



# FDF Routing



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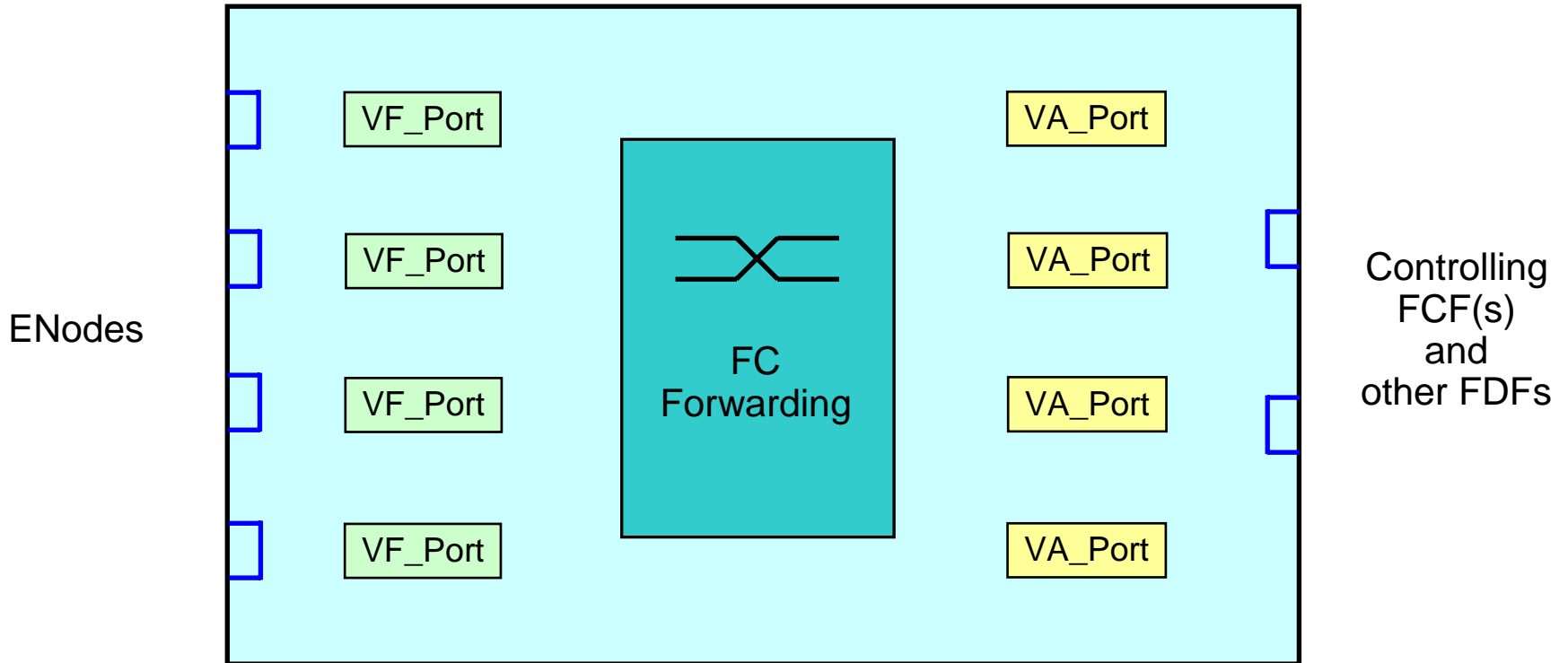
T11/10-465v0, October 2010



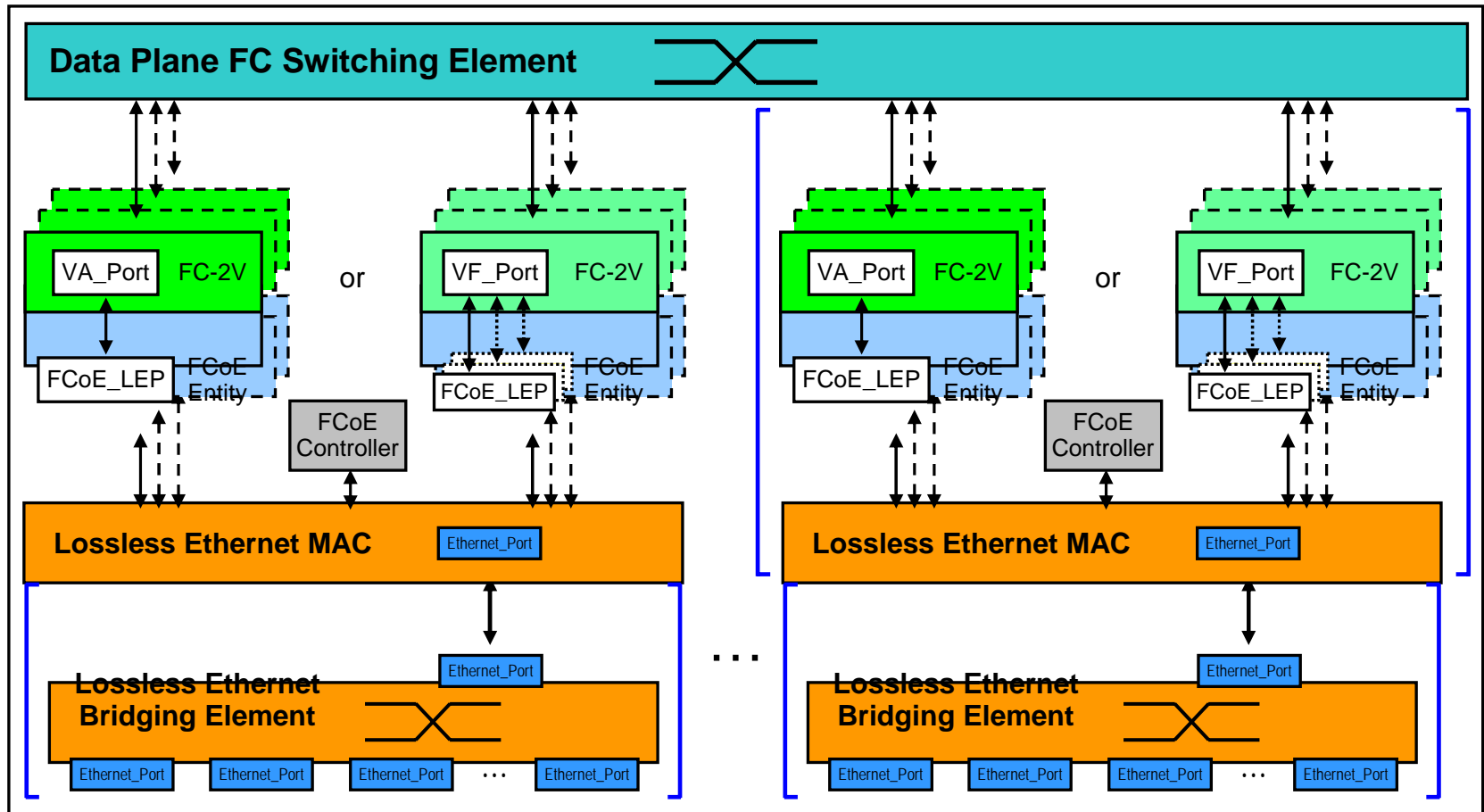
# The FDF

- **FC/FCoE Data-plane Forwarder**
  - A simple data plane entity fully controlled by the Controlling FCF
- **The combination Controlling FCF / controlled FDFs behave as a single distributed FCF**
- **FDFs instantiate VF\_Ports and VA\_Ports**
- **VF\_Ports operate as defined in FC-BB-5**
- **VA\_Ports:**
  - Are not VE\_Ports**
  - Are instantiated through FIP ELP with FDF flag**
  - Performs Virtual Link maintenance through FIP advertisements**
  - Use only four new SW\_ILSs:**
    - N\_Port\_ID Range Allocation
    - N\_Port\_ID Allocation Request
    - N\_Port\_ID Deallocation Request
    - N\_Port\_ID and Zoning ACL Distribution

# FDF Forwarding



# FDF Functional Model



# Let's Remember “Networking 101” (1)

- **When studying networking, we learn some basic routing concepts**

- **Routing can be:**

**Static: the forwarding tables are pre-computed and configured in each intermediate system of the network**

E.g.: the public telephone network

**Dynamic: the forwarding tables are dynamically computed by the network**

# Let's Remember “Networking 101” (2)

- **Dynamic routing can be:**

**Centralized:** a central node knows the network structure and addressing, computes the routes, and distributes the computed routes to the remaining nodes

Works properly in presence of a set of entities controlled by a central entity

A route distribution protocol is needed

**Distributed:** each node computes independently the routes

Works properly in presence of a set of equivalent entities

E.g., a set of IP routers, or a set of FC switches

A distributed routing protocol is needed

E.g., IS-IS, OSPF, RIP, FSPF

# Controlling FCF vs. FDFs

- **A Controlling FCF and its FDFs are in a hierarchical relationship**

**FDFs are controlled by the Controlling FCF and operates according to the information it sends them**

**They are not equivalent nodes**

- **The proper routing algorithm is centralized routing**

**The Controlling FCF assign addresses, computes the routes, and distributes addresses and routes to its FDFs**

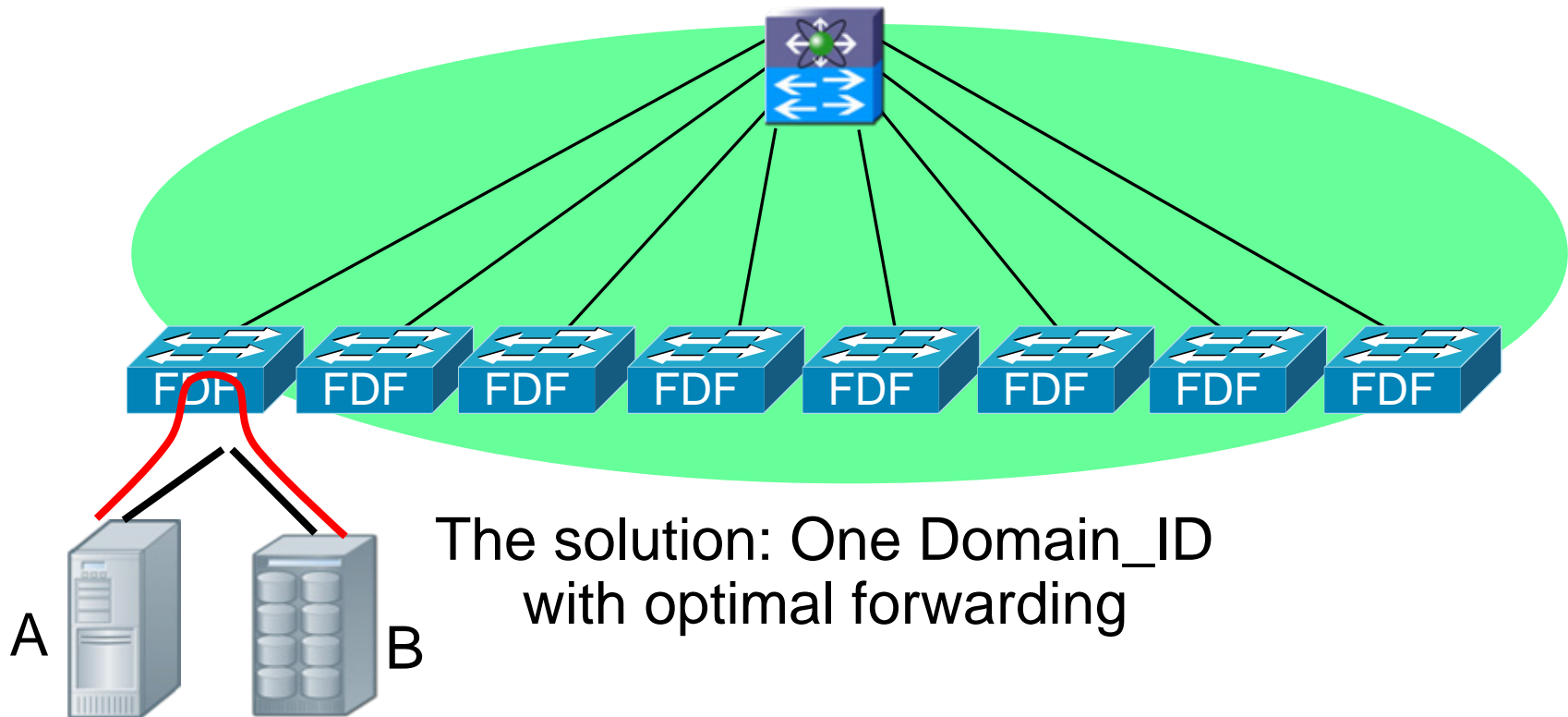
**A route distribution protocol is needed**

**A distributed routing protocol is an overkill**

**An FDF does not need to compute routes**

# Controlling FCF / FDFs

## Controlling FCF



# The VA\_Port Route Distribution Protocol

- **The Controlling FCF distributes Routes to its FDFs via two SW\_ILSs:**

## **N\_Port\_ID Range Allocation SW\_ILS**

Used when an FDF first connect to a Controlling FCF

Provides the “local routes” (i.e., the reachable N\_Port\_IDs on the Virtual Domain controlled by the controlling FCF) and the “remote routes” (i.e., the Domain\_IDs reachable through the sending Controlling FCF)

## **N\_Port\_ID and Zoning ACL Distribution SW\_ILS**

Used when an N\_Port\_ID is assigned

Provides both route and policy update

# N\_Port\_ID Range Allocation SW\_ILS

Local routes:  
An entry per each  
controlled FDF

Remote routes:  
An entry per each  
remote Domain\_ID

Item	Size
SW_ILS Code	4
Controlling FCF Switch_Name	8
Recipient FDF_Name	8
Number of N_Port_ID Range Entries (p)	4
N_Port_ID Range Entry #1	
N_Port_ID Range Entry #2	
...	
N_Port_ID Range Entry #p	
Number of Reachable Domain_ID Entries (r)	4
Reachable Domain_ID Entry #1	
Reachable Domain_ID Entry #2	
...	
Reachable Domain_ID Entry #r	

# N\_Port\_ID Range and Reachable Domain\_ID Entries

Item	Size
FDF_Name	8
Number of N_Port_ID Ranges (q)	4
N_Port_ID Range #1	4
N_Port_ID Range #2	4
...	
N_Port_ID Range #q	4

The N\_Port\_ID Range is defined by an N\_Port\_ID in the least significant three bytes, and by the number of bits defining the range in the most significant byte (e.g., 1.2.0/15)

Item	Size
Reachable Domain_ID, cost	4

The Reachable Domain\_ID is defined by a Domain\_ID in the most significant byte, and by the cost to reach it in the least significant three bytes (e.g., 24, cost 1250)

# N\_Port\_ID and Zoning ACL Distribution SW\_ILS

Item	Size
SW_ILS Code	4
Controlling FCF Switch_Name	8
Recipient FDF_Name / Controlling FCF Switch_Name	8
Flags	4
N_Port_Name of Allocated/Deallocated N_Port_ID	8
Allocated/Deallocated N_Port_ID	4
FDF_Name of the FDF to which the Allocated/Deallocated N_Port_ID is connected	8
FLOGI LS_ACC Parameters	116
Number of Peering Entries (h)	4
Peering Entry #1	
Peering Entry #2	
...	
Peering Entry #h	

Route update:  
An N\_Port\_ID  
is allocated or  
deallocated

Policy  
Update:  
Zoning ACL  
distribution

The most  
significant bit of  
the most  
significant byte  
indicates  
deallocation vs.  
allocation

Present only if  
the appropriate  
flag is set to  
one

# Peering Entry Format

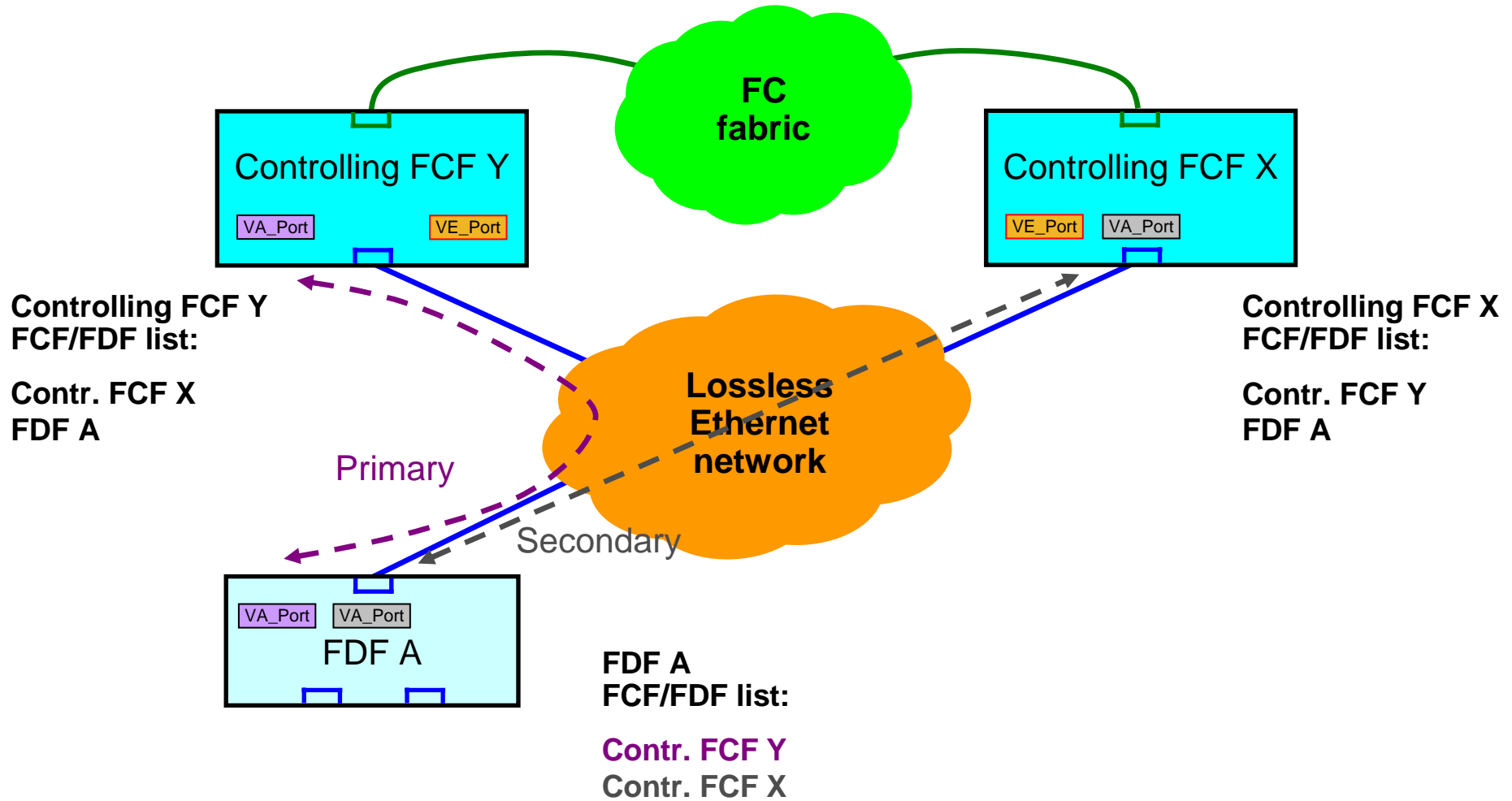
Item	Size
Peering N_Port_ID	4
Number of Allowed Peers (k)	4
Peer N_Port_ID #1	4
Peer N_Port_ID #2	4
...	
Peer N_Port_ID #k	4

# N\_Port\_ID Range Allocation SW\_ACC

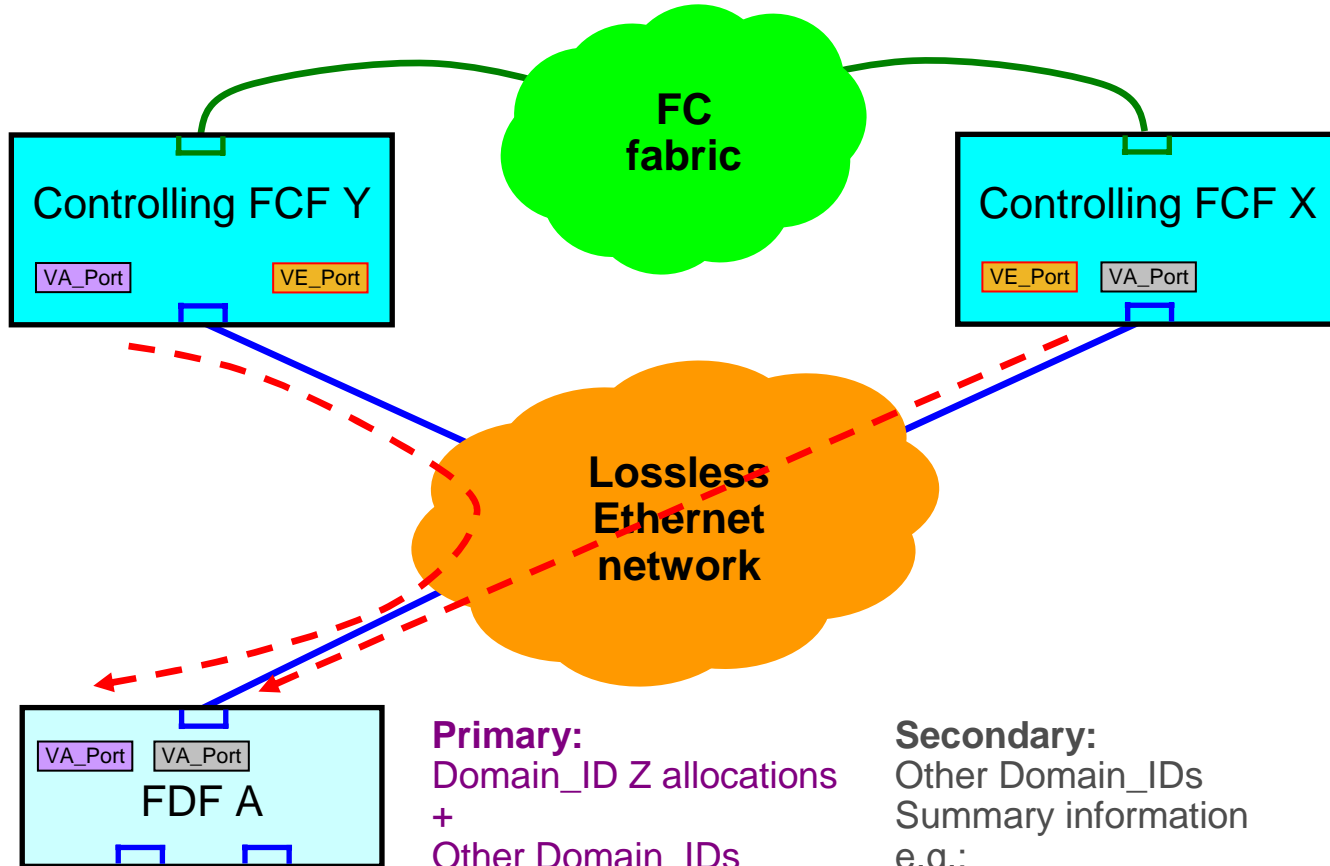
## N\_Port\_ID and Zoning ACL Distribution SW\_ACC

Item	Size
SW_ACC Code	4

# VA\_Port to VA\_Port Virtual Links



# N\_Port\_ID Range Allocation Distribution



$my < mx$   
 $nx < ny$   
 $py < px$

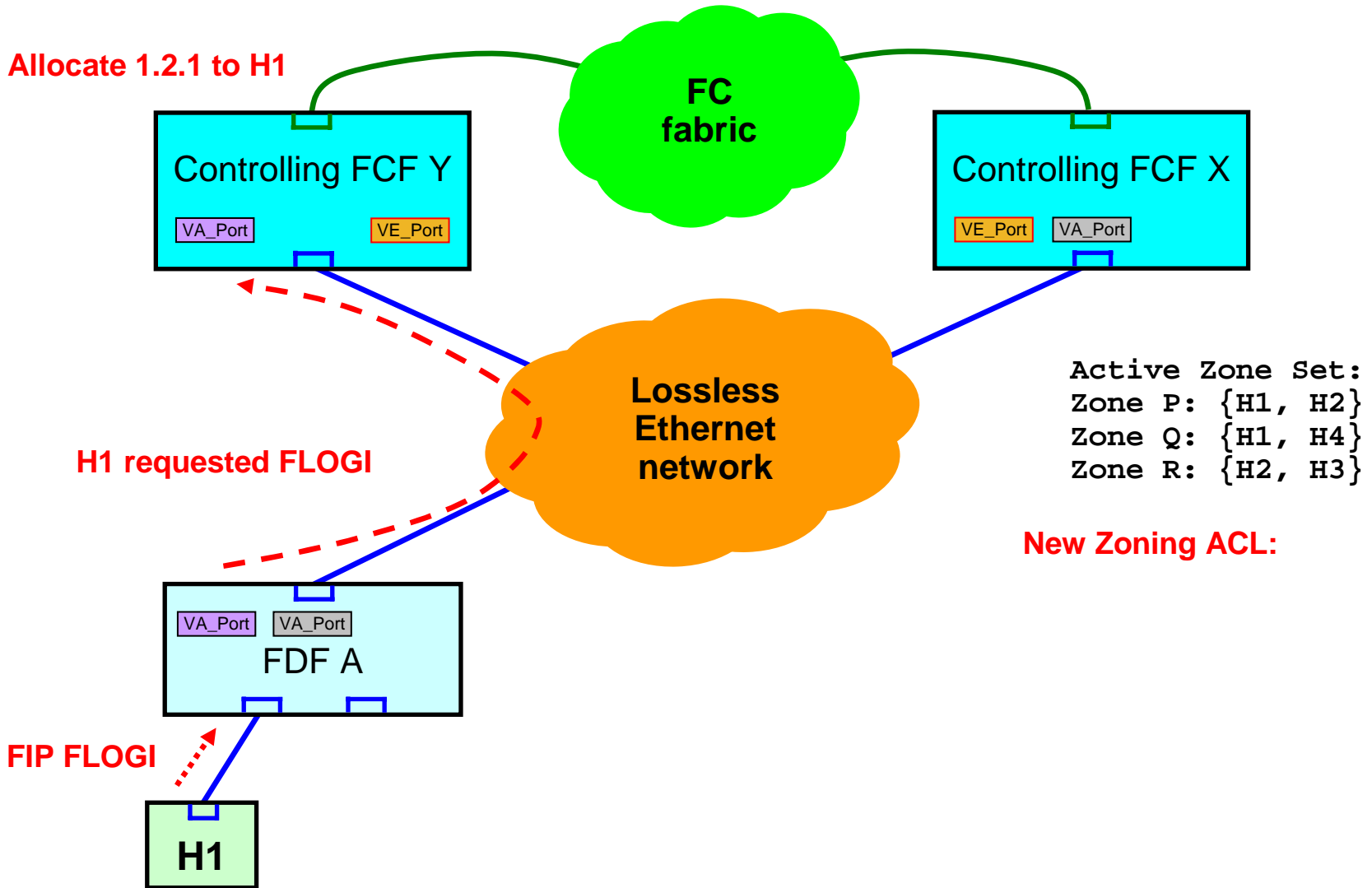
## FDF A Forwarding Table:

$M \rightarrow$  Contr. FCF Y  
 $N \rightarrow$  Contr. FCF X  
 $P \rightarrow$  Contr. FCF Y

**Primary:**  
 Domain\_ID Z allocations  
 +  
 Other Domain\_IDs  
 Summary information  
 e.g.:  
 Domain\_ID M, cost  $my$   
 Domain\_ID N, cost  $ny$   
 Domain\_ID P, cost  $py$

**Secondary:**  
 Other Domain\_IDs  
 Summary information  
 e.g.:  
 Domain\_ID M, cost  $mx$   
 Domain\_ID N, cost  $nx$   
 Domain\_ID P, cost  $px$

# H1 N\_Port\_ID Allocation

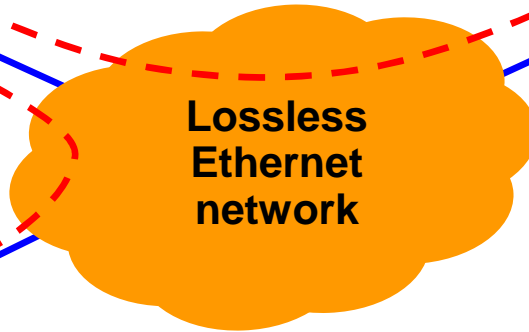


# N\_Port\_ID and Zoning ACL Distribution

Allocate 1.2.1 to H1

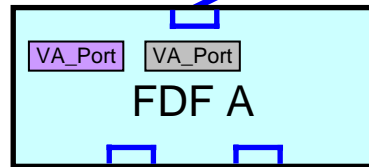


H1: 1.2.1, FDF A, alloc



H1: 1.2.1, FDF A, alloc

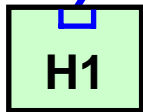
Active Zone Set:  
 Zone P: {H1, H2}  
 Zone Q: {H1, H4}  
 Zone R: {H2, H3}



**FDF A Forwarding Table:**

1.2.1 → self [P1]  
 M → Contr. FCF Y  
 N → Contr. FCF X  
 P → Contr. FCF Y

FIP FLOGI ACC



1.2.1

# N\_Port\_ID Allocation Request SW\_ILS

Item	Size
SW_ILS Code	4
Requesting FDF_Name	8
Controlling FCF Switch_Name	8
F_Port_Name	8
FLOGI/NPIV FDISC Parameters	116

# N\_Port\_ID Deallocation Request SW\_ILS

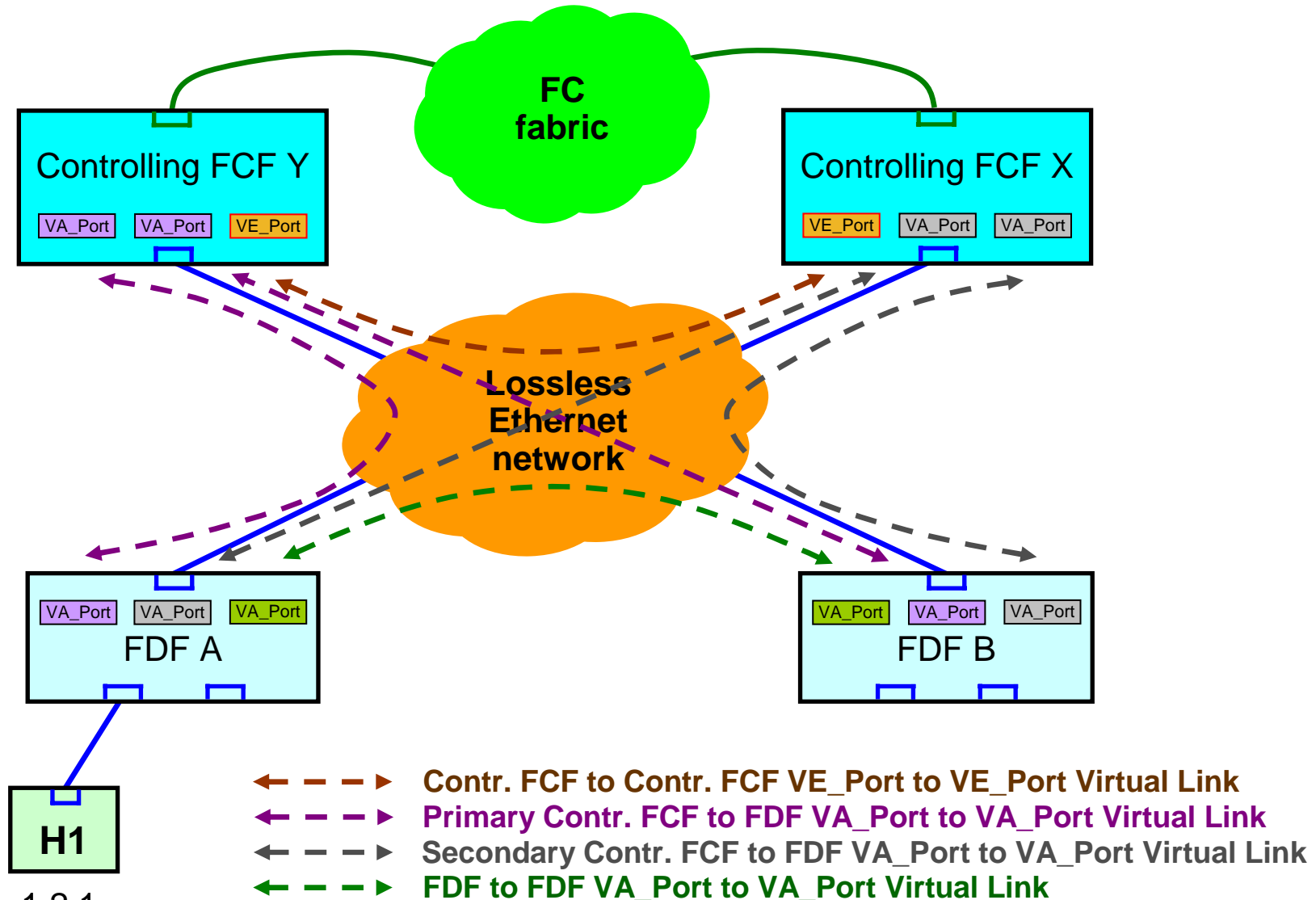
Item	Size
SW_ILS Code	4
Requesting FDF_Name	8
Controlling FCF Switch_Name	8
Unreachable N_Port_Name	8
Unreachable N_Port_ID	4

# N\_Port\_ID Allocation Request SW\_ACC

## N\_Port\_ID Deallocation Request SW\_ACC

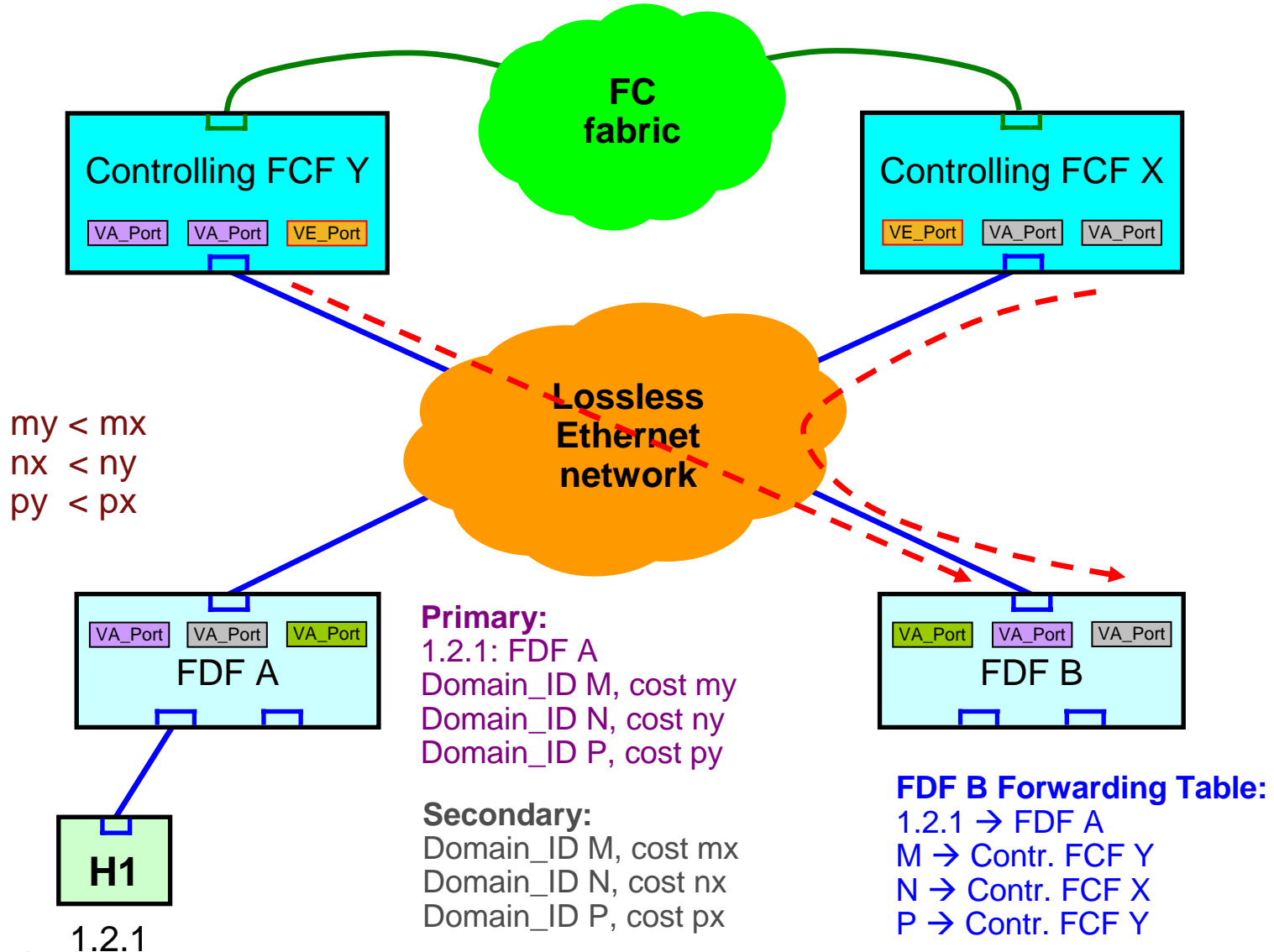
Item	Size
SW_ACC Code	4

# Virtual Links

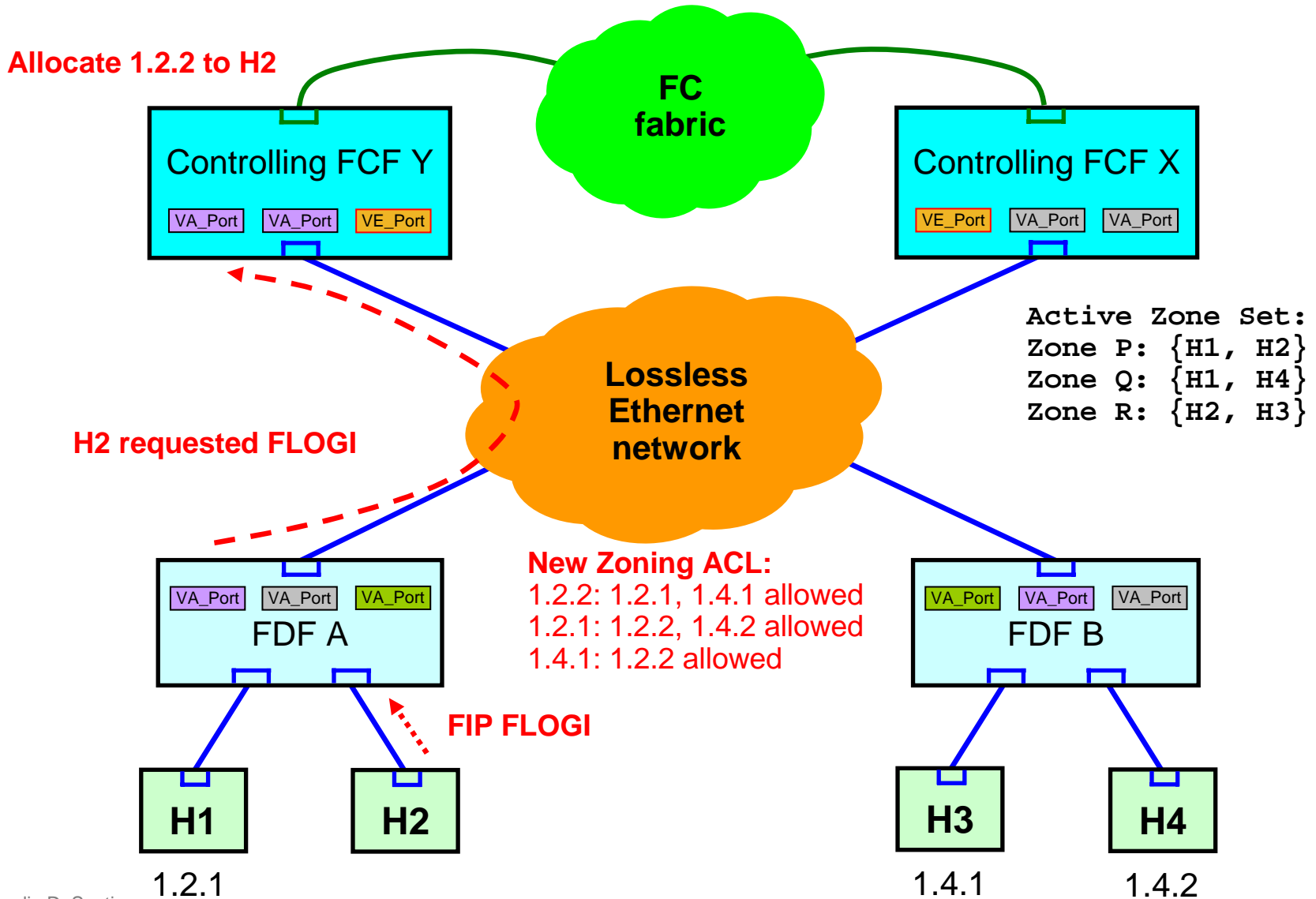


1.2.1

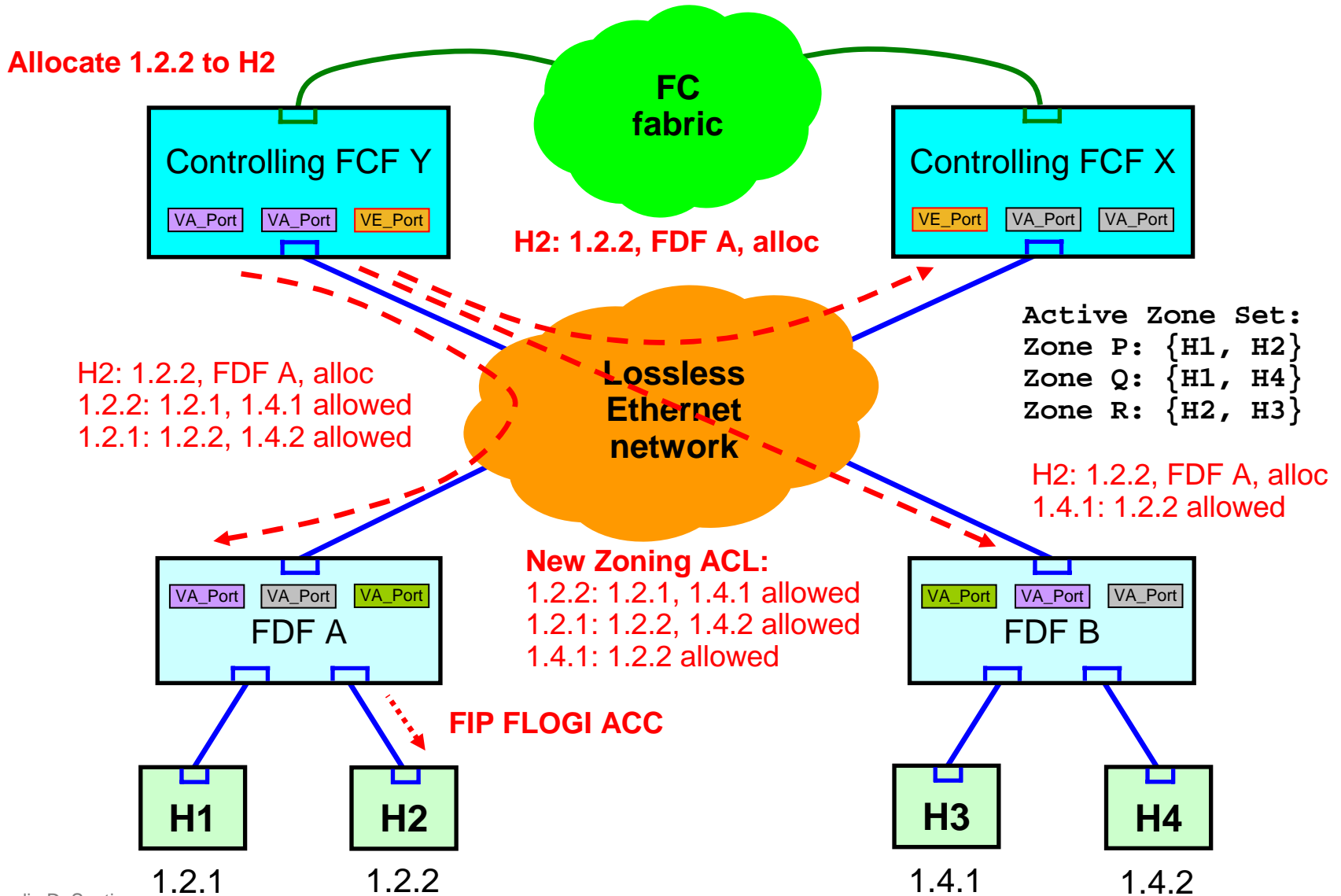
# N\_Port\_ID Range Allocation Distribution



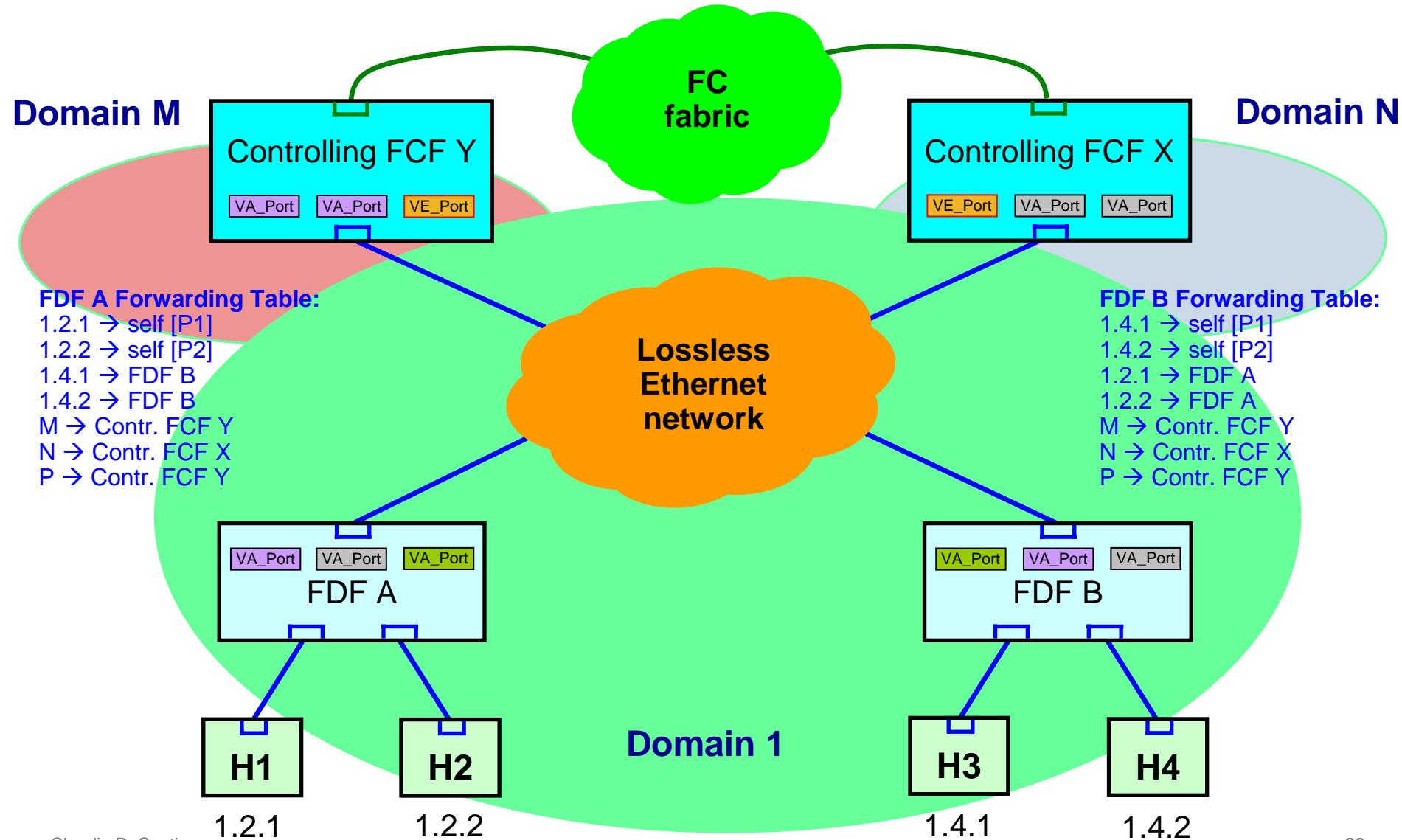
# N\_Port\_ID Allocation (2)



# N\_Port\_ID and Zoning ACL Distribution (2)



# Forwarding Tables



# Distributed FCF

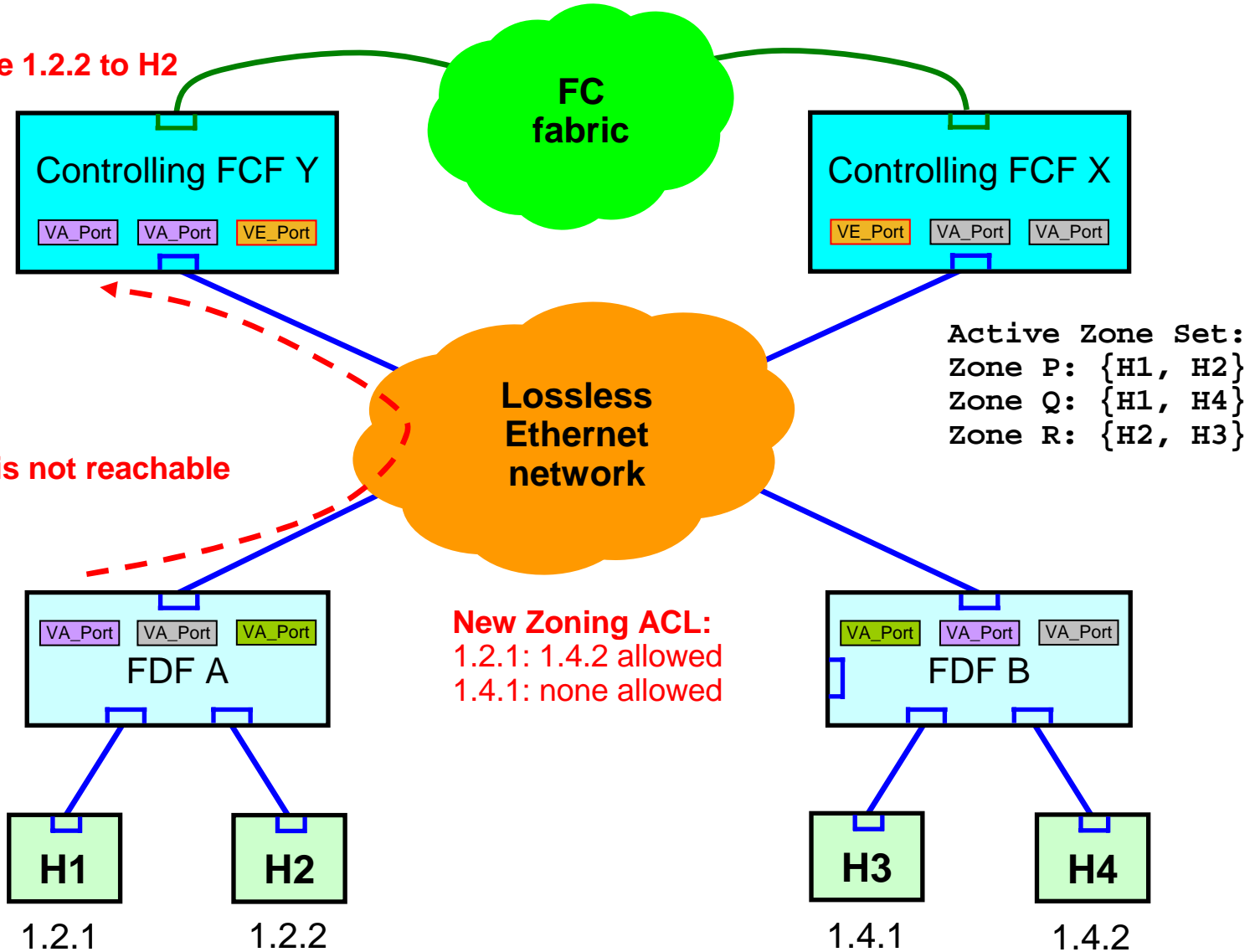
- **The combination Controlling FCF / Controlled FDFs behave as a single distributed FCF**

**An ENode is not able to distinguish if it is connected to an FCF or to an FDF**

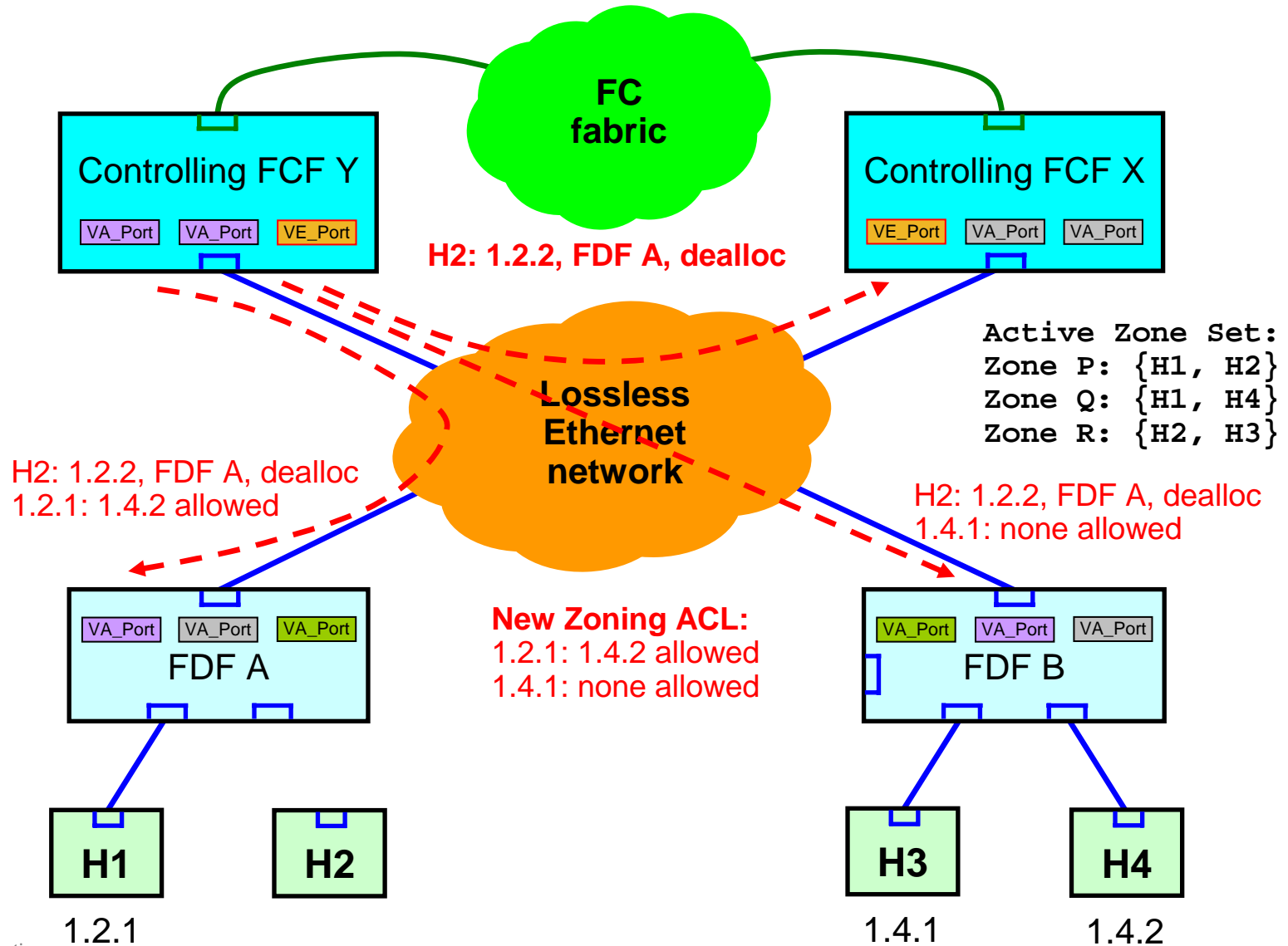
# N\_Port\_ID Move (1)

De-Allocate 1.2.2 to H2

H2 is not reachable

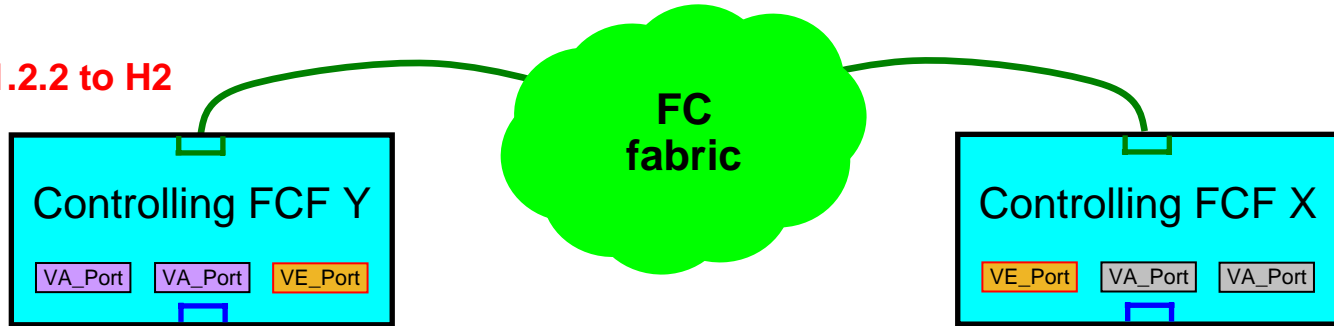


# N\_Port\_ID Move (2)



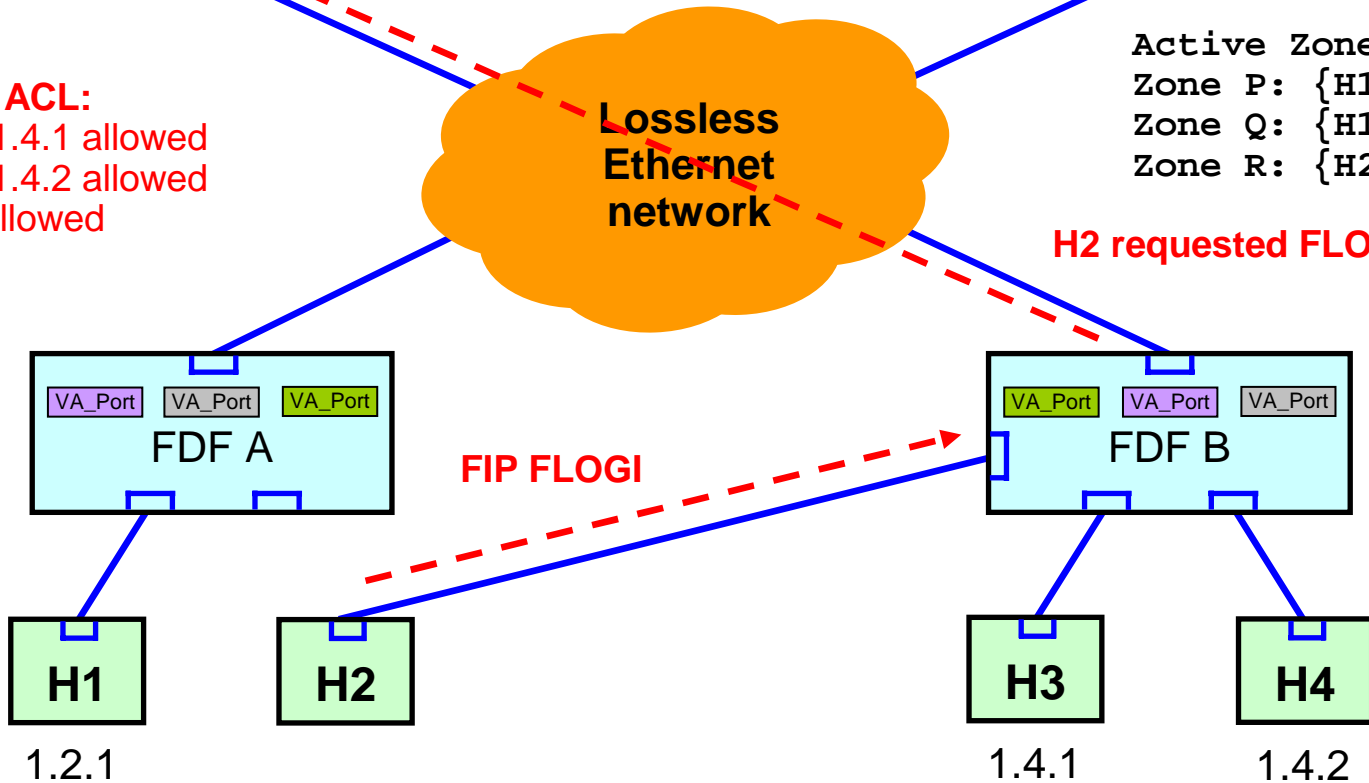
# N\_Port\_ID Move (3)

Allocate 1.2.2 to H2

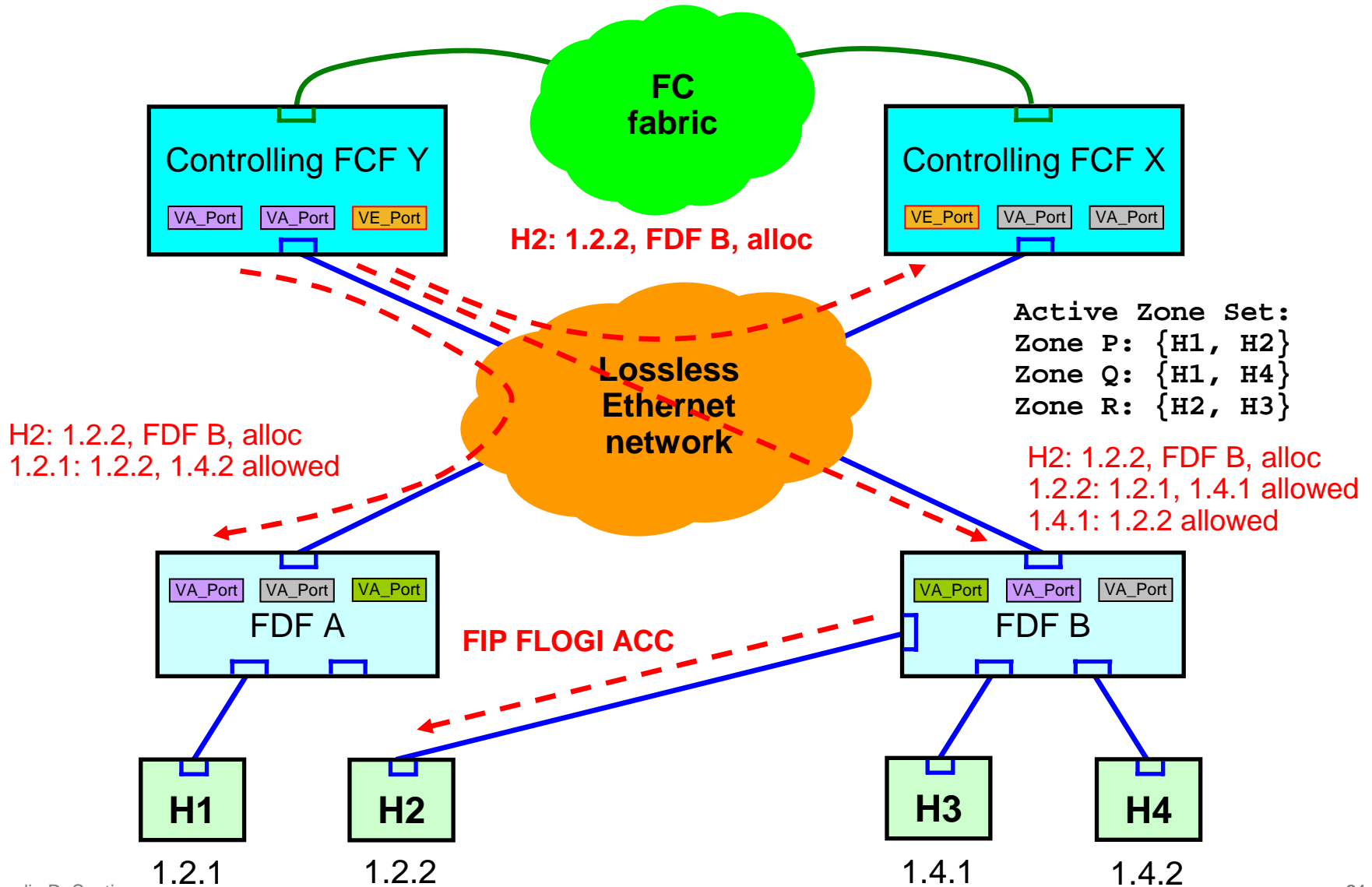


**New Zoning ACL:**  
1.2.2: 1.2.1, 1.4.1 allowed  
1.2.1: 1.2.2, 1.4.2 allowed  
1.4.1: 1.2.2 allowed

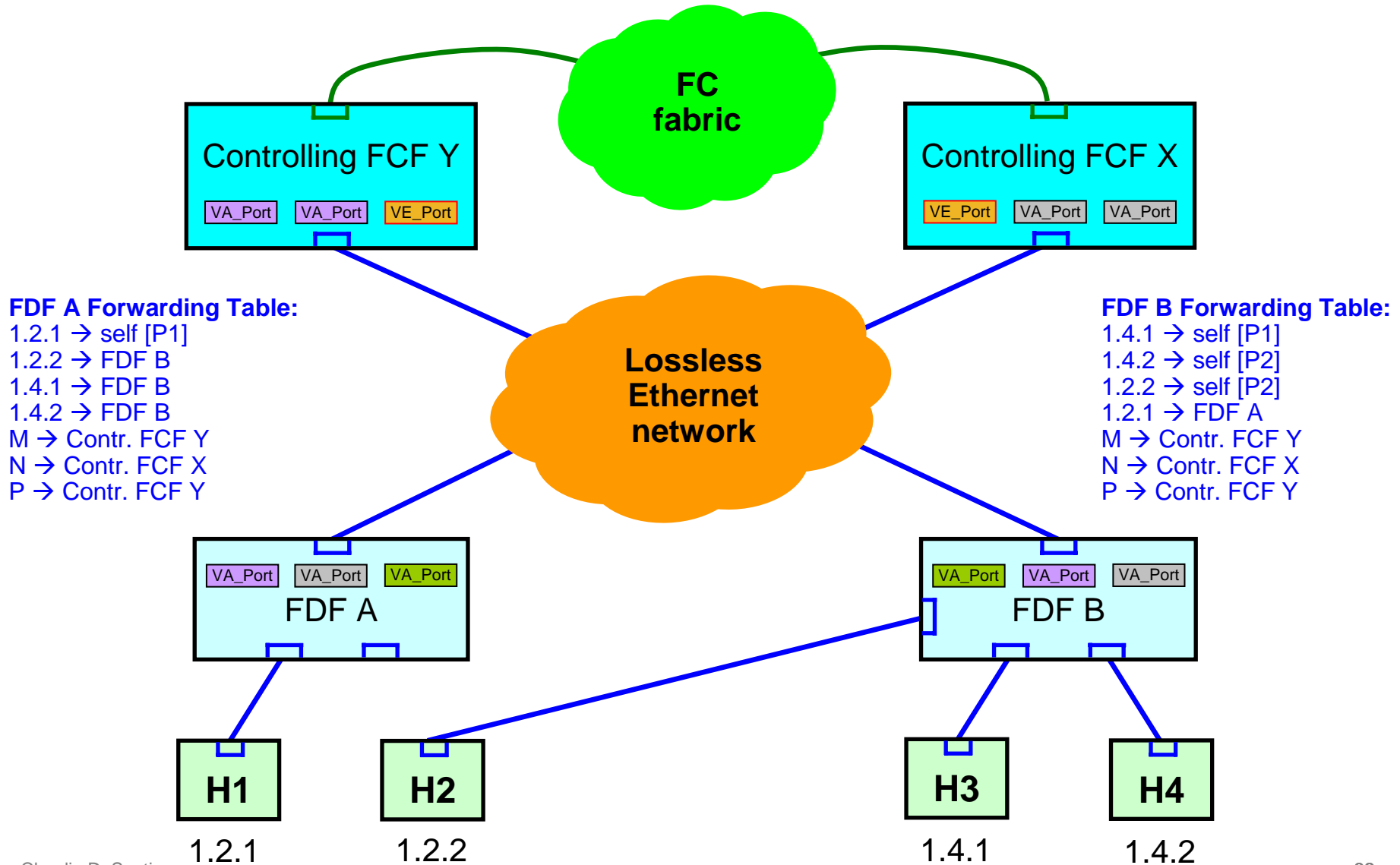
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# N\_Port\_ID Move (4)



# Forwarding Tables



# Summary: the FDF

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# Thank You



Total Solar Eclipse July 11, 2010  
As seen by  
Landon Curt Noll and Claudio DeSanti