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The bridge to possible

SDA for everyone – now even ready for YOUR network!

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BRKEMT-2102

The bridge to possible

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The bridge to possible

Thank you

Peter Fuchs

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SDA for everyone – now even ready for YOUR network!

Agenda

- Introduction
- Onboard the Border
- Demystify Wake-on-LAN & Silent hosts
- Conclusion

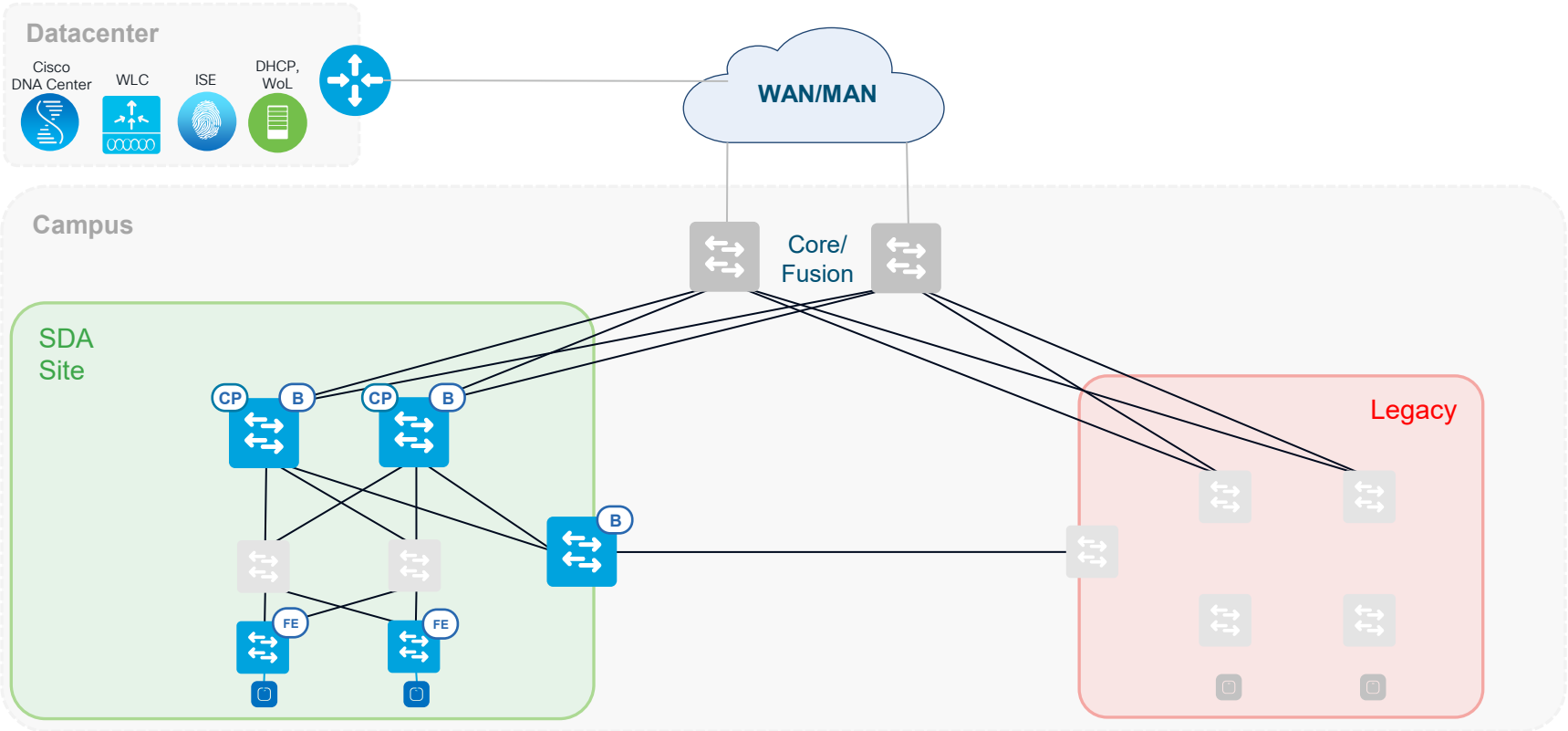
Introduction

ITs-Best Corp Introduction

- As-IS
  - Existing | traditional Layer-2 based network in the campus
  - Datacenter hosts applications and tools

- To-BE
  - New SDA-Environment in the campus
  - Layer-2 interconnect between existing network and new SDA network for migration purpose

ITs-Best Corp
High Level Layout



ITs-Best Corp Challenges

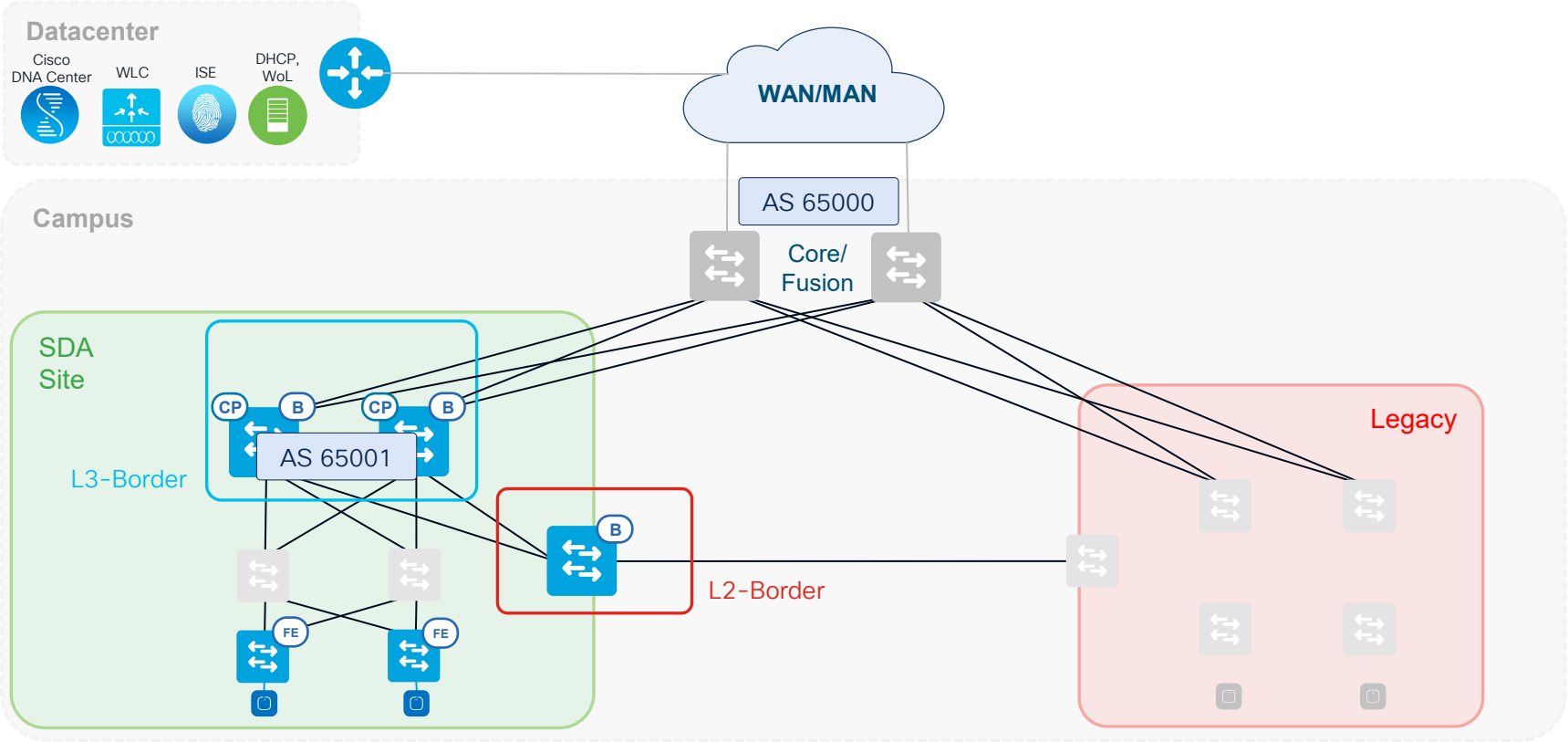
- Day-0
  - L2-Border vs. L3-Border
  - Deployment of the L3-Border and starting the SDA setup
  - How to interconnect existing environment for migration purpose
  - Onboard the border

- Day-1
  - What about my Wake-on-LAN?
  - What about my Silent Hosts?
  - Demystify Wake-on-LAN | Silent hosts

Onboard the Border

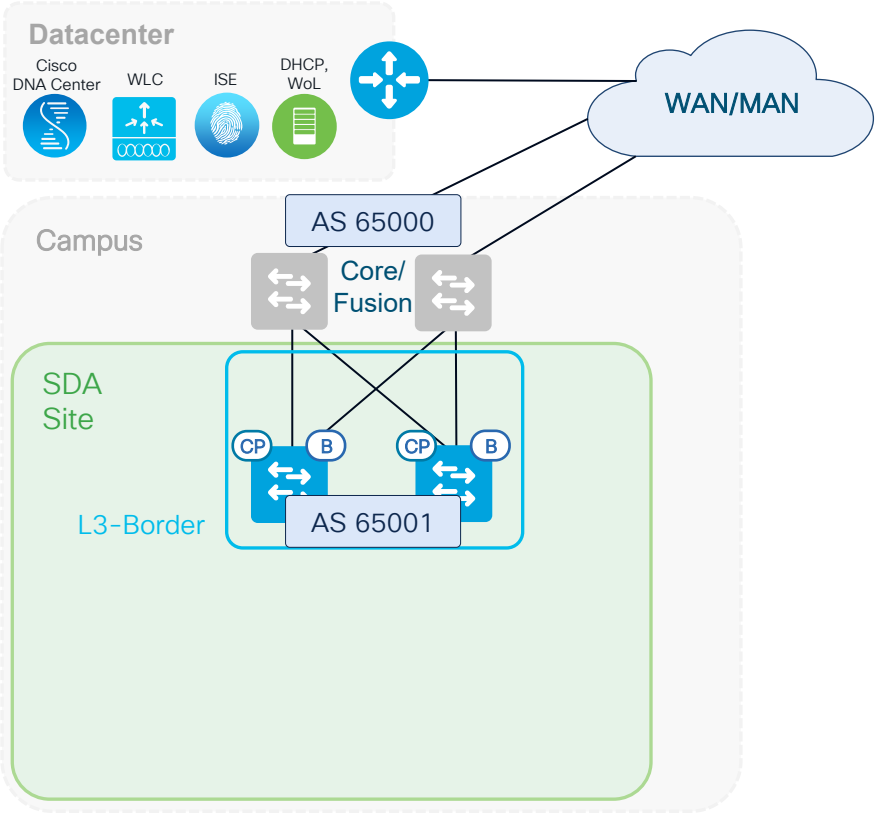
Onboard the Border

High Level Design



Onboard the Border

Introduction L3-Border



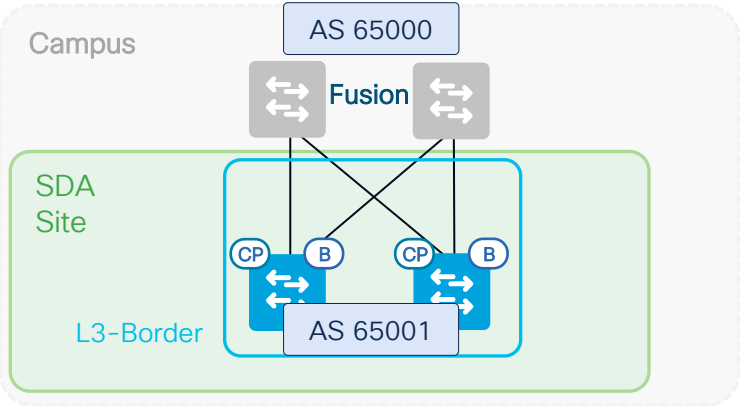
- Connects the Fabric to the outside
- Type:
  - Internal
  - External
  - Internal & External
  - -> BRKCRS-2811

Reference

Onboard the Border

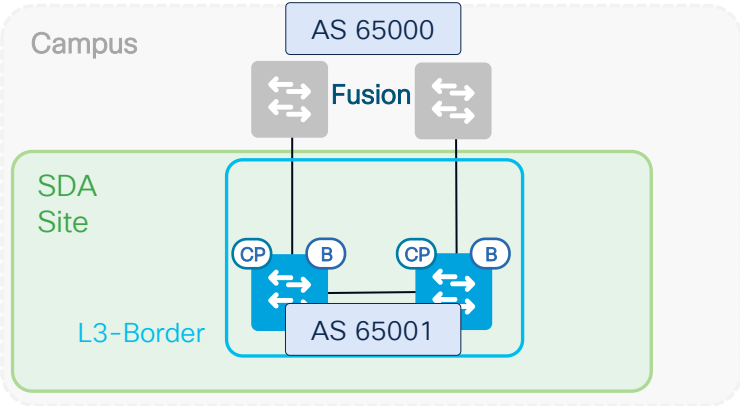
Design Options

X-Shape



Fully automated

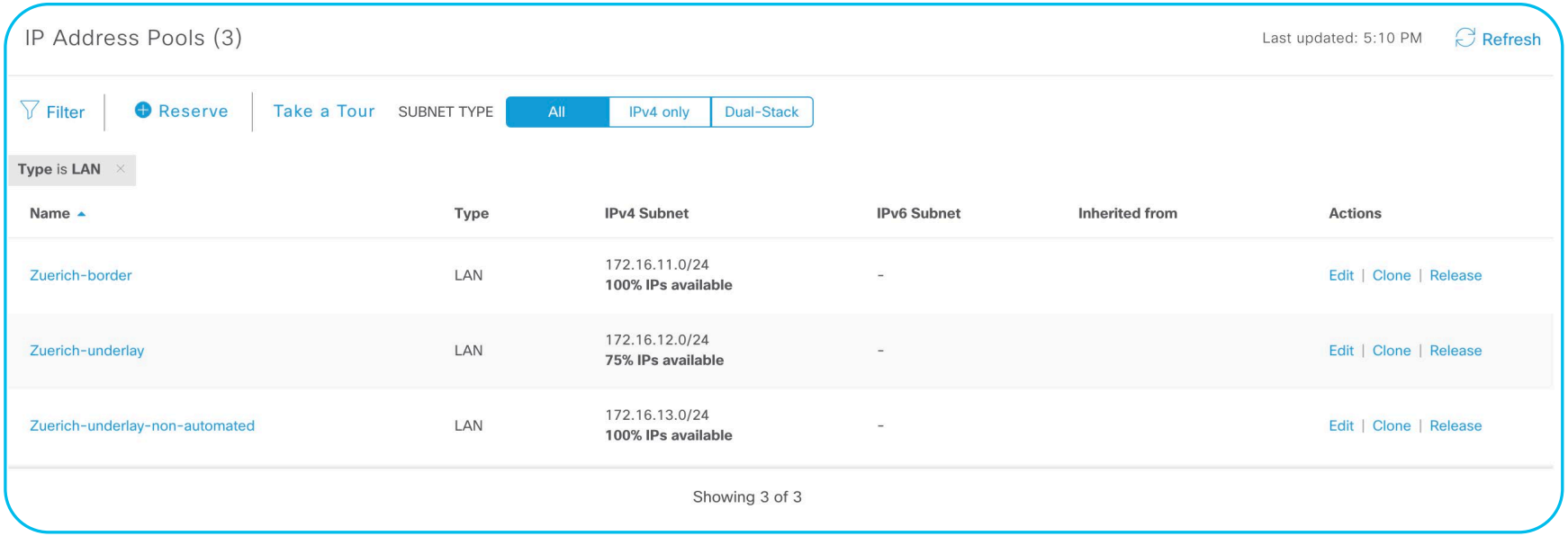
U-Shape



Manual config of B2B-link & iBGP
Less uplinks required

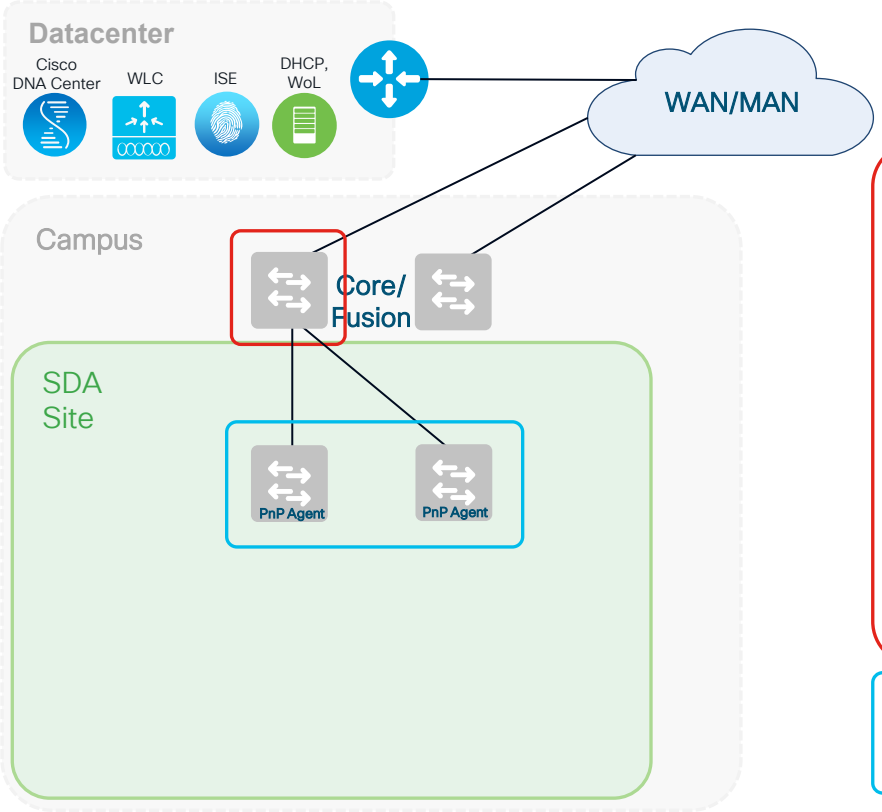
Onboard the Border

Step 1: Reserve IP Address Pools



Onboard the Border

Step 2: Plug and Play (PnP) for the two L3-Border



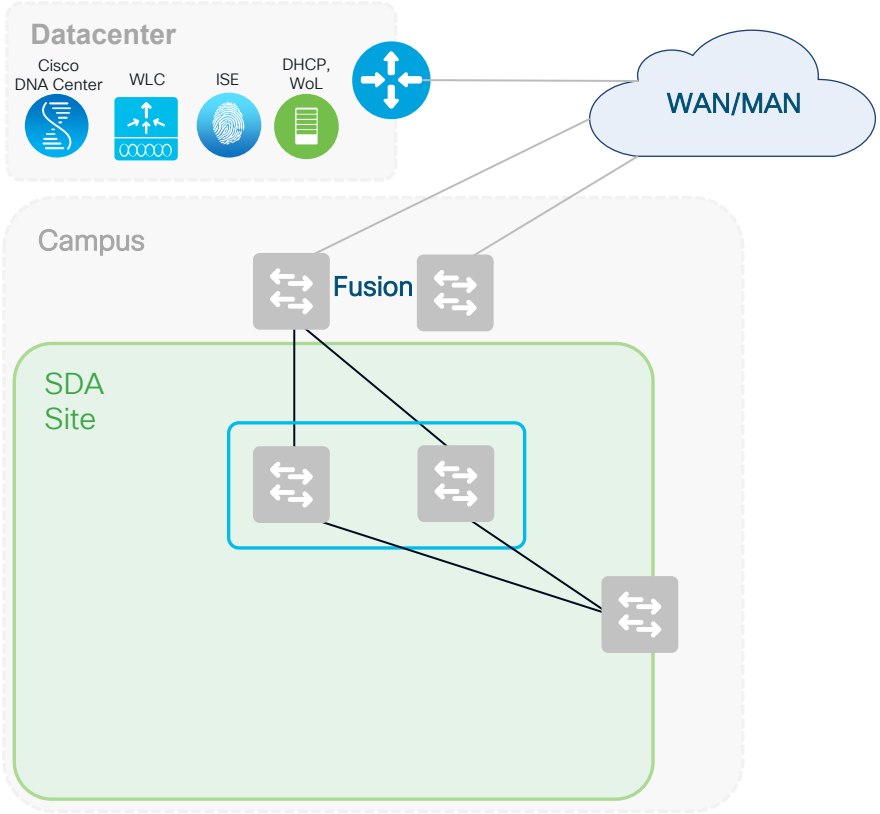
On the Fusion add:

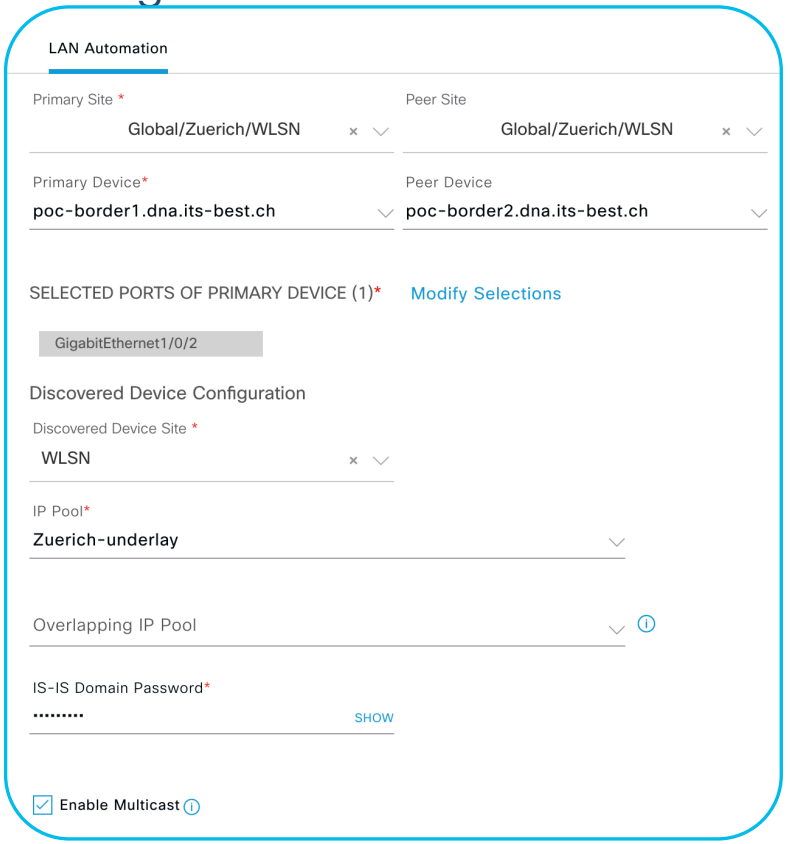
```
ip dhcp excluded-address 172.16.13.1
ip dhcp pool nw_orchestration_pool
  network 172.16.13.0 255.255.255.192
  option 43 ascii 5A1D;B2;K4;I192.168.99.10;J80;
  default-router 172.16.13.1
  class ciscopnp
    address range 172.16.13.2 172.16.13.62
ip dhcp class ciscopnp
  option 60 ^ciscopnp
vlan 13
  name PnP_OnboardTheBorder
interface Vlan13
  ip address 172.16.13.1 255.255.255.192
pnp startup-vlan 13
static route 172.16.12.0 255.255.255.0 172.16.13.2
```

Border gets initial config template (Appendix)

Onboard the Border

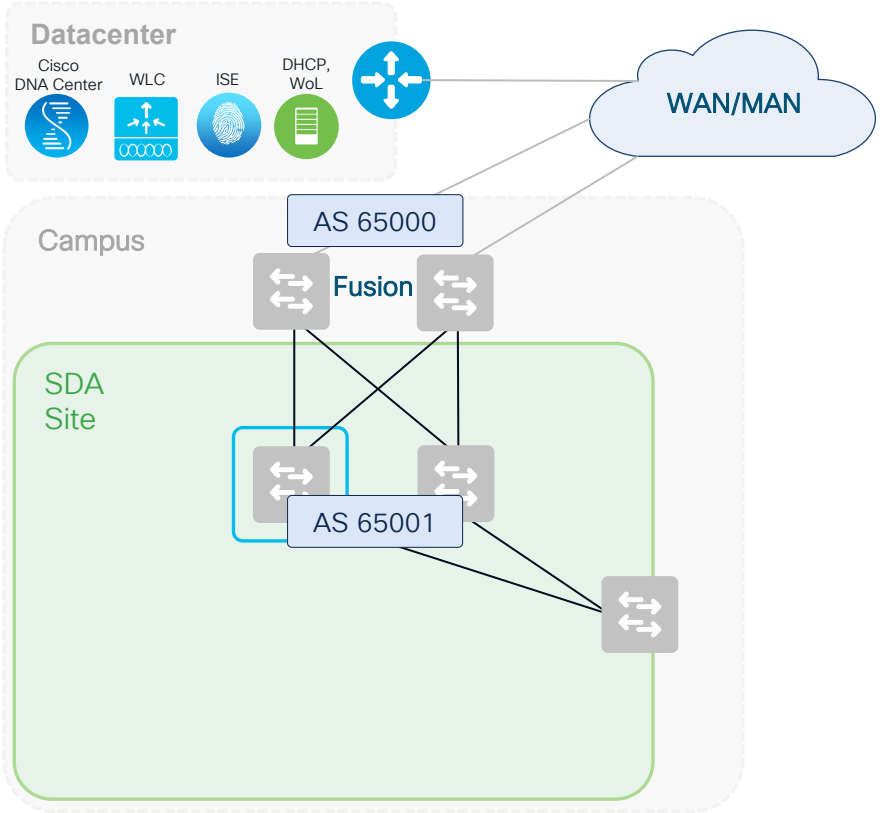
Step 3: LAN Automation for IS-IS & Multicast Config

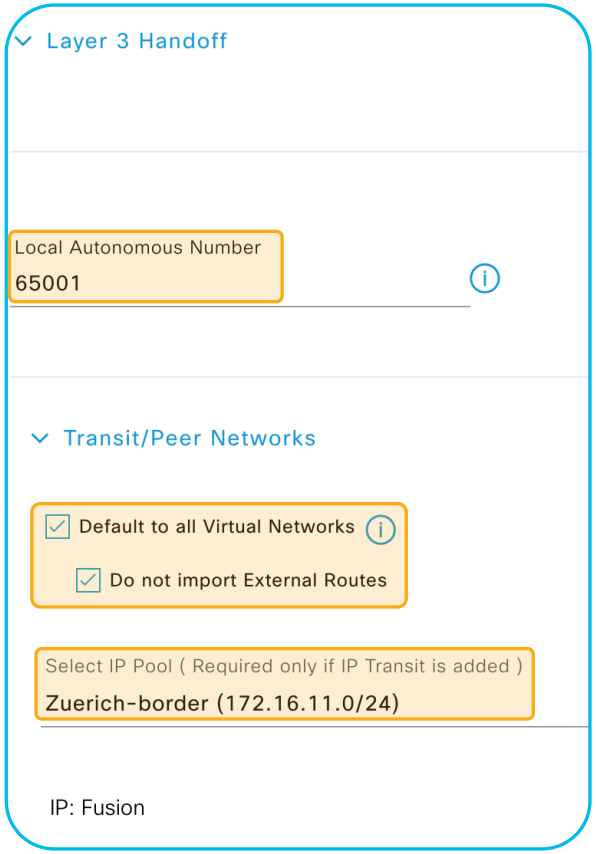




Onboard the Border

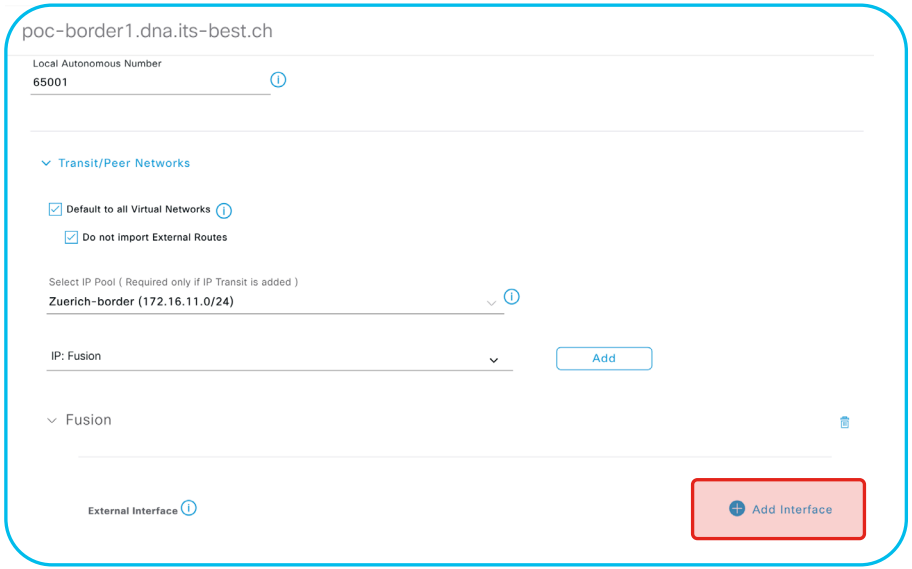
Step 4: L3-Border Handoff (1/2)

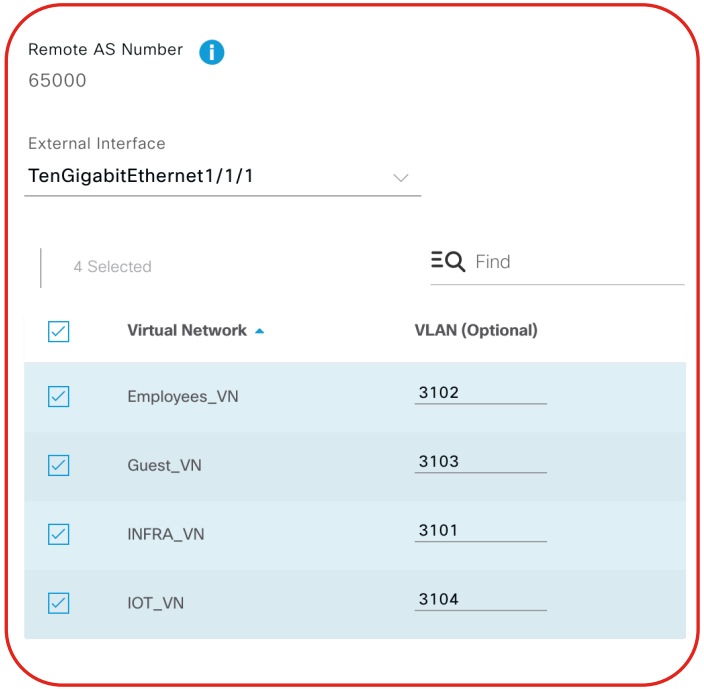




Onboard the Border

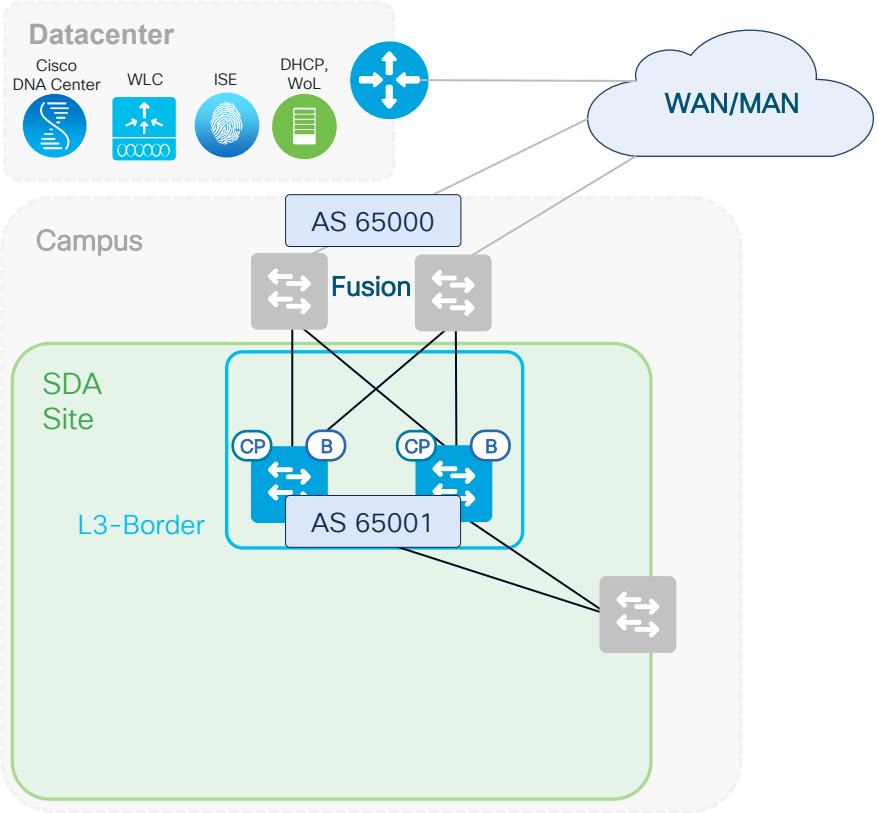
Step 4: L3-Border Handoff (2/2)





Onboard the Border

Conclusion L3-Border



Add DHCP and PnP startup VLAN config to Fusion

Use trunk interface between Fusion and Border

Run LAN Automation for IS-IS & Multicast Config

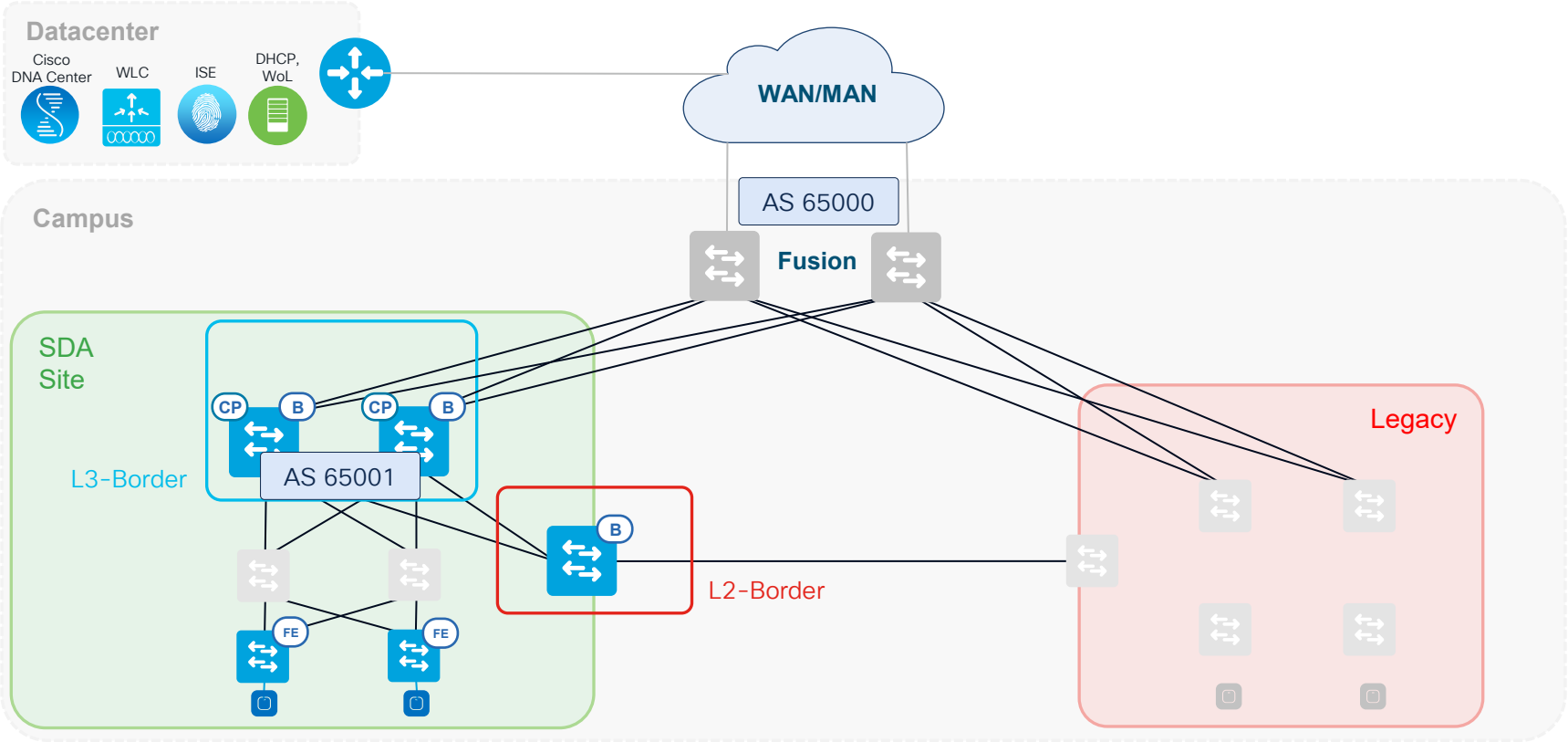
Layer 3 Handoff for all VN's

- Incl. INFRA_VN = underlay
- Add redistribute IS-IS for underlay

Add BGP config on Fusion and remove temporary config (VLAN13, DHCP & static route)

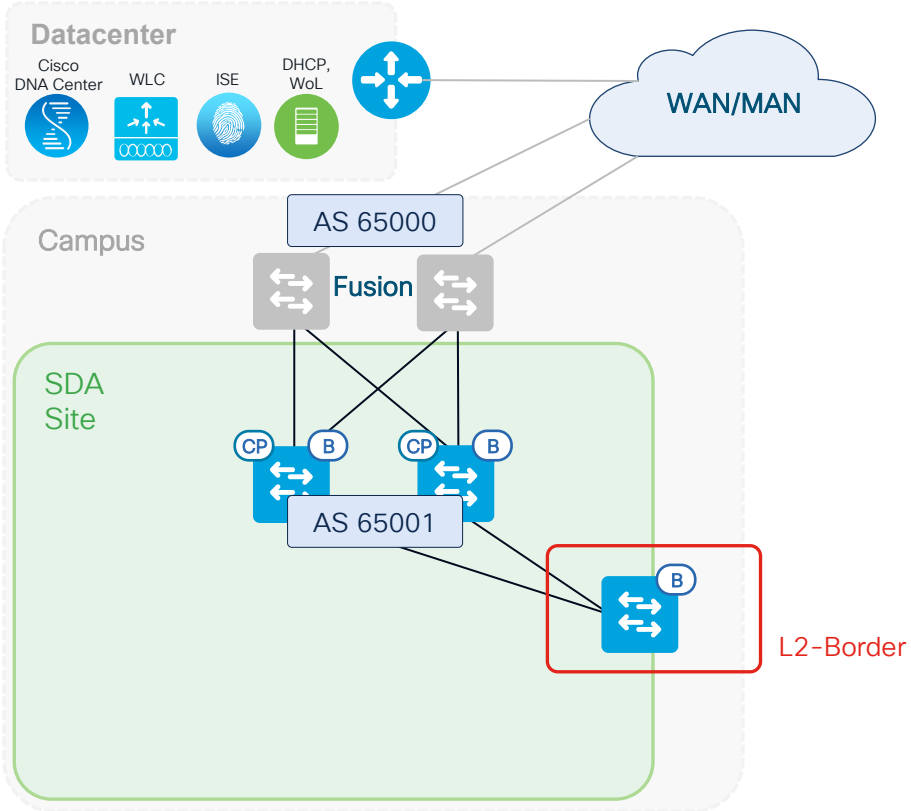
Onboard the Border

High Level Design



Onboard the Border

Introduction L2-Border



Connects your Legacy network via Layer 2 connectivity with the Fabric

Use dedicated L2-Border For Redundancy

- StackWise-480 or
- StackWise Virtual (2.1.2.x+)

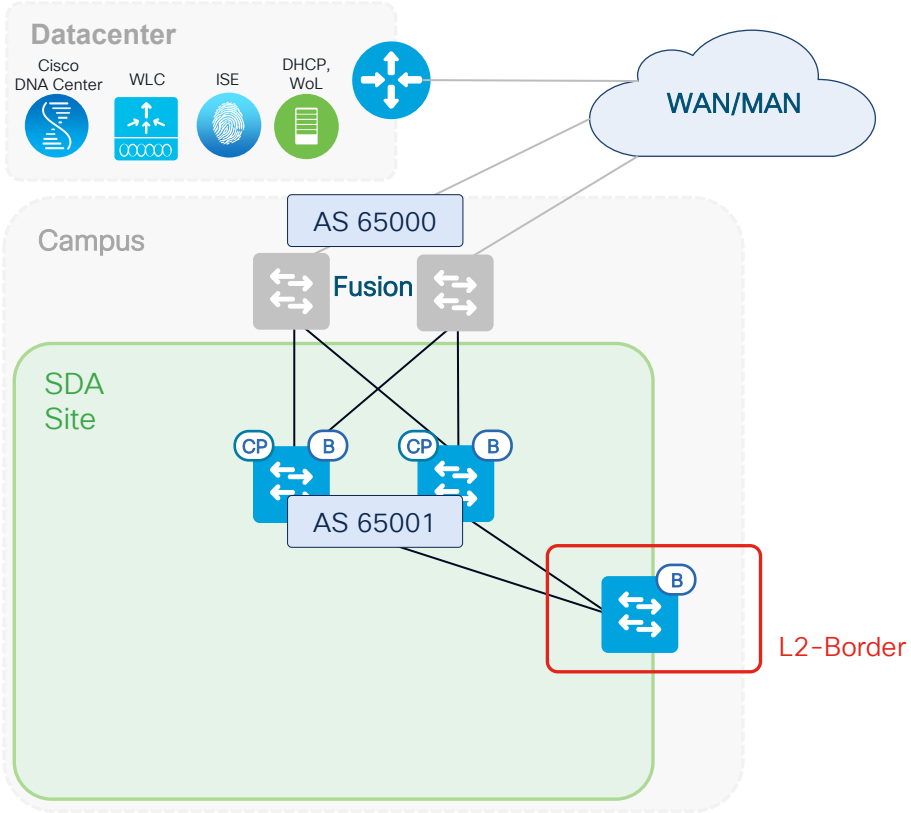
L3 Gateway

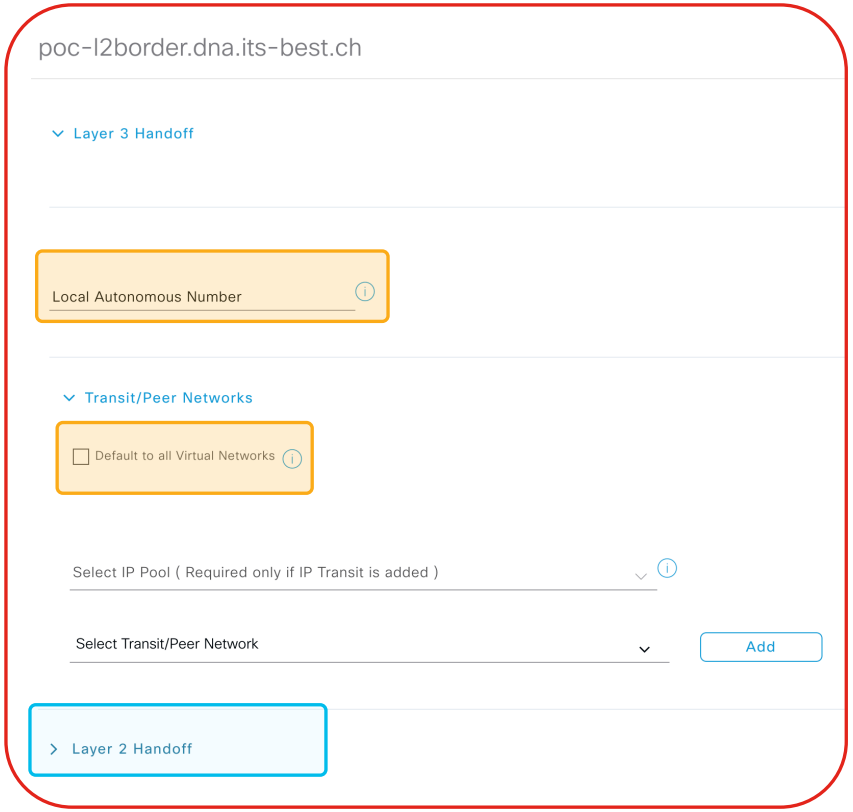
- Move inside the Fabric
- Outside the Fabric (2.1.2.x+)

Reference

Onboard the Border

Step 1: L2-Border configure Local AS





Onboard the Border

Step 2: L2-Border Handoff (1/2)

poc-l2border.dna.its-best.ch

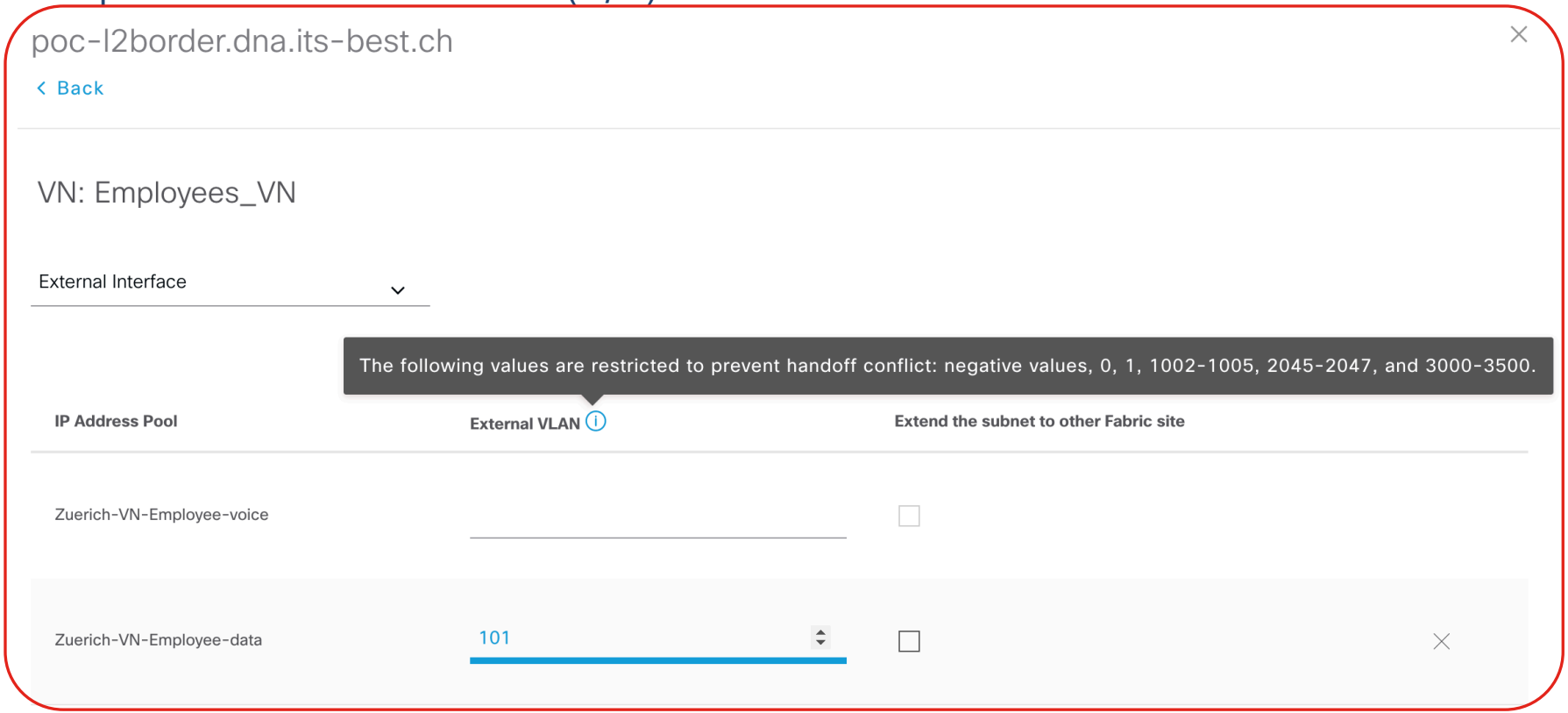
> Layer 3 Handoff

v Layer 2 Handoff

	Virtual Network	IP Pools
☐	IOT_VN	1
☐	Guest_VN	1
☐	Employees_VN	2

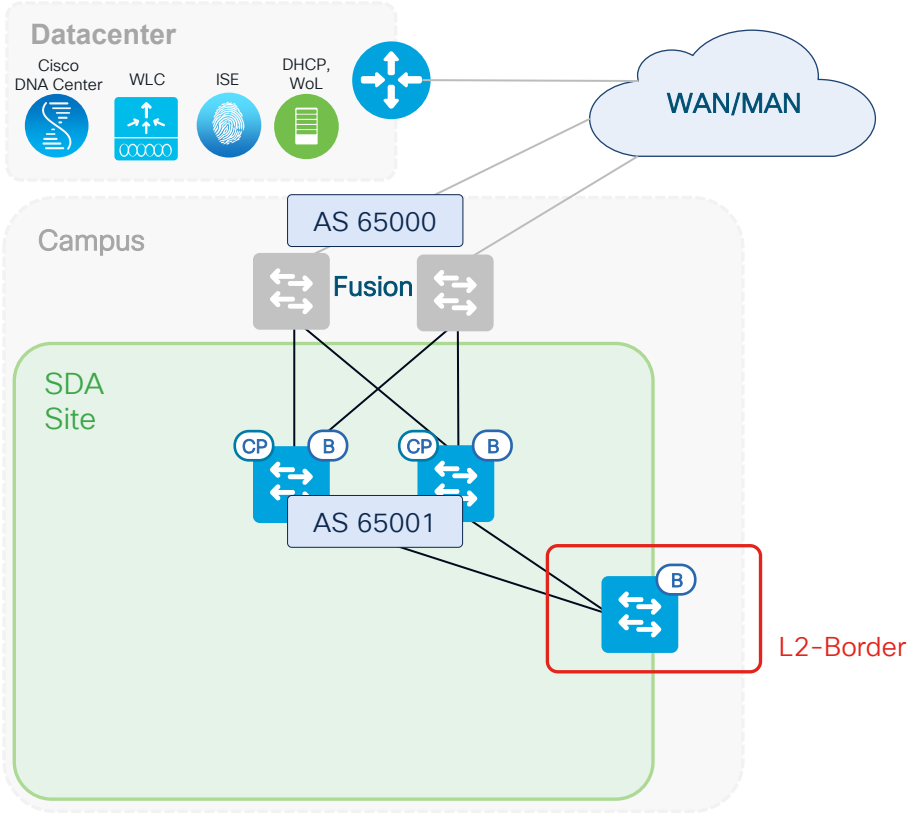
Onboard the Border

Step 2: L2-Border Handoff (2/2)



Onboard the Border

Conclusion L2-Border



- Use dedicated Border for L2 Handoff
- L3 Gateway
  - Move inside the Fabric -> Route IP Pool to External Borders
  - Outside the Fabric -> enable L2 flooding to use external gateway (2.1.2.x+)

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Demystify Wake-on-LAN & Silent hosts

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What is Wake-on-LAN

Reference

- Wake-on-LAN wakes up a client that is in sleep mode
- A client that is in sleep mode does:
  - usually require less power
  - goes through a state change when moving from active to sleep
  - not respond to normal ethernet frames
  - if it supports WoL and is correctly configured, it wakes up if it is the target of a Wake-on-LAN magic packet

Why do you need Wake-on-LAN

Reference

- you want to patch windows endpoints during not operational times
- you want to wake up sleeping clients before an event/session starts
- you want to make endpoints react as they are very silent otherwise

IP-Directed Broadcast – Wake-on-LAN (WoL) Introduction

Reference

WoL Ethernet Broadcast

- The source and destination are both in the **same** subnet.
- This feature is supported today with the Layer 2 Flooding features introduced in Cisco DNA Center 1.2.5/6.

WoL Subnet Broadcast

- The source and destination are both in **different** subnet.
- Referred to as *Subnet-directed broadcast* or *IP-directed broadcast.*

WoL Magic Packet

- A Broadcast frame that can be sent as an Ethernet Broadcast or Subnet Broadcast.
- Typically sent to UDP destination port 7 or port 9.
- Payload contains *FF FF FF FF FF FF* in hexadecimal followed by sixteen (16) repetitions of the target machine's MAC address.

The magic packet Header – using Ethernet Broadcast

Reference

No.	Time	Source	Destination	Protocol	Info
40	2020-10-21 16:50:10.961631	10.2.17.14	10.2.17.127	WOL	MagicPacket for 98:fa:9b:8c:62:51

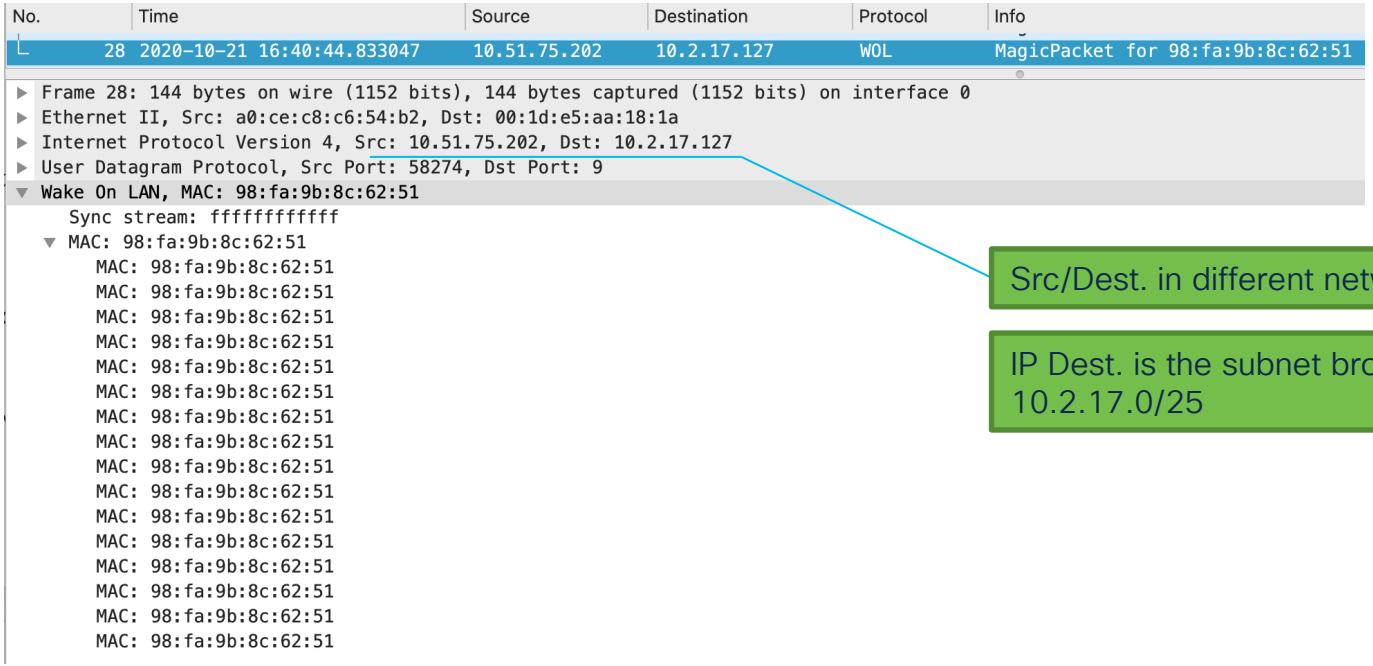
```
▶ Frame 40: 144 bytes on wire (1152 bits), 144 bytes captured (1152 bits) on interface 0
▶ Ethernet II, Src: a0:ce:c8:c6:54:b2, Dst: ff:ff:ff:ff:ff:ff
▶ Internet Protocol Version 4, Src: 10.2.17.14, Dst: 10.2.17.127
▶ User Datagram Protocol, Src Port: 64530, Dst Port: 9
▼ Wake On LAN, MAC: 98:fa:9b:8c:62:51
    Sync stream: ffffffffffff
  ▼ MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
      MAC: 98:fa:9b:8c:62:51
```

L2 Broadcast

Src/Dest. on same subnet
IP Dest. Address is the broadcast address of 10.2.17.0/25

The magic packet Header – using IP directed Broadcast

Reference

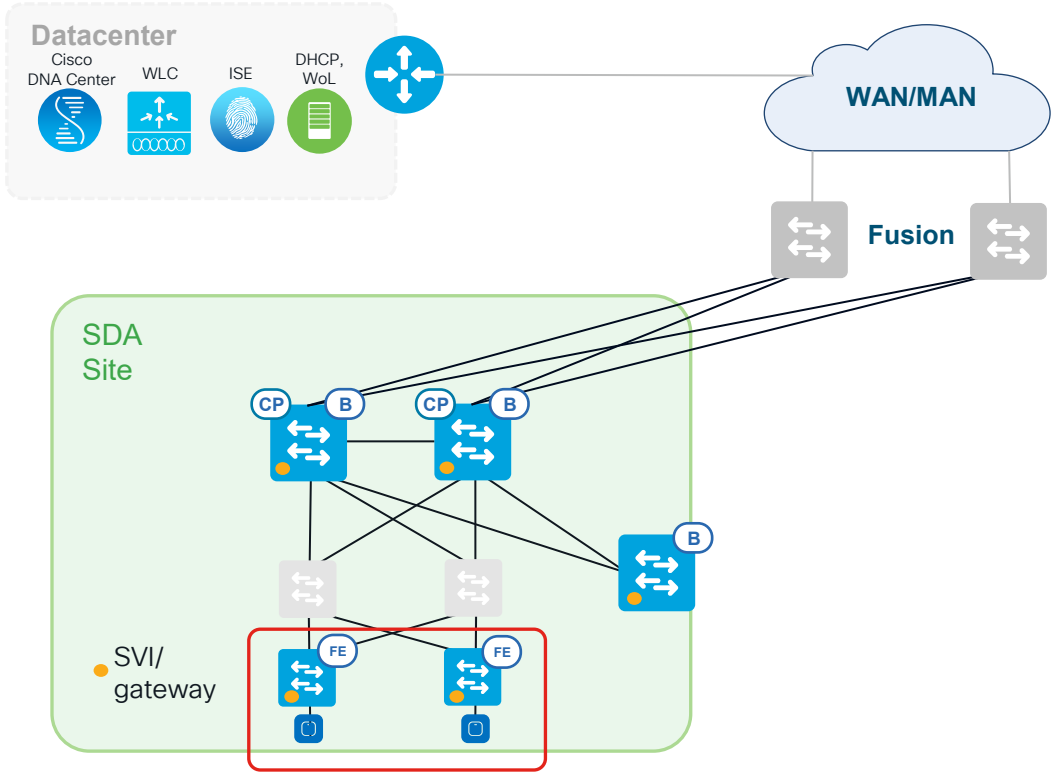


Src/Dest. in different networks

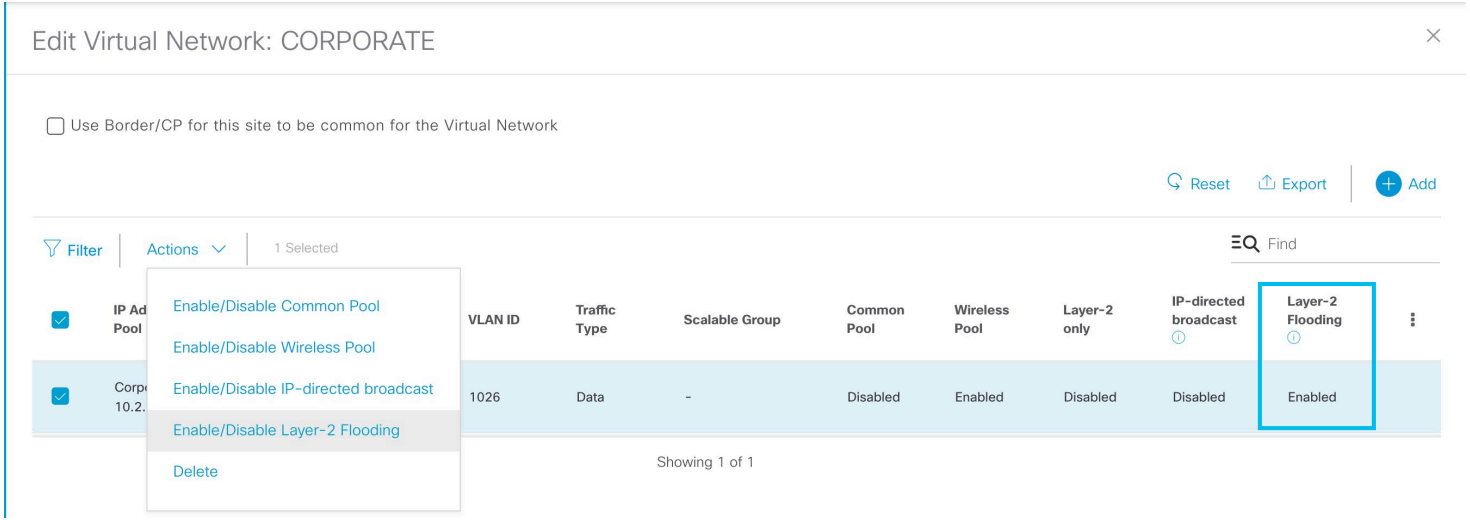
IP Dest. is the subnet broadcast address of 10.2.17.0/25

Challenge #1: Gateway function in SDA

- Without any “tuning” SDA terminates broadcasts on the Edge switch
- Each Edge switch is the gateway – same SVI, same IP, same MAC -> Anycast Gateway



How to solve it – Ethernet Broadcast



Use cases and best practices for subnet broadcast

- L2 flooding might be required if you have BAC NET running in your network – e.g for PLC and building automation installations
- WoL Server and Clients are both part of the same IP address segment in SDA

- Best practice:
- Keep your broadcast segments small – it broadcasts ☺

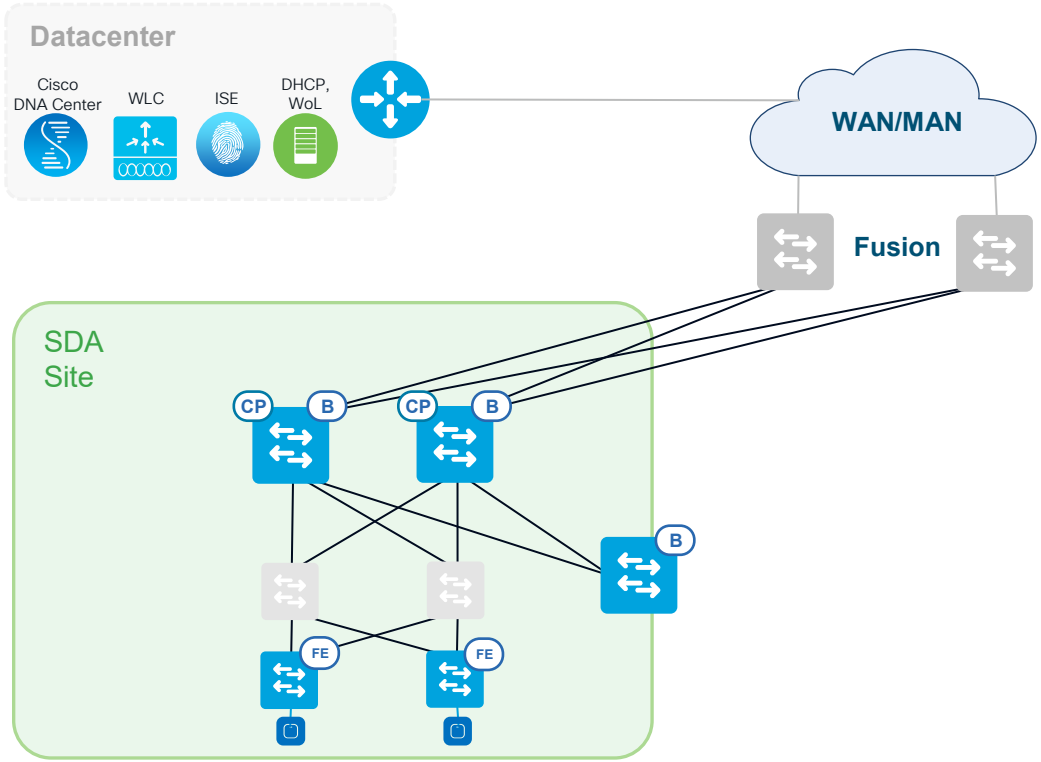
Challenge #2: 802.1x and dynamic vlan assignment

Situation:

Interfaces of Edge switches are in closed Authentication mode

VN / IP Pool assignment happens via ISE

No static assignment applied on interfaces

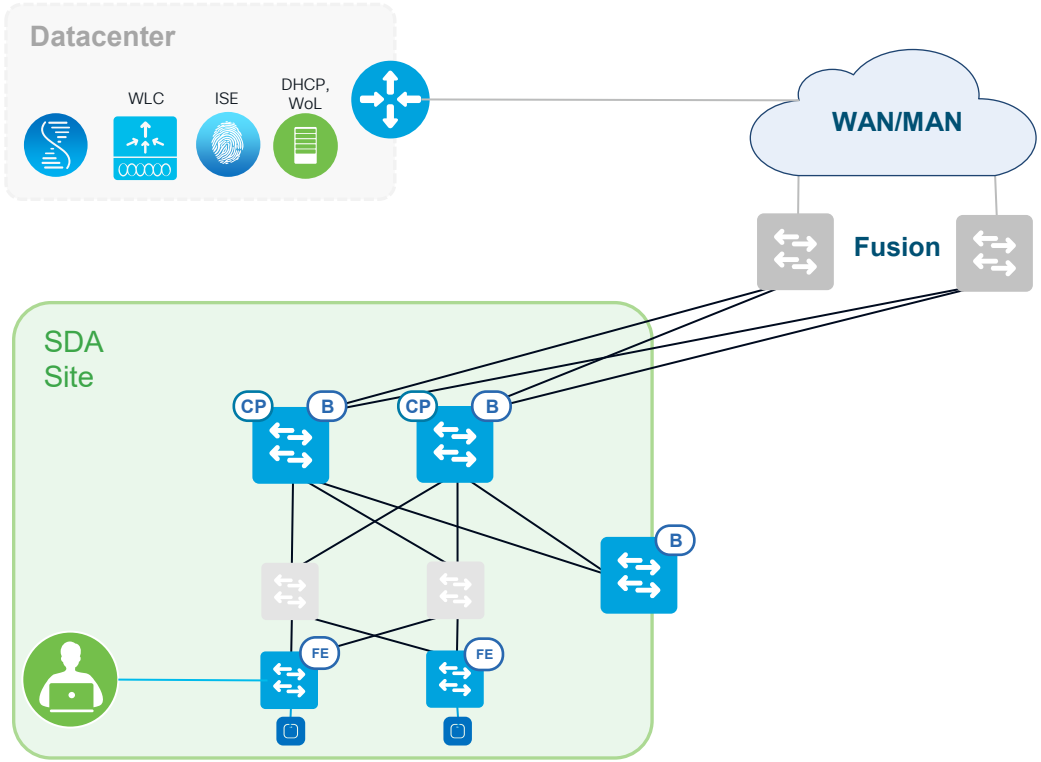


Challenge #2: 802.1x and dynamic vlan assignment

Situation:

User is authenticated/authorized

ISE assigned the User to VN/Pool CORPORATE



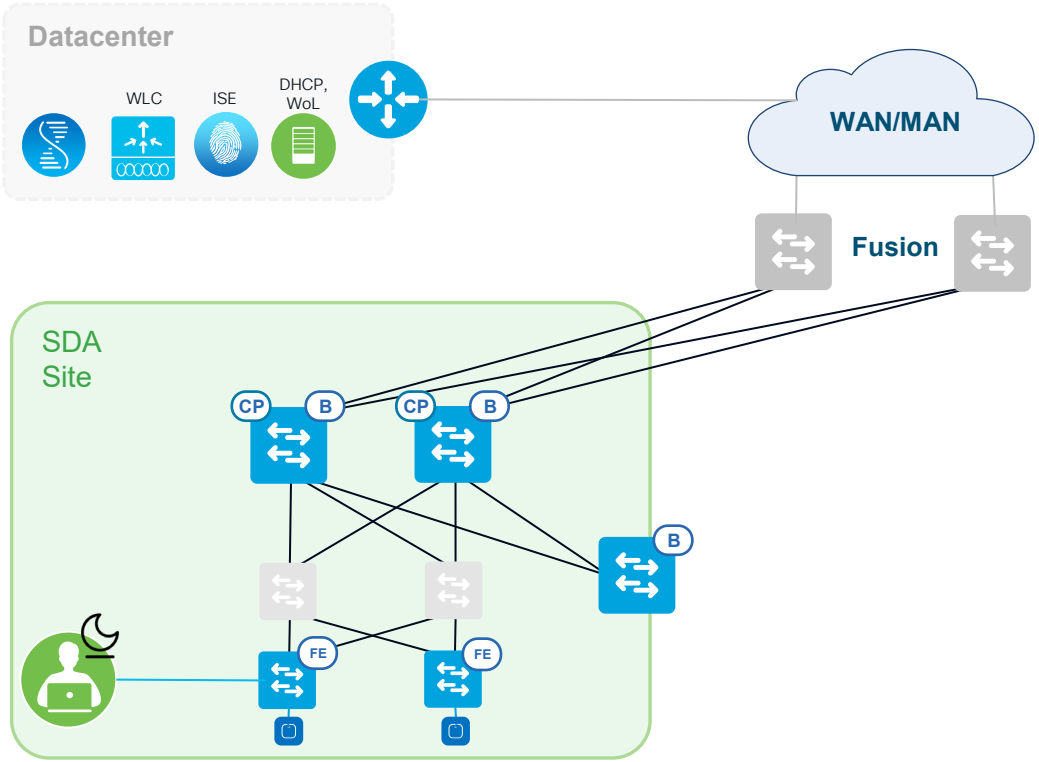
Challenge #2: 802.1x and dynamic vlan assignment

Situation:

Client changes to sleep mode

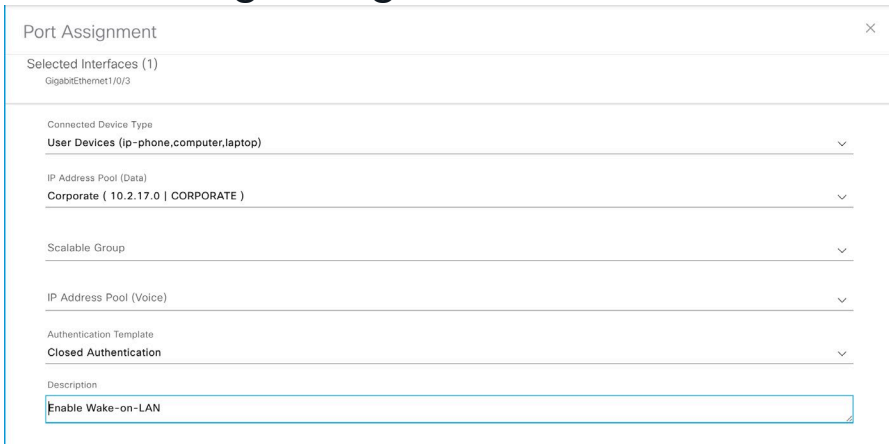
Client executes state change on interface from GE to 100/half

Therefore client is moved to default port setting (Vlan1)



How to solve it – port configuration

- #1: use a static port configuration, ISE authorization has higher priority
  - Drawback: it depends how many ports you need to configure
  - Your WOL segment might differ from the target segment



How to solve it – port configuration

- #2: use an event manager applet that dynamically configures your switch ports
- Configure: `authentication logging verbose`

→ Use DNAC template engine to push it to your edge switches

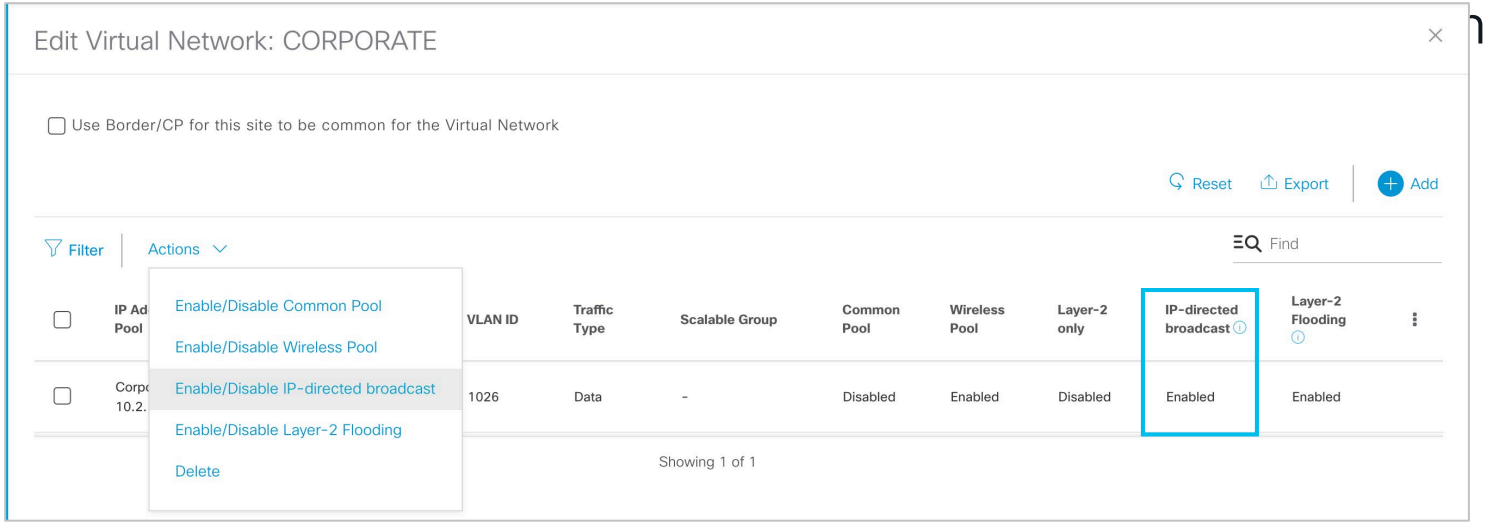
```
event manager applet
Copy_Dynamic_VLAN_Assigned_from_ISE_to_native_vlan
event syslog pattern "%SESSION_MGR-5-SUCCESS:"
action 0.1 regexp "Interface ([^ ]+)" "$_syslog_msg"
match intf
action 0.2 cli command "enable"
action 0.3 cli command "show interface $intf
switchport | include Access Mode VLAN"
action 0.4 regexp "Access Mode VLAN: ([0-9]+)"
"$_cli_result" match OPER_VLAN
action 0.5 syslog msg "Dynamically set vlan is
$OPER_VLAN"
action 0.6 cli command "config terminal"
action 0.7 cli command "interface $intf"
action 0.8 cli command "switchport access vlan
$OPER_VLAN"
action 0.9 cli command "exit"
```

Wake-on-LAN from outside of the fabric

- If your Wake-on-LAN server is located in a Datacenter outside of the fabric, directed Broadcast usually doesn't go through
  - Your Default gateway configuration in the server segment will block it
  - The Border will not translate it to vxlan

How to solve it – IP directed Broadcast

- Step 1: enable ip directed-broadcast on your Server Gateway
- Step 2: enable L2-Flooding for the segment



Use cases and best practices – IP directed broadcast

- use cases:
- WoL Server is outside of the fabric, your WoL Clients are part of the fabric
- Wake up sleepy clients that don't talk regulary
- Best practice:
- Keep your broadcast segments small – it broadcasts ☺

- Device Support:
- DNAC 1.2.5/6 for L2-Broadcast
- DNAC 2.1.2.4 for directed-Broadcast
- Routers, Nexus 7700 are not supported
- Edge and Border require ≥ 17.3.1

SDA for everyone – now even ready for YOUR network!

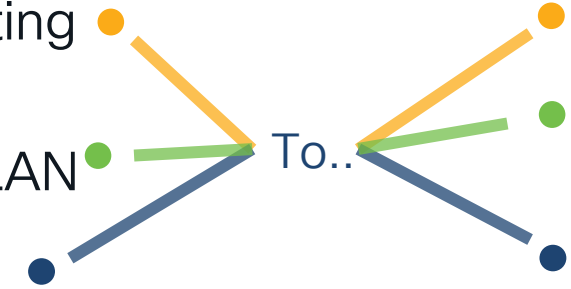
Conclusion

... there is a way ...

to migrate an existing network

to use Wake-on-LAN

to get Silent Host



participate in an SDA network

Wake-Up Hosts in an SDA network

Integrated in an SDA network

Where to go next....

- BRKCSR-2811 Connecting the Fabric to External Networks
- BRKCRS-2810 Cisco SD-Access Fundamentals
- BRKSDN-2500 Real World Use Cases for Deploying and Operating Cisco SD-Access Using Cisco DNA Center

SDA for everyone – now even ready for YOUR network!

The bridge to possible

Thank you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Appendix


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