0.1 update-source Loopback1
neighbor 10.0.0.1 route-reflector-client
neighbor 10.0.0.2 remote-as 65001
neighbor 10.0.0.2 update-source Loopback0
neighbor 10.0.0.2 route-reflector-client
!
address-family l2vpn evpn
neighbor 10.0.0.1 activate
neighbor 10.0.0.1 send-community both
neighbor 10.0.0.1 route-reflector-client
neighbor 10.0.0.2 activate
neighbor 10.0.0.2 send-community both
neighbor 10.0.0.2 route-reflector-client
exit-address-family
```

Access

```
router bgp 65001
bgp router-id 10.0.0.1
bgp log-neighbor-changes
neighbor 10.0.0.99 remote-as 65001
neighbor 10.0.0.99 update-source Loopback1
!
address-family l2vpn evpn
neighbor 10.0.0.99 activate
neighbor 10.0.0.99 send-community both
exit-address-family
```

VXLAN Configuration

CORE

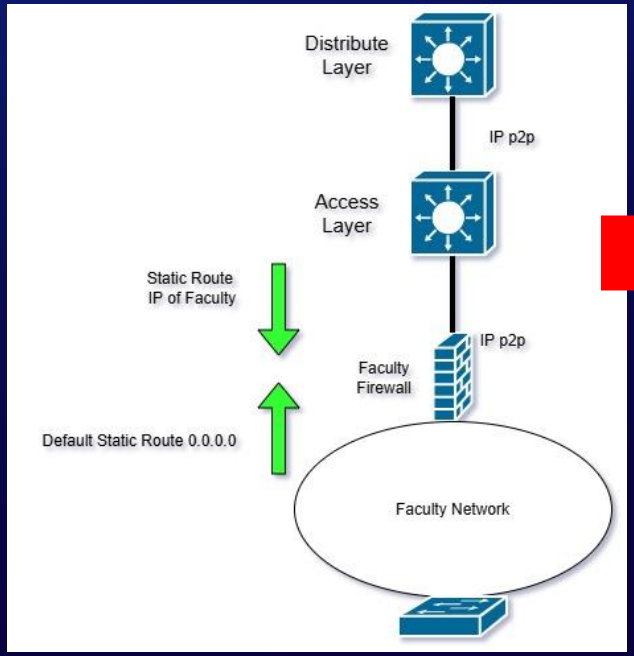
```
l2vpn evpn
logging peer state
replication-type ingress
router-id Loopback1
default-gateway advertise
!
l2vpn evpn instance 2010 vlan-based
encapsulation vxlan
!
vlan configuration 2010
member evpn-instance 2010 vni 12010
!
interface nve1
no ip address
source-interface Loopback1
host-reachability protocol bgp
member vni 12010 ingress-replication
!
```

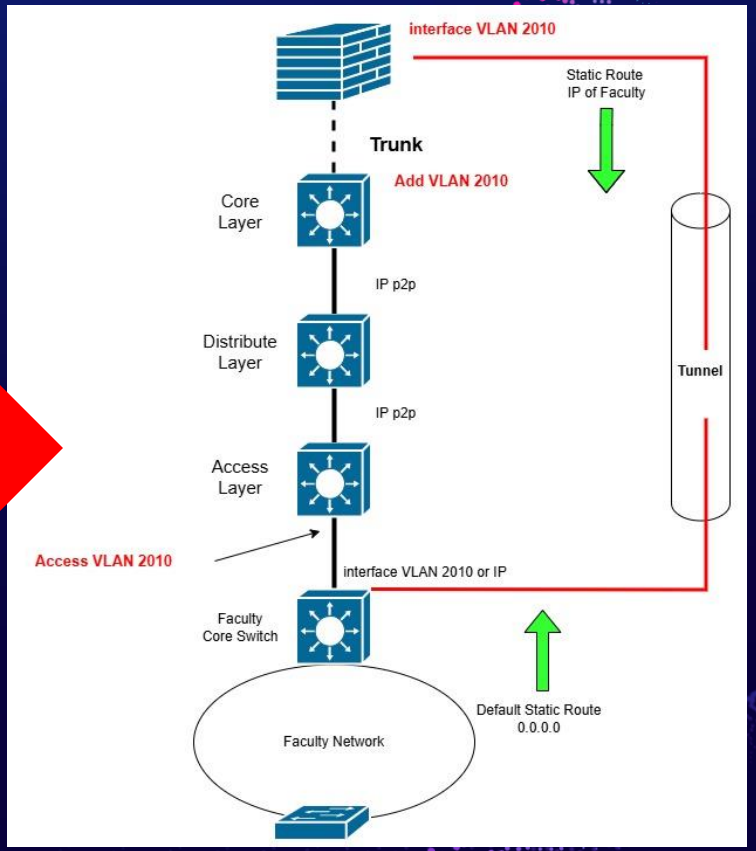
Access

```
l2vpn evpn
logging peer state
replication-type ingress
router-id Loopback1
default-gateway advertise
!
l2vpn evpn instance 2010 vlan-based
encapsulation vxlan
!
vlan configuration 2010
member evpn-instance 2010 vni 12010

interface nve1
no ip address
source-interface Loopback1
host-reachability protocol bgp
member vni 12010 ingress-replication
```

Network Migration





THANKS

DOES ANYONE HAVE ANY QUESTIONS?

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