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# Migración de la LAN de Campus de la UIB a una Fabric Network

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Servei d'Infraestructures TIC

Palma, 30/05/2024



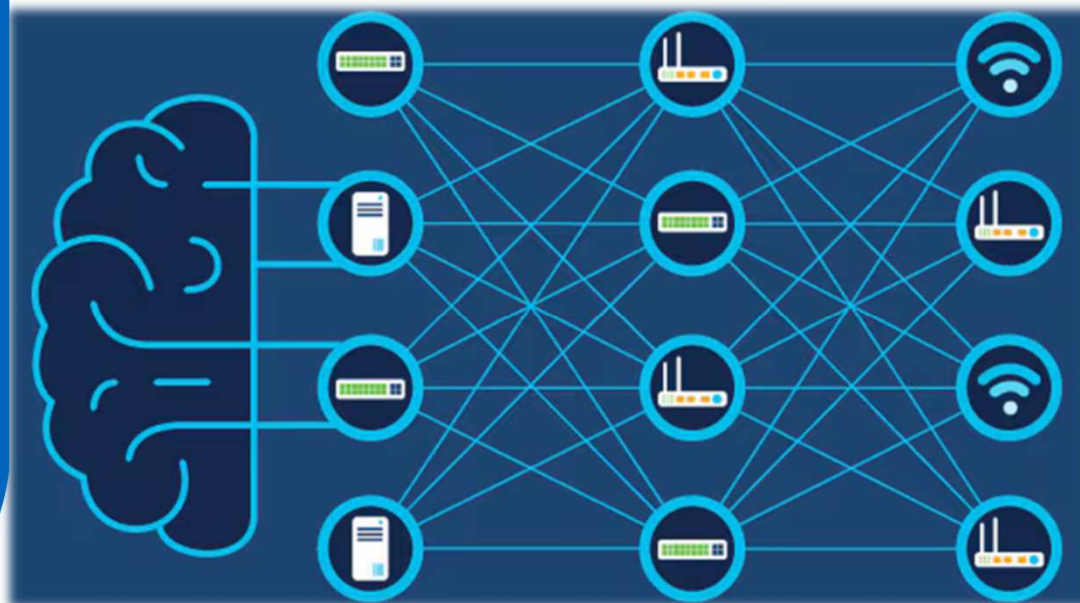
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**RedIRIS 2024**  
JORNADAS TÉCNICAS  
*Palma de Mallorca*



Universitat de les Illes Balears  
28-30 de mayo



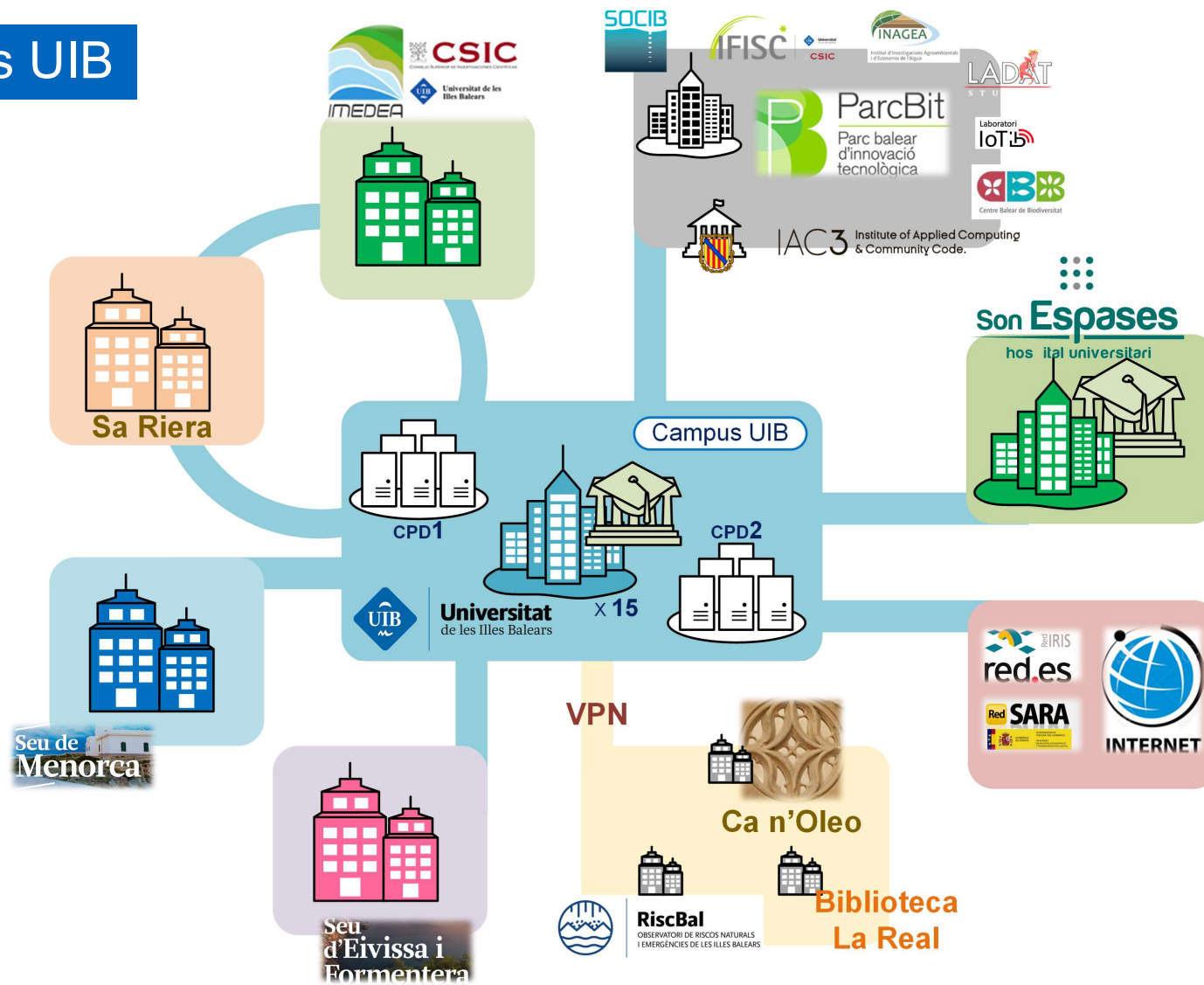


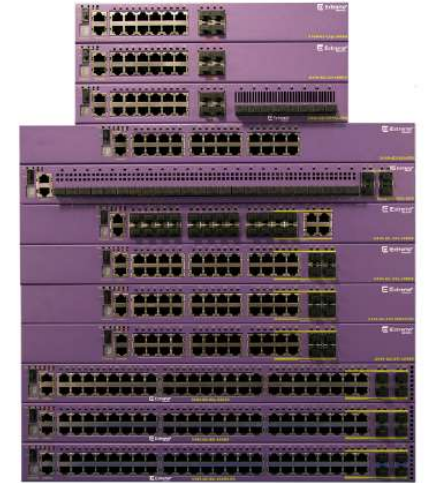
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LAN Campus UIB

# LAN Campus UIB





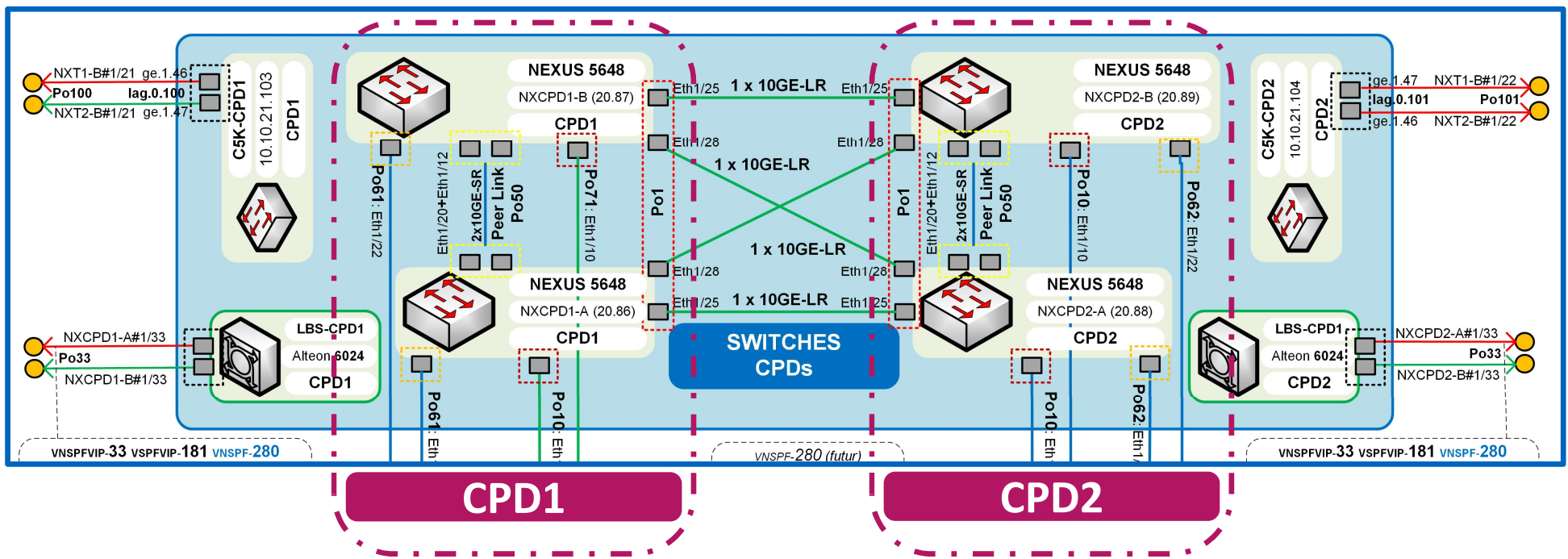
- Switches de **acceso**:

- Enterasys Networks C2/C3/C5/D2/B5 (EOS).
- Extreme Networks summit X430/X435/X440/X460 (EXOS).

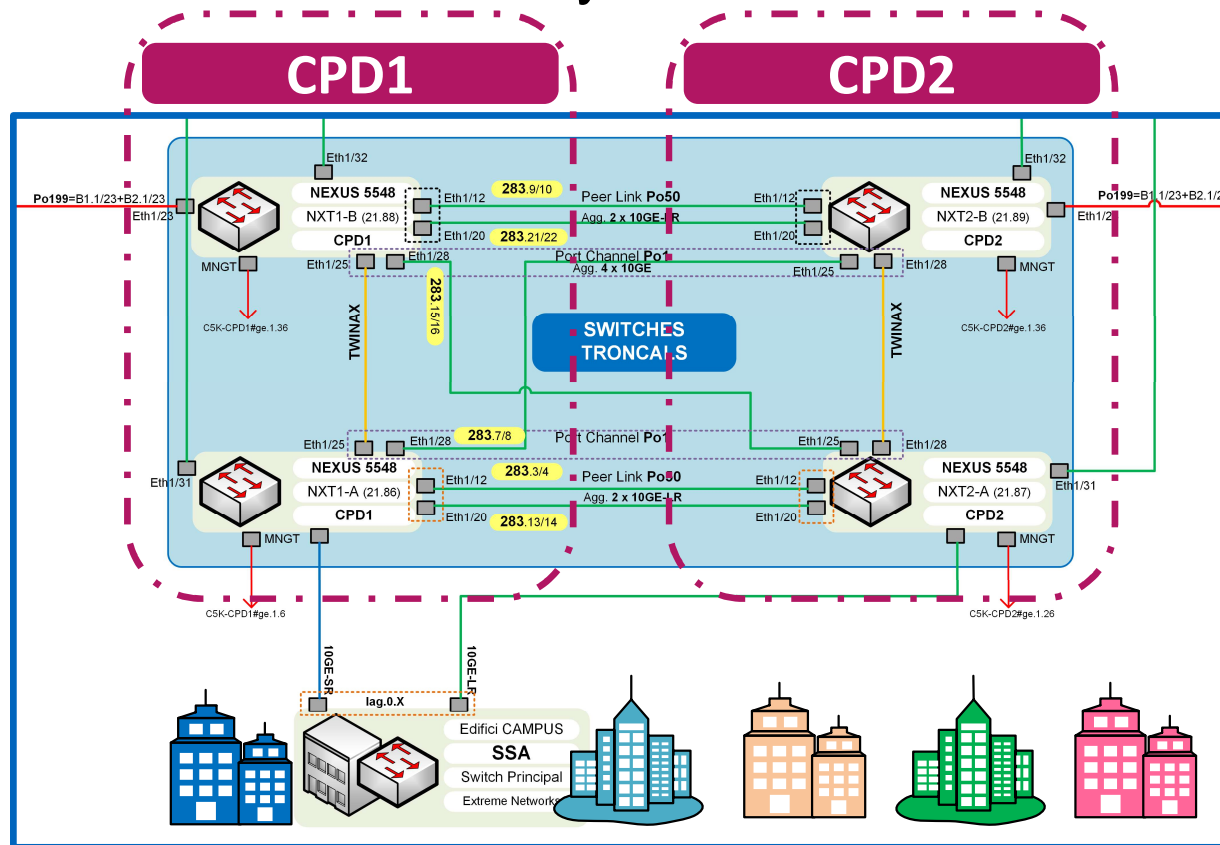
- Switches de **agregación/distribución**: Enterasys Networks SSA G1018 y G8018 (EOS).



## Switches CPD: Cisco Systems Nexus 5648.



- Switches **CORE**: Cisco Systems Nexus 5548.





- **Cisco** anuncia el fin del soporte de los switches **core**.

<b>End of SW Maintenance Releases Date:</b> HW,OS SW	The last date that Cisco Engineering may release any final software maintenance releases or bug fixes. After this date, Cisco Engineering will no longer develop, repair, maintain, or test the product software.	May 4, 2020
<b>End of Service Contract Renewal Date:</b> HW,OS SW	The last date to extend or renew a service contract for the product.	August 3, 2023
<b>Last Date of Support:</b> HW,OS SW	The last date to receive applicable service and support for the product as entitled by active service contracts or by warranty terms and conditions. After this date, all support services for the product are unavailable, and the product becomes obsolete.	May 31, 2024

- También lo anuncia **Extreme Networks** para la mayoría de sus switches de **acceso** y **distribución**.
- El año **2020** iniciamos el proyecto del nuevo **core**, teniendo en cuenta que en posteriores años deberán de renovarse las capas de acceso y distribución.

- Contactamos con Huawei, Aruba Networks, Cisco Systems, Dell y Extreme Networks.
- Aprovechar el cambio para replantear tecnología y la arquitectura de la red de Campus.
- Realizamos dos PoC con **Dell** (SO Pluribus) y con **Extreme Networks** (SO VOSS).
- A finales de **2021** se publica el **contrato de suministro** del core y en **2022** se resuelve (Axians con Extreme Networks)





**VSP 7400-48Y-8C**



- 48 x SFP28 1Gb/10Gb/25Gb ports
- 8 x QSFP28 40Gb/100Gb ports
- 1 x Serial console port RJ-45
- 1 x 10/100/1000BASE-T out-of-band management port
- Micro-USB Type A storage port



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¿Fabric Network?

## Fabric Network: LAN Campus tradicional

- La administración de una LAN de Campus tradicional:
  - Gestión de enlaces redundantes con STP.
  - Propagación de VLANs.
  - Control del tráfico broadcast.
  - Switching y routing de tráfico IP Multicast.
  - Extensión de la LAN de Campus a sedes remotas.
  - Captura de tráfico de red con RSPAN.
  - Gran cantidad de usuarios y dispositivos.
  - Variedad de la tipología de los dispositivos conectados.

## Fabric Network: objetivos

- Objetivos de una **Fabric Network**:
  - Simplicidad + Flexibilidad + Resiliencia
- Ayudar a los **administradores de red** a gestionar su LAN de Campus y ofrecer a los **usuarios, dispositivos y aplicaciones** el **servicio seguro de red** que requieran.
- ... a través de la **virtualización de la red**, separación entre:
  - **Underlay**: Infraestructura de red (switches, routers y APs) junto con su plano de control.
  - **Overlay**: **múltiples redes overlay**, optimizadas para un determinado servicio de red, e implantadas **sobre el mismo underlay**.

# Fabric Network: virtualización de la red



Overlay



Overlay



Overlay



Underlay



### ○ Ethernet Fabrics:

- Basados en **SPB** (Shortest Path Bridging) IEEE 802.1aq o en **TRILL** (Transparent Interconnection of Lots of Links)
- Usan un Link State Protocol (**IS-IS** o **OSPF**) como plano de control **underlay**
- Implementan **ECMP**: múltiples enlaces con el mismo coste **activos**

### ○ IP Fabrics:

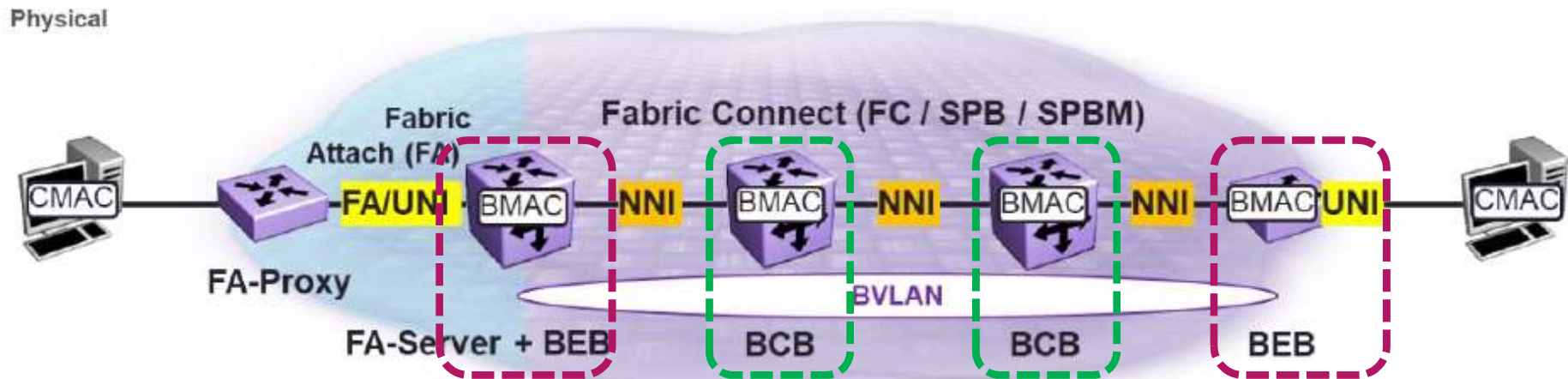
- Basados en **BGP** o en **EVPN** (Ethernet VPN)
- Usan un Link State Protocol (**BGP**) como plano de control **underlay** y BGP/EVPN con VXLAN como plano de datos (**overlay**)
- También implementan **ECMP**

## Fabric Network: Extreme Fabric Connect

- **Fabric Connect:** fabric network de  Extreme<sup>®</sup> networks
- Ethernet fabric basado en estándares:
  - **SPBM:**
    - **Shortest Path Bridging** IEEE 802.1aq
    - **Provider Backbone Bridging (MAC-in-MAC)** IEEE 802.1ah
  - **IETF RFC 6329 (IS-IS** Extensions Supporting IEEE 802.1aq Shortest Path Bridging)



# Fabric Network: Extreme Fabric Connect



**BCB:** Backbone **C**ore Bridge

**BEB:** Backbone **E**dge Bridge

**BMAC:** Backbone MAC (identifica un BCB/BEB)

**NNI:** Network to Network Interface (tramas ethernet **SPBM** 802.1ah **Mac-in-Mac**)

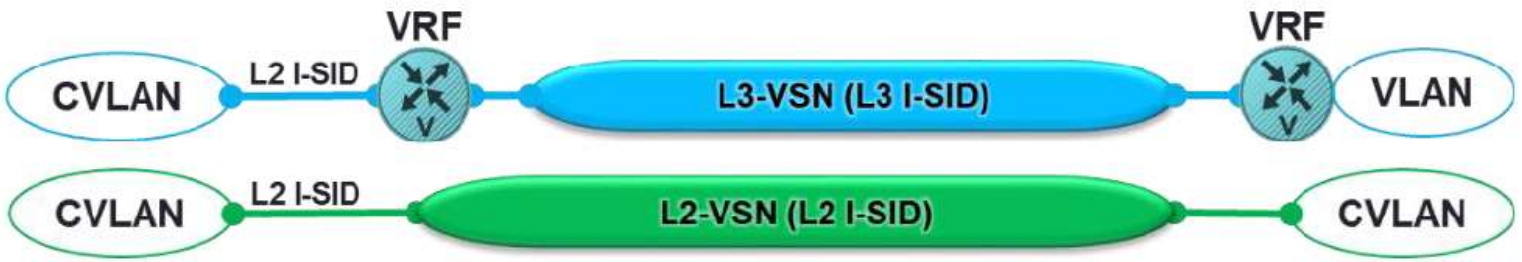
**UNI:** User to Network Interface (tramas ethernet 802.3/802.1q)

**FA:** Fabric Attach (conexión de un switch no fabric, LLDP para señalización de servicios fabric)

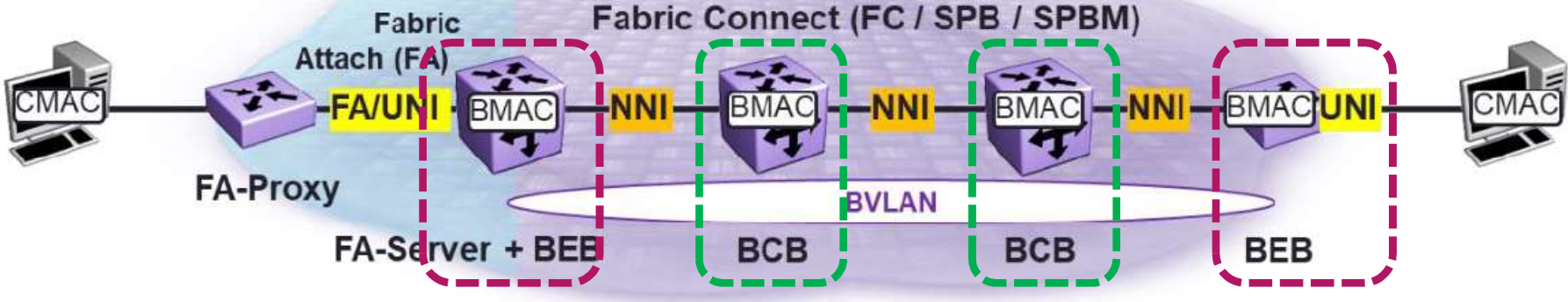
# Fabric Network: Extreme Fabric Connect

**VSN:** Virtual Service Network. Servicio de red L2/L3/Multicast del fabric identificado con un **I-SID** (I-Service ID).

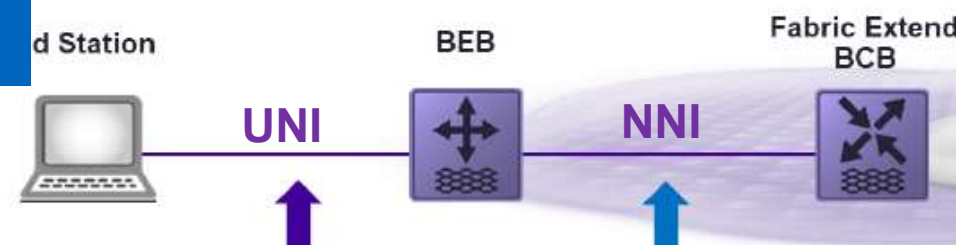
Overlay



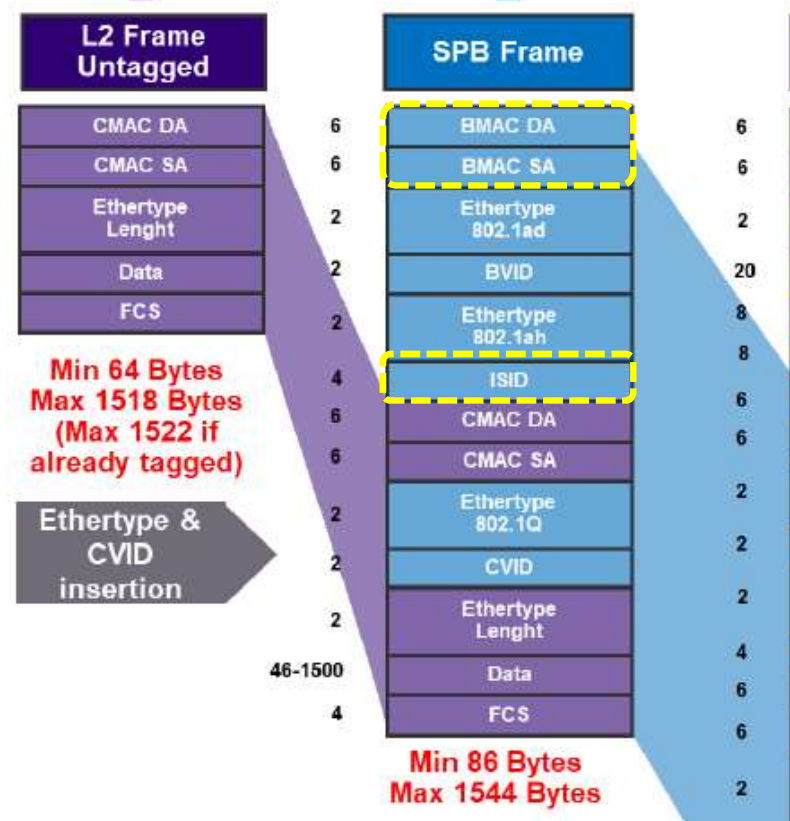
Underlay



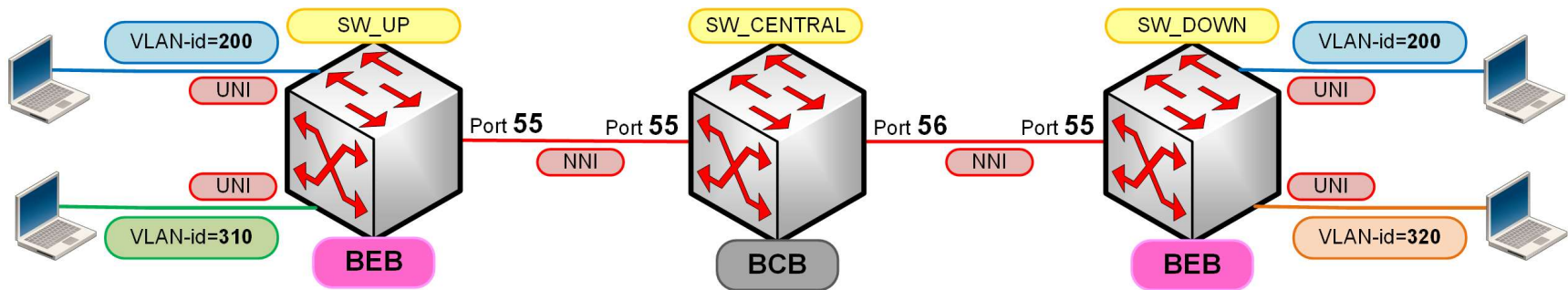
# Fabric Network: Extreme Fabric Connect



- Un **BCB** sólo commuta **tramas SPBM** a partir de su tabla L2-SPB de **BMACs** mantenida por **IS-IS**.
- Un **BCB** es transparente a los servicios **I-SID** transportados en el fabric y a las **CMACs**.
- Los servicios **I-SIDs** se crean en el **Edge** (BEBs), no en los BCBs.
- **IS-IS** mantiene la tabla de I-SIDs / BEBs.
- Un **BEB** commuta **tramas SPBM**, crea los servicios **I-SID** y conecta al fabric los dispositivos **ethernet** a través de sus puertos **UNI**.



# Fabric Network: "Hello fabric !"



```

SW_UP:1(config)#sh isis adj
*****
Command Execution Time: Fri May 24 12:09:30 2024 CEST
*****

=====
                        ISIS Adjacencies
=====
INTERFACE      L STATE      UPTIME PRI  HOLDTIME  SYSID      HOST-NAME      STATUS  AREA  AREA-NAME
-----
Port1/55      1 UP         00:16:17 127      24 00db.bada.0019  SW-CENTRAL    ACTIVE  HOME
=====
    
```

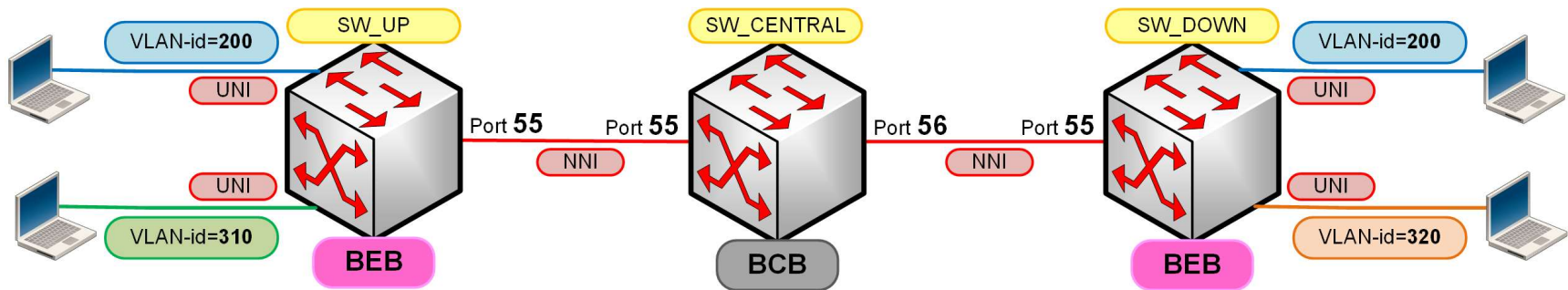
```

SW_DOWN:1#sh isis adjacencies
*****
Command Execution Time: Fri May 24 12:18:55 2024 CEST
*****

=====
                        ISIS Adjacencies
=====
INTERFACE      L STATE      UPTIME PRI  HOLDTIME  SYSID      HOST-NAME      STATUS  AREA  AREA-NAME
-----
Port1/55      1 UP         00:17:27 127      20 00db.bada.0019  SW-CENTRAL    ACTIVE  HOME
=====
    
```



# Fabric Network: "Hello fabric !"



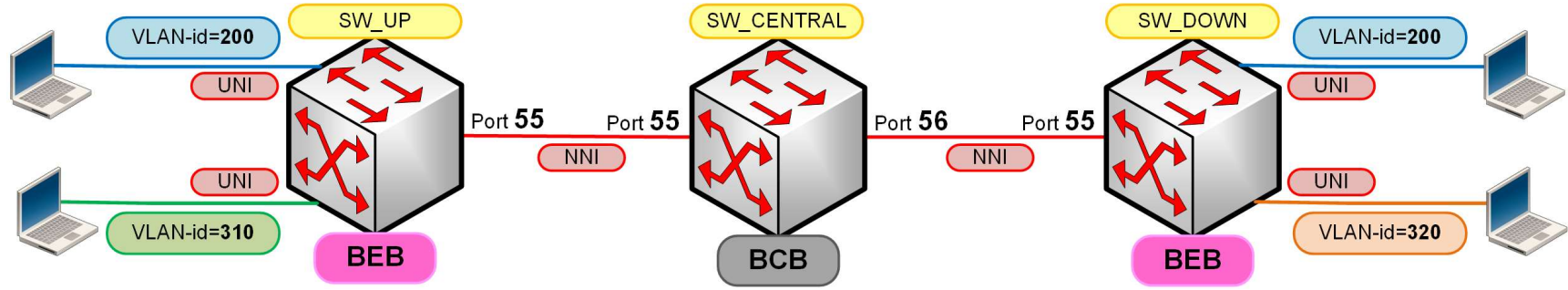
```

Sw_CENTRAL:1#sh isis adjacencies
*****
Command Execution Time: Fri May 24 12:08:56 2024 CEST
*****

-----
                        ISIS Adjacencies
-----
INTERFACE      L STATE      UPTIME PRI  HOLDDTIME  SYSID      HOST-NAME      STATUS  AREA  AREA-NAME
-----
Port1/55       1 UP         00:15:05 127    25 00db.bada.0025  SW-UP         ACTIVE  HOME
Port1/56       1 UP         00:15:32 127    26 00db.bada.0221  SW-DOWN         ACTIVE  HOME

-----
Home: 2 out of 2 interfaces have formed an adjacency
-----
    
```

# Fabric Network: SPBM FIB



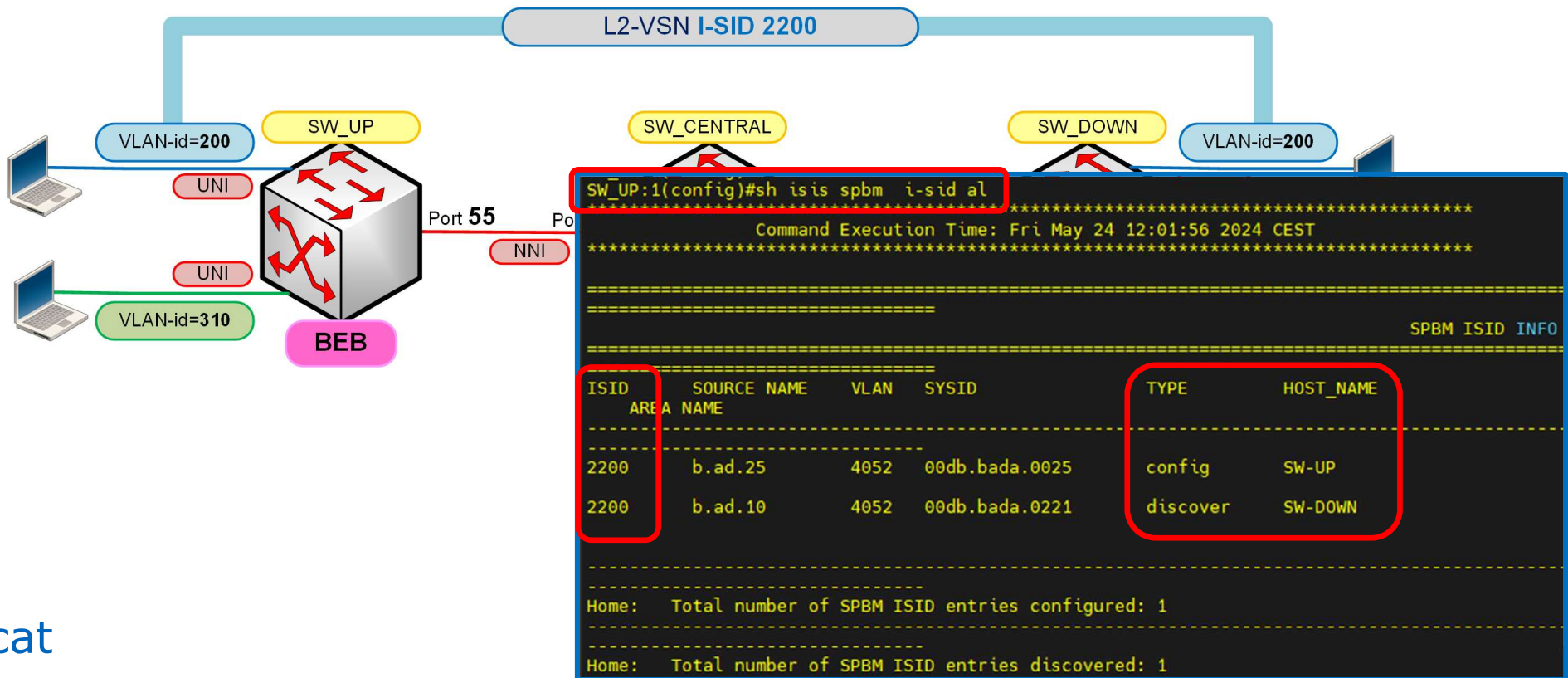
```
SW_UP:1(config)#sh isis spbm unicast-fib
*****
Command Execution Time: Fri May 24 12:16:23 2024 CEST
*****
=====
SPBM UNICAST FIB ENTRY INFO
=====
DESTINATION ADDRESS      BVLAN  SYSID      HOST-NAME      OUTGOING INTERFACE
-----
00:db:ba:da:00:19 4051    00db.bada.0019 SW-CENTRAL      1/55
b2:ad:19:ff:ff:ff 4051    00db.bada.0019 SW-CENTRAL      1/55
00:db:ba:da:00:19 4052    00db.bada.0019 SW-CENTRAL      1/55
b2:ad:19:ff:ff:ff 4052    00db.bada.0019 SW-CENTRAL      1/55
00:db:ba:da:00:25 4051    00db.bada.0025 SW-UP            cpp
b2:ad:25:ff:ff:ff 4051    00db.bada.0025 SW-UP            cpp
00:db:ba:da:00:25 4052    00db.bada.0025 SW-UP            cpp
b2:ad:25:ff:ff:ff 4052    00db.bada.0025 SW-UP            cpp
00:db:ba:da:02:21 4051    00db.bada.0221 SW-DOWN          cpp
b2:ad:10:ff:ff:ff 4051    00db.bada.0221 SW-DOWN          cpp
00:db:ba:da:02:21 4052    00db.bada.0221 SW-DOWN          cpp
b2:ad:10:ff:ff:ff 4052    00db.bada.0221 SW-DOWN          cpp
```

```
SW_DOWN:1#sh isis spbm unicast-fib
*****
Command Execution Time: Fri May 24 12:27:23 2024 CEST
*****
=====
SPBM UNICAST FIB ENTRY INFO
=====
DESTINATION ADDRESS      BVLAN  SYSID      HOST-NAME      OUTGOING INTERFACE      COST
-----
00:db:ba:da:00:19 4051    00db.bada.0019 SW-CENTRAL      1/55                    10
b2:ad:19:ff:ff:ff 4051    00db.bada.0019 SW-CENTRAL      1/55                    10
00:db:ba:da:00:19 4052    00db.bada.0019 SW-CENTRAL      1/55                    10
b2:ad:19:ff:ff:ff 4052    00db.bada.0019 SW-CENTRAL      1/55                    10
00:db:ba:da:00:25 4051    00db.bada.0025 SW-UP            1/55                    20
b2:ad:25:ff:ff:ff 4051    00db.bada.0025 SW-UP            1/55                    20
00:db:ba:da:00:25 4052    00db.bada.0025 SW-UP            1/55                    20
b2:ad:25:ff:ff:ff 4052    00db.bada.0025 SW-UP            1/55                    20
00:db:ba:da:02:21 4051    00db.bada.0221 SW-DOWN          cpp                     0
b2:ad:10:ff:ff:ff 4051    00db.bada.0221 SW-DOWN          cpp                     0
00:db:ba:da:02:21 4052    00db.bada.0221 SW-DOWN          cpp                     0
b2:ad:10:ff:ff:ff 4052    00db.bada.0221 SW-DOWN          cpp                     0
-----
Home: Total number of SPBM UNICAST FIB entries 12
-----
```

# Fabric Network: L2VSN

```
vlan create 200 type port-mstprstp 0
vlan i-sid 200 2200
```

```
vlan create 200 type port-mstprstp 0
vlan i-sid 200 2200
```





# Fabric Network: L2VSN

```
vlan create 200 type port-mstprstp 0  
vlan i-sid 200 2200
```

```
vlan create 200 type port-mstprstp 0  
vlan i-sid 200 2200
```

L2-VSN I-SID 2200

VLAN-id=200

SW\_UP

SW\_CENTRAL

SW\_DOWN:1#sh isis spbm i-sid all

```
*****  
Command Execution Time: Fri May 24 12:12:52 2024 CEST  
*****  
===== SPBM ISID INFO =====  
=====
```

ISID	SOURCE NAME	VLAN	SYSID	TYPE	HOST_NAME
2200	b.ad.25	4052	00db.bada.0025	discover	SW-UP
2200	b.ad.10	4052	00db.bada.0221	config	SW-DOWN

```
-----  
Home: Total number of SPBM ISID entries configured: 1  
-----  
Home: Total number of SPBM ISID entries discovered: 1  
-----
```

SW\_DOWN

VLAN-id=200

UNI

Port 55

NNI

UNI

VLAN-id=320

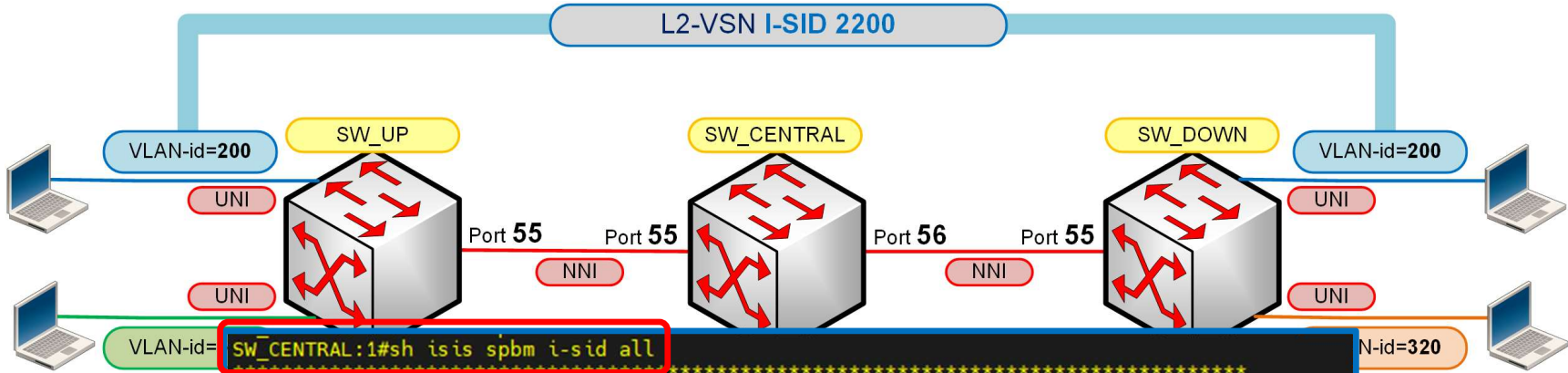
BEB



# Fabric Network: L2VSN

```
vlan create 200 type port-mstprstp 0  
vlan i-sid 200 2200
```

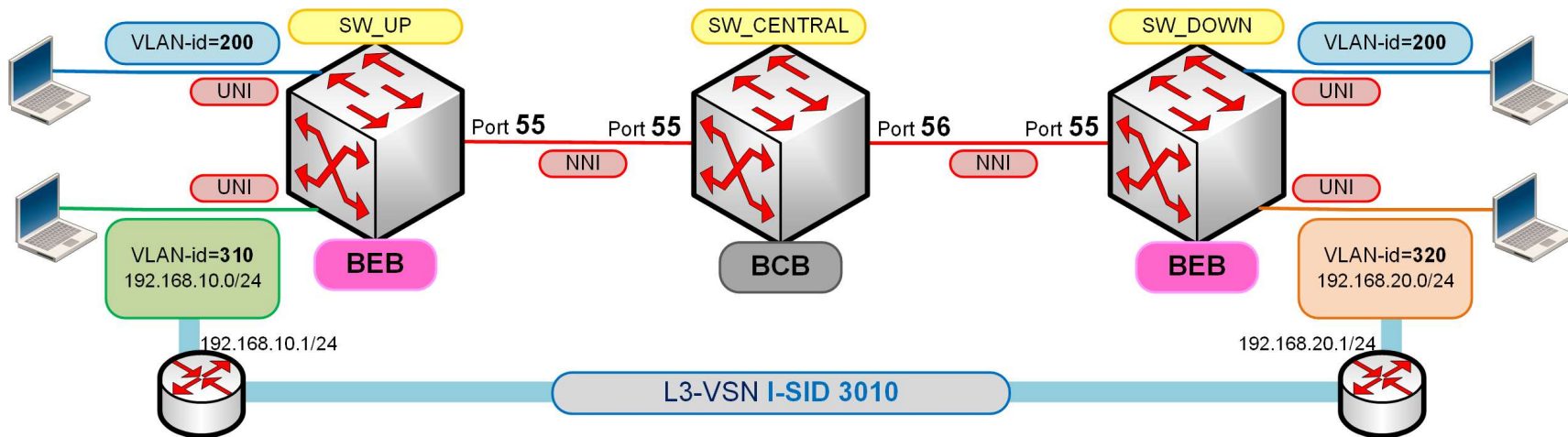
```
vlan create 200 type port-mstprstp 0  
vlan i-sid 200 2200
```



```
SW_CENTRAL:1#sh isis spbm i-sid all  
*****  
Command Execution Time: Fri May 24 12:03:40 2024 CEST  
*****  
===== SPBM ISID INFO =====  
=====
```

ISID	AREA	SOURCE NAME	VLAN	SYSID	TYPE	HOST_NAME
2200		b.ad.25	4052	00db.bada.0025	discover	SW-UP
2200		b.ad.10	4052	00db.bada.0221	discover	SW-DOWN

# Fabric Network: L3VSN

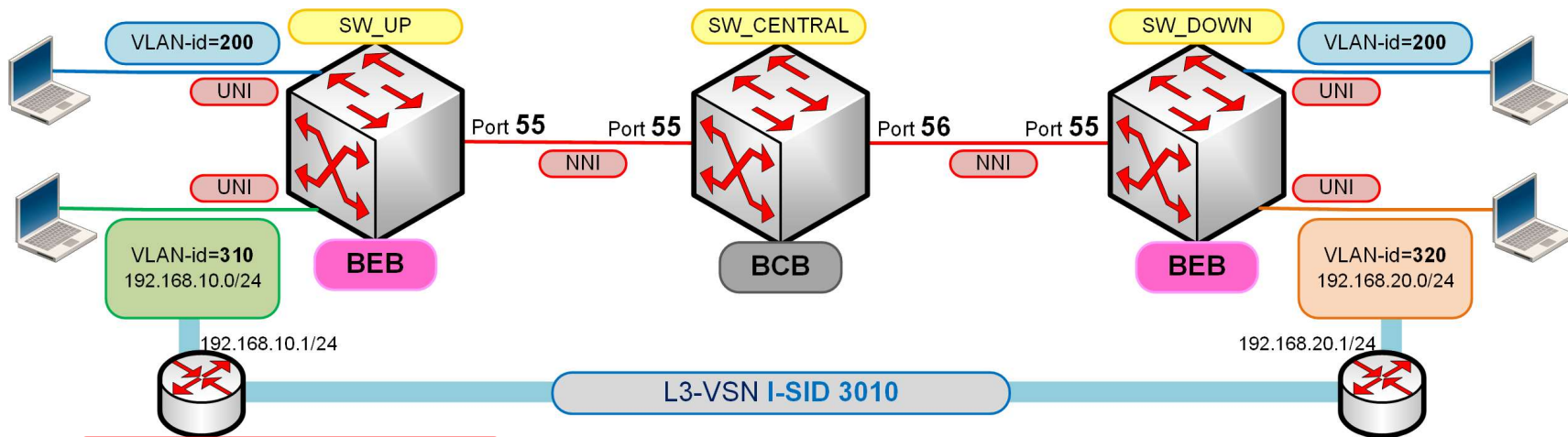


```
#  
# VRF CONFIGURATION  
#  
ip vrf peda1 vrfid 1
```

```
vlan create 310 type port-mstprstp 0  
vlan members 310 1/1-1/10 portmember  
interface Vlan 310  
vrf peda1  
ip address 192.168.10.1 255.255.255.0 0
```

```
#  
# ISIS SPBM IPVPN CONFIGURATION  
#  
router vrf peda1  
ipvpn  
i-sid 3010  
ipvpn enable  
exit
```

# Fabric Network: L3VSN



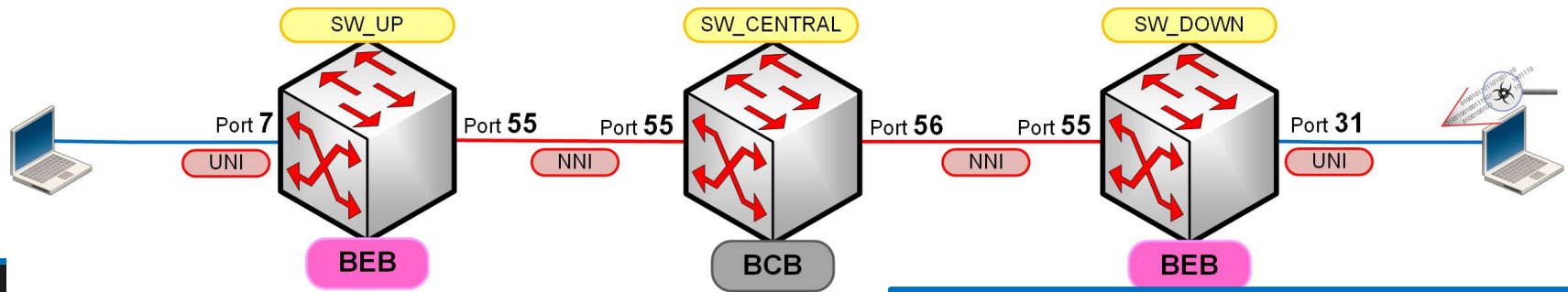
```

Sw_UP:1#sh ip route vrfids 1
*****
Command Execution Time: Fri May 24 12:36:40 2024 CEST
*****
=====
IP Route - VRF peda1
=====
DST          MASK          NEXT          NH          COST    INTER  PROT AGE  TYPE  PRF
VRF/ISID
-----
192.168.10.0 255.255.255.0 192.168.10.1 -          1      310    LOC  0    DB    0
192.168.20.0 255.255.255.0 SW-DOWN       peda1      20     4051   ISIS 0    IBSV  7
=====
2 out of 2 Total Num of Route Entries, 2 Total Num of Dest Networks displayed.
=====

```



# Fabric Network: Fabric RSPAN

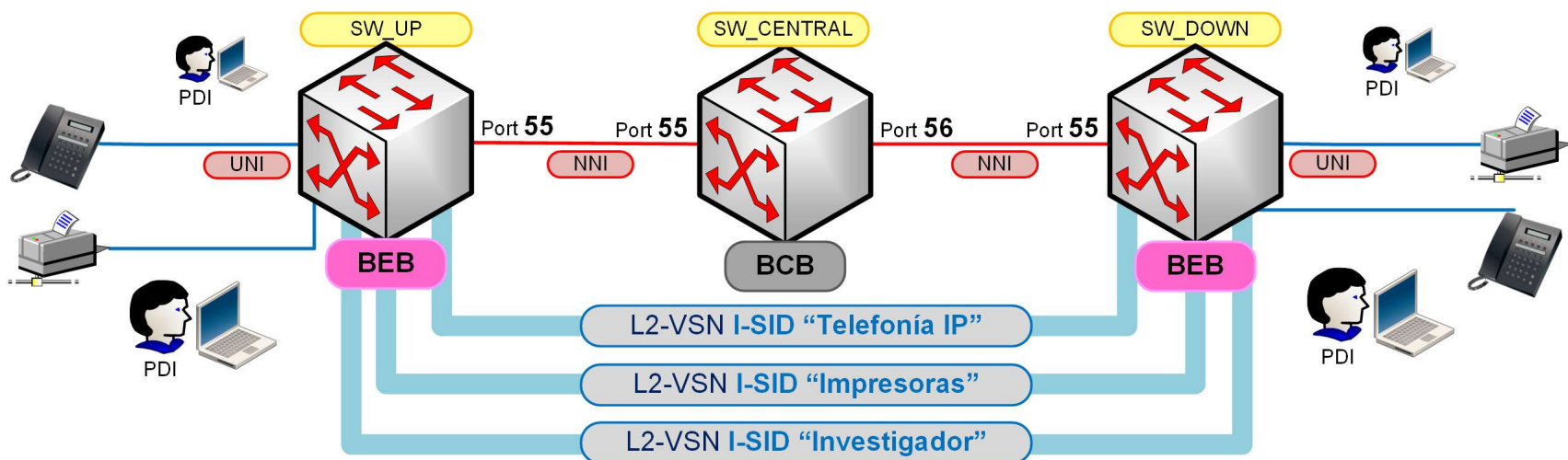


```
#
# DIAG CONFIGURATION
#
mirror-by-port 1 in-port 1/7 monitor-isid-offset 1
```

```
#
# DIAG CONFIGURATION
#
monitor-by-isid 1 monitor-isid-offset 1 egress-ports 1/31
```

```
SW_UP:1(config)#sh isis spbm i-sid all
*****
Command Execution Time: Fri May 24 13:08:19 2024 CEST
*****
=====
SPBM ISID INFO
=====
ISID      SOURCE NAME  VLAN  SYSID      TYPE      HOST_NAME      ISID NAME      AREA
  AREA NAME
-----
2200     b.ad.25     4052  00db.bada.0025  config   SW-UP          ISID-2200      HOME
16776000 b.ad.25     4052  00db.bada.0025  config   SW-UP          MIRROR-ISID    HOME
2200     b.ad.10     4052  00db.bada.0221  discover SW-DOWN        ISID-2200      HOME
```

# Fabric Network: Zero-touch y Zero-Trust



## Fabric Network: Zero-touch y Zero-Trust

- **IMPORTANT:** imatge per provisionament dinàmic d'un L2SVN amb autenticació (MAC/802.1x..): ISID es crea automàticament al switch Edge, abans el broadcast de la VLAN no arribava al switch + col·laboració amb CNI per l'homologació de VOSS a EMMA.
- Només trob assignació dinàmica I-SID-VLAN amb FA???



## Fabric Network: beneficios

- Con una **Fabric Network** conseguimos, entre otros:
  - Mejorar el **tiempo de despliegue** de un servicio de red: L2, L3, mcast.
  - Mejorar la **disponibilidad** de la red (aumento de **enlaces redundantes**).
  - Mejorar el **tiempo de recuperación** en caso de un nodo/enlace caído.
  - Mejorar la **QoE**, calidad de la experiencia de los usuarios/dispositivos debido a que su tráfico se transporta por los mejores paths (**↓latencia**).
  - Minimizar el impacto de los **errores del administrador de red**. Los servicios de red se configuran en el borde de la red (**Edge**), no en el core.
  - Gestionar eficientemente la propagación del **tráfico broadcast**.
  - Mejorar la seguridad de la red virtualizándola con múltiples **overlays**.



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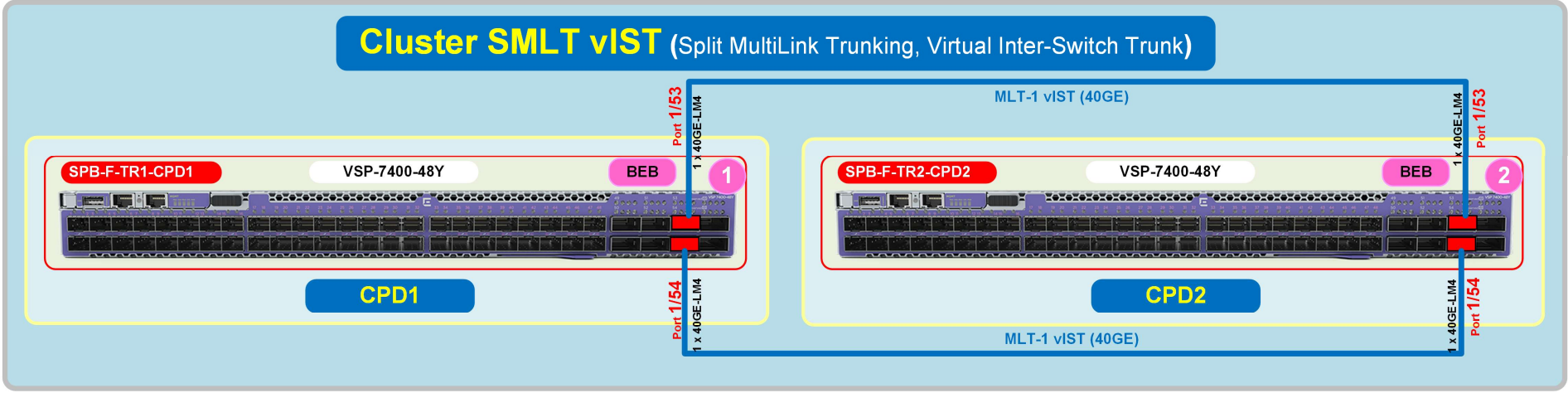
3

Fabric Network de la UIB

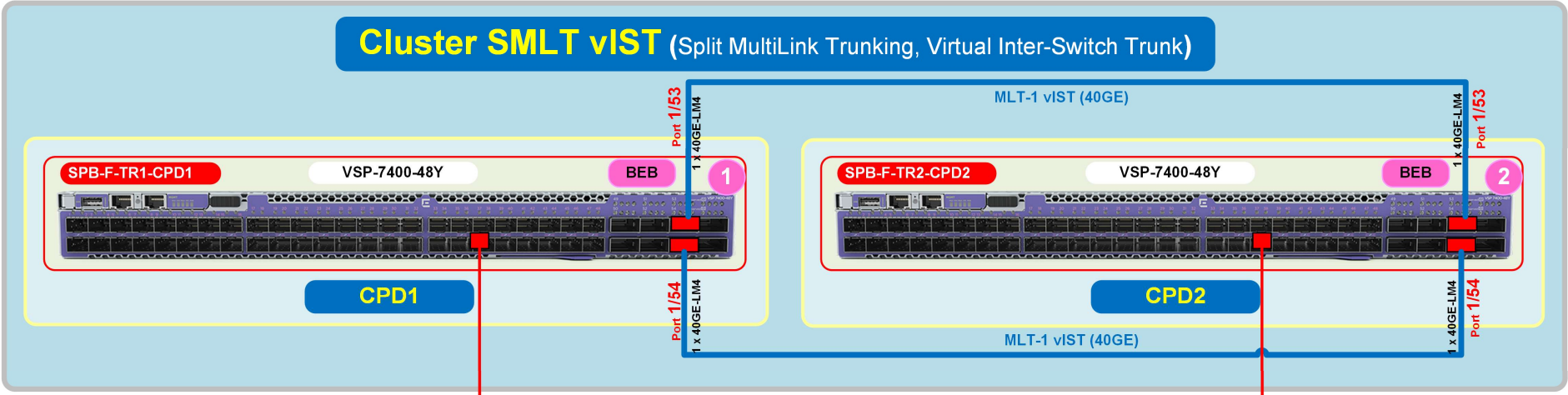
- Situación **actual** Fabric Network UIB:
  - Capa de **núcleo**: **2** x VSP-7400 (migración completa)
  - Capa de **agregación**: **3** x 5520-24X
  - Capa de **acceso**: **20** x 5320-48T/**P**
- Situación **futura** (adjudicación provisional suministro):
  - Capa de **agregación**: **9** x 5520-24X (permitirá migración completa)
  - Capa de **acceso**: **89** x 5320-48T y **3** x 5320-48**P**
- Pendiente adquisición:
  - Capa de **acceso**: dos edificios y switches PoE/PoE+

- Switches de **núcleo**:
  - VSP 7400-48Y-8C y 4 x QSFP+ 40GE
- Switches de **agregación/distribución**:
  - 5520-24X y 5520-VIM-4YE (25GE)
- Switches de **acceso**:
  - 5320-48T-8XE (10GE)
  - 5320-48**P**-8XE (10GE)
- Switches de **CPD**:
  - 5720-48MXW (1/2.5/5/10GE) y 5720-VIM-6YE (25GE)

# Fabric Network UIB: core



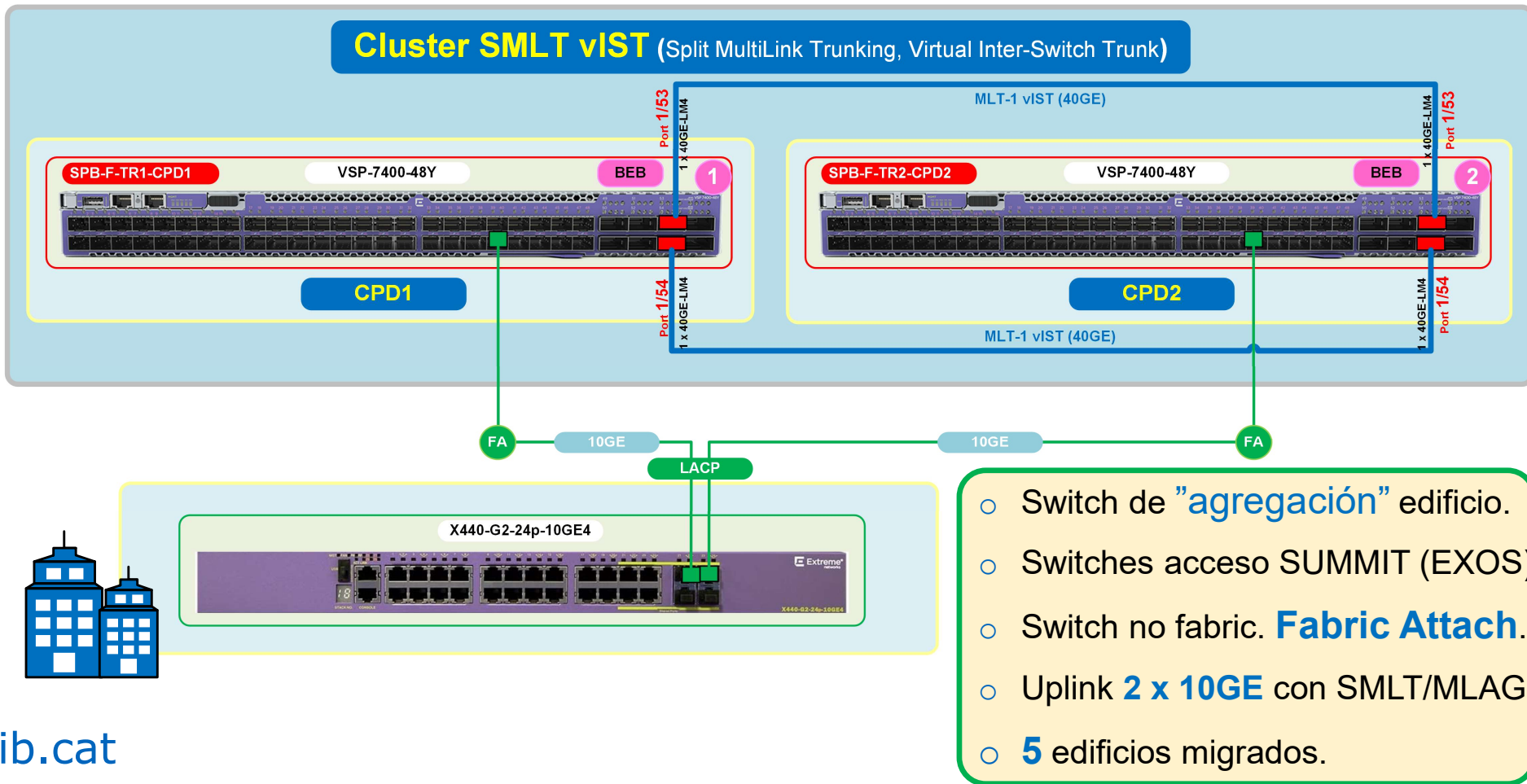
# Fabric Network UIB: agregación fabric



uib.cat

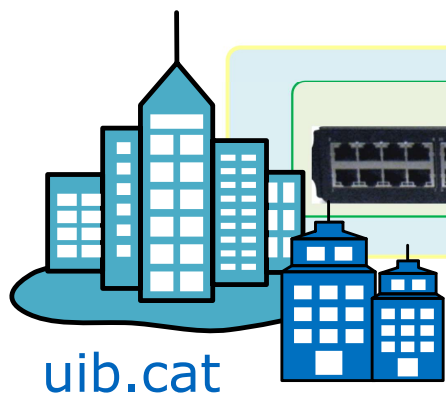
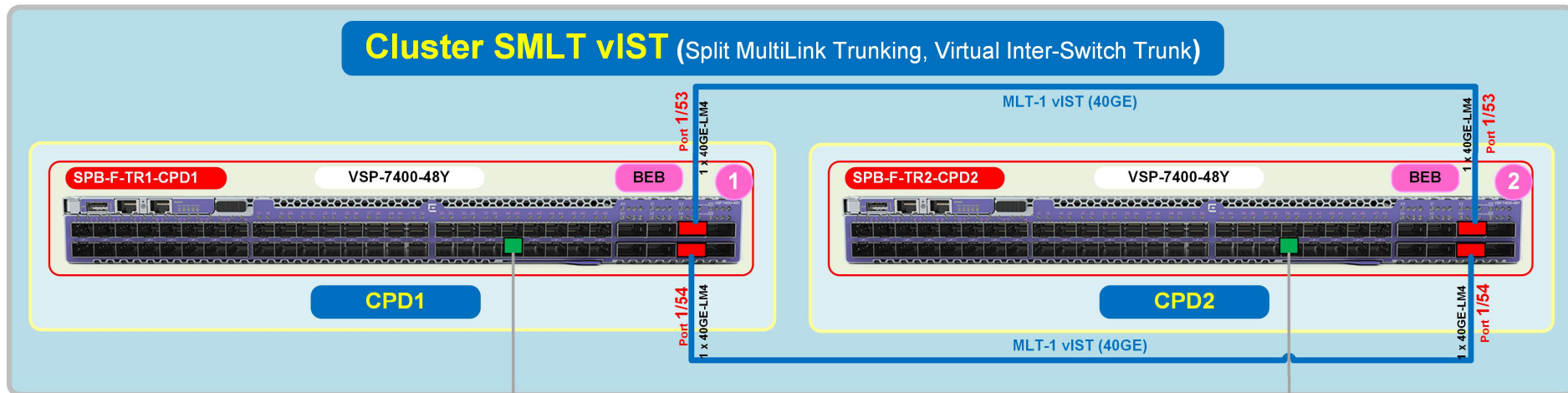
- Switch de **agregación** de edificio.
- Switch **fabric** (BEB o BCB)
- Uplink **10** o **25GE**. No agregados
- **3** edificios migrados.
- Resto edificios a migrar en **2024**.

# Fabric Network UIB: agregación FA





# Fabric Network UIB: agregación “legacy”

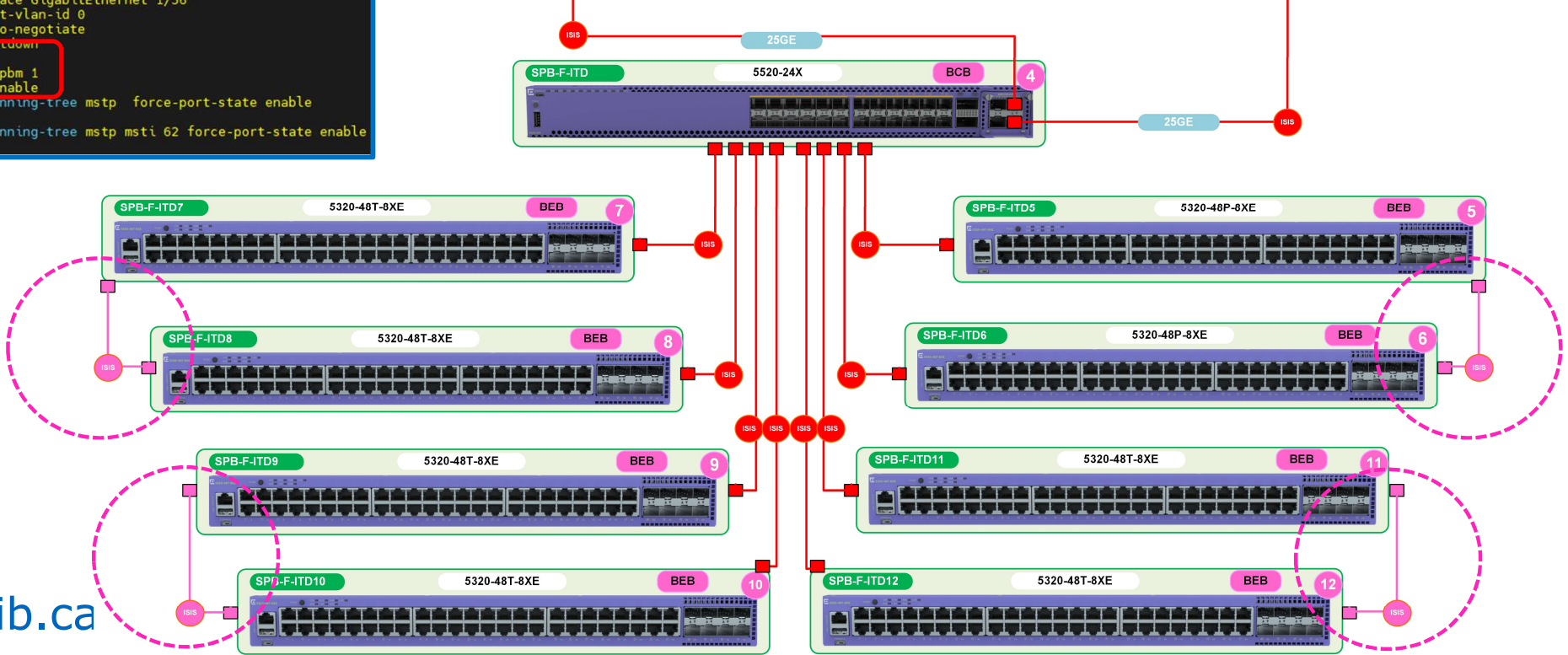
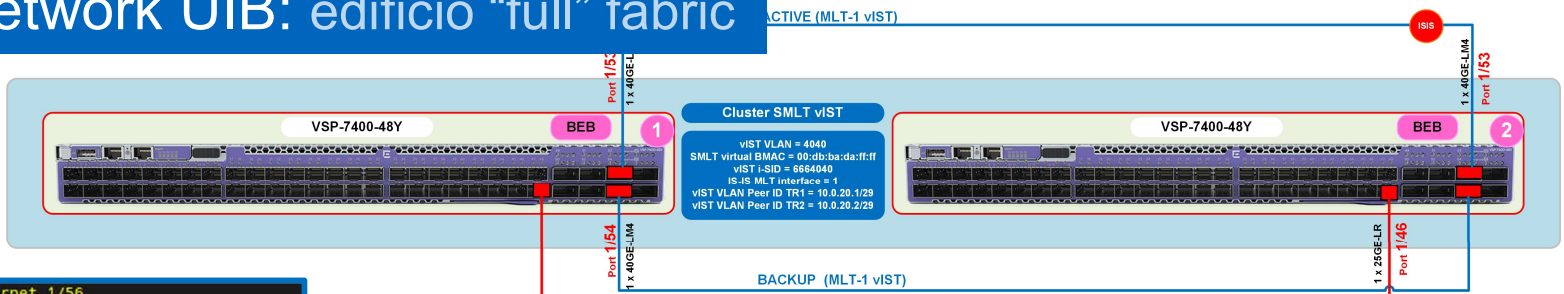


- Switch de **agregación** de edificio.
- Switch no fabric. **“Legacy”**.
- Uplink **2x1/10GE** con SMLT/MLAG
- Migración **14** edificios **2024**.

# Fabric Network UIB: edificio "full" fabric

```

interface GigabitEthernet 1/56
default-vlan-id 0
no auto-negotiate
no shutdown
isis
isis spbm 1
isis enable
no spanning-tree mstp force-port-state enable
no spanning-tree msti 62 force-port-state enable
exit
    
```



# Fabric Network UIB: servicios

6660010	b.ad.23	4052	00db.bada.0023	discover	SPB-F-CB11	ISID-6660010	HOME
6660060	b.ad.23	4052	00db.bada.0023	discover	SPB-F-CB11	ISID-6660060	HOME
6660090	b.ad.23	4052	00db.bada.0023	discover	SPB-F-CB11	ISID-6660090	HOME
6660031	b.ad.26	4051	00db.bada.0026	discover	SPB-F-HOT2	ISID-6660031	HOME
6660053	b.ad.26	4051	00db.bada.0026	discover	SPB-F-HOT2	ISID-6660053	HOME
6660060	b.ad.26	4052	00db.bada.0026	discover	SPB-F-HOT2	ISID-6660060	HOME
6660130	b.ad.26	4052	00db.bada.0026	discover	SPB-F-HOT2		

```

-----
Home: Total number of SPBM ISID entries configured: 144
-----
Home: Total number of SPBM ISID entries discovered: 269
Remote: Total number of SPBM ISID entries discovered: 0
-----
Home: Total number of SPBM ISID entries: 413
Remote: Total number of SPBM ISID entries: 0
-----

```

EXTR1:1#

00:db:ba:da:00:16	4052	00db.bada.0016	SPB-F-CB4	1/27	20	HOME
b2:ad:16:ff:ff:ff	4052	00db.bada.0016	SPB-F-CB4	1/27	20	HOME
00:db:ba:da:00:17	4051	00db.bada.0017	SPB-F-CB5	1/27	20	HOME
b2:ad:17:ff:ff:ff	4051	00db.bada.0017	SPB-F-CB5	1/27	20	HOME
00:db:ba:da:00:17	4052	00db.bada.0017	SPB-F-CB5	1/27	20	HOME
b2:ad:17:ff:ff:ff	4052	00db.bada.0017	SPB-F-CB5	1/27	20	HOME
00:db:ba:da:00:18	4051	00db.bada.0018	SPB-F-CB6	1/27	20	HOME
b2:ad:18:ff:ff:ff	4051	00db.bada.0018	SPB-F-CB6	1/27	20	HOME
00:db:ba:da:00:18	4052	00db.bada.0018	SPB-F-CB6	1/27	20	HOME
b2:ad:18:ff:ff:ff	4052	00db.bada.0018	SPB-F-CB6	1/27	20	HOME
00:db:ba:da:00:20	4051	00db.bada.0020	SPB-F-CB8	1/27	20	HOME
b2:ad:20:ff:ff:ff	4051	00db.bada.0020	SPB-F-CB8	1/27	20	HOME
00:db:ba:da:00:20	4052	00db.bada.0020	SPB-F-CB8	1/27	20	HOME
b2:ad:20:ff:ff:ff	4052	00db.bada.0020	SPB-F-CB8	1/27	20	HOME
00:db:ba:da:00:21	4051	00db.bada.0021	SPB-F-CB9	1/27	20	HOME
b2:ad:21:ff:ff:ff	4051	00db.bada.0021	SPB-F-CB9	1/27	20	HOME
00:db:ba:da:00:21	4052	00db.bada.0021	SPB-F-CB9	1/27	20	HOME
b2:ad:21:ff:ff:ff	4052	00db.bada.0021	SPB-F-CB9	1/27	20	HOME
00:db:ba:da:00:22	4051	00db.bada.0022	SPB-F-CB10	1/27	20	HOME
b2:ad:22:ff:ff:ff	4051	00db.bada.0022	SPB-F-CB10	1/27	20	HOME
00:db:ba:da:00:22	4052	00db.bada.0022	SPB-F-CB10	1/27	20	HOME
b2:ad:22:ff:ff:ff	4052	00db.bada.0022	SPB-F-CB10	1/27	20	HOME
00:db:ba:da:00:23	4051	00db.bada.0023	SPB-F-CB11	1/27	20	HOME
b2:ad:23:ff:ff:ff	4051	00db.bada.0023	SPB-F-CB11	1/27	20	HOME
00:db:ba:da:00:23	4052	00db.bada.0023	SPB-F-CB11	1/27	20	HOME
b2:ad:23:ff:ff:ff	4052	00db.bada.0023	SPB-F-CB11	1/27	20	HOME
00:db:ba:da:00:26	4051	00db.bada.0026	SPB-F-HOT2	1/48	20	HOME
b2:ad:26:ff:ff:ff	4051	00db.bada.0026	SPB-F-HOT2	1/48	20	HOME
00:db:ba:da:00:26	4052	00db.bada.0026	SPB-F-HOT2	1/48	20	HOME
b2:ad:26:ff:ff:ff	4052	00db.bada.0026	SPB-F-HOT2	1/48	20	HOME

```

-----
Home: Total number of SPBM UNICAST FIB entries 96
Remote: Total number of SPBM UNICAST FIB entries 0
-----

```

- 144 I-SIDs L2-VSN
- 25 switches Fabric Connect

uib.cat

# Gracias!

```
FABRIC-UIB# Hello fabric users!
```

```
FABRIC-UIB# reload  
Now, this system is shutting down...  
Xavier Bonet y Miquel Bordoy
```



**Universitat**  
de les Illes Balears