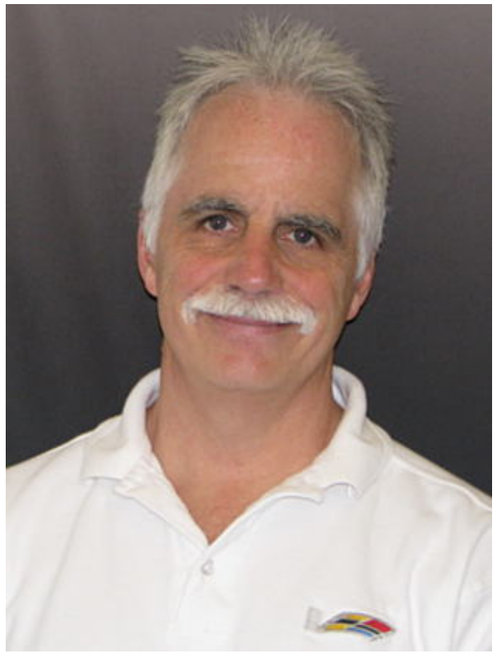
Fibre Channel Zoning Basics

Live Webcast
June 27, 2019
10:00 am PT

Today's Presenters



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About the FCIA

- The Fibre Channel Industry Association (FCIA) is a mutual benefit, non-profit, international organization of manufacturers, system integrators, developers, vendors, and industry professionals, and end users
  - Promotes the advancement of Fibre Channel technologies and products that conform to the existing and emerging T11 standards.
  - Maintains resources and supports activities to ensure multi-vendor interoperability for hardware, interconnection, and protocol solutions.
  - Promotion and marketing of FC solutions, educational awareness campaigns, hosting public interoperability demonstrations, and fostering technology and standards conformance.

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Agenda

- What is Zoning?
  - Why is it needed?
- How does Zoning work?
  - Configuration, activation flow, etc.
- Connecting Switches via ISLs
  - What happens when switches connect?
- What are the best practices?
- Latest advances in Zoning
  - The introduction of Peer Zones
- Summary

INCITS/T11

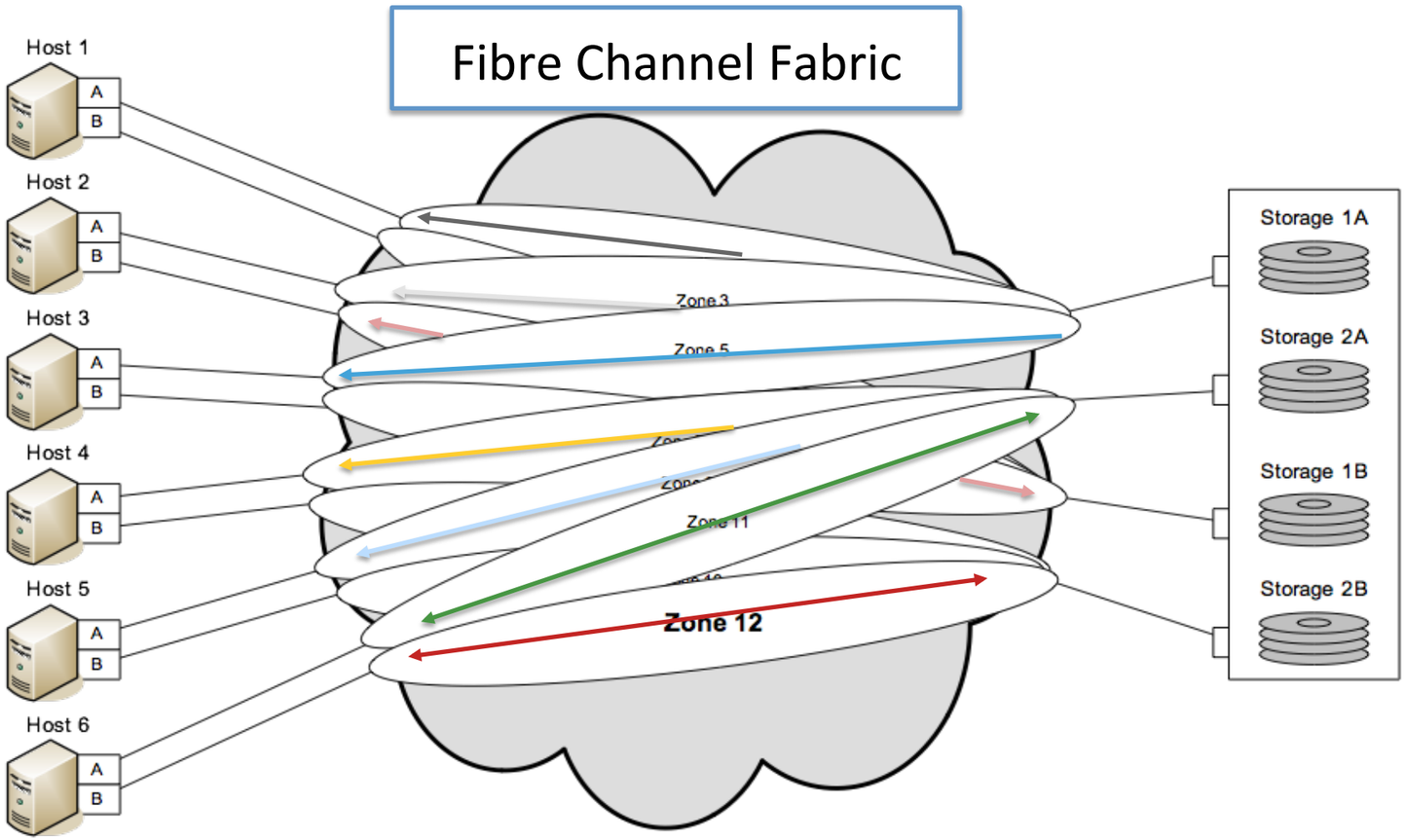
- International Committee for Information Technology Standards
- T11 is the INCITS standard containing Fibre Channel
- Various specification exist
  - FC-PI – Physical Interface
  - FC-FS – Framing and Signaling
  - FC-LS – Link Services
  - FC-GS – Generic Services
  - FC-SW – Switch Fabric
  - Etc…
- Zoning is defined in FC-GS and FC-SW standards
- Material for this presentation taken from in FC-GS and FC-SW

What is Zoning?

- Zoning allows specific groups of devices to communicate with each other
  - Kind of like a mini-VPN (Virtual Private Network)

- Individual zones limit communication between the devices that “care” about each other
  - A “Default” zone or no zone allows every device to communicate with every other device
  - This may be permitted or denied

- In Fibre Channel switches, the “Fabric Zone Server” controls zoning



Source: Erik Smith, EMC

What is Zoning?

Terminology

- **Zone Set**
  - A collection of zones
- **Active Zone Set**
  - The Zone Set currently enforced by the Fabric.
- **Zone**
  - A “container” with members representing end devices
- **Member** – Two contexts:
  - In a zoneset a **member** is a zone
  - In a zone a **member** represents an end device or group of end devices
- **Zone Alias**
  - a name that represents one or more FC devices

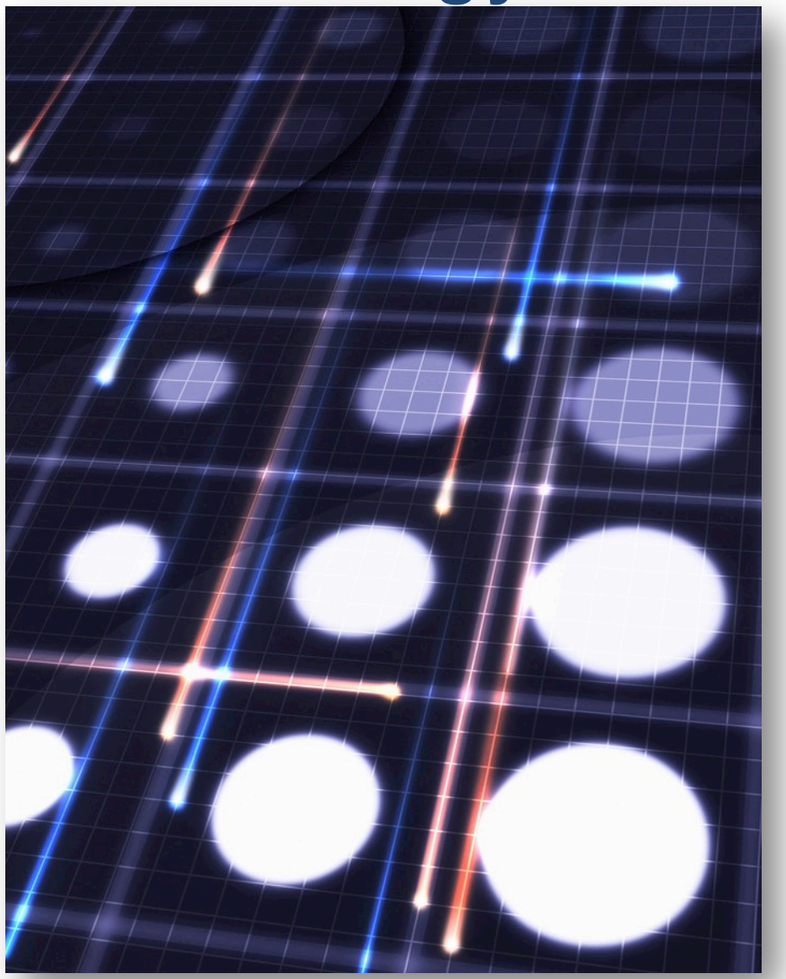
What is Zoning?

Terminology – continued…

- **Default Zone**
  - Contains all devices not a member of any zone in the active zone set
  - This group of devices may be permitted to communicate or denied
- **Basic Zoning Mode**
  - Zoning changes done w/o fabric wide lock.
  - Lock obtained once changes sent to fabric
  - Less efficient zone data structure
- **Enhanced Zoning Mode**
  - All zoning changes occur only after a fabric wide lock is obtained. Ends with a commit of changes.
  - More efficient zone data structure

What is Zoning?

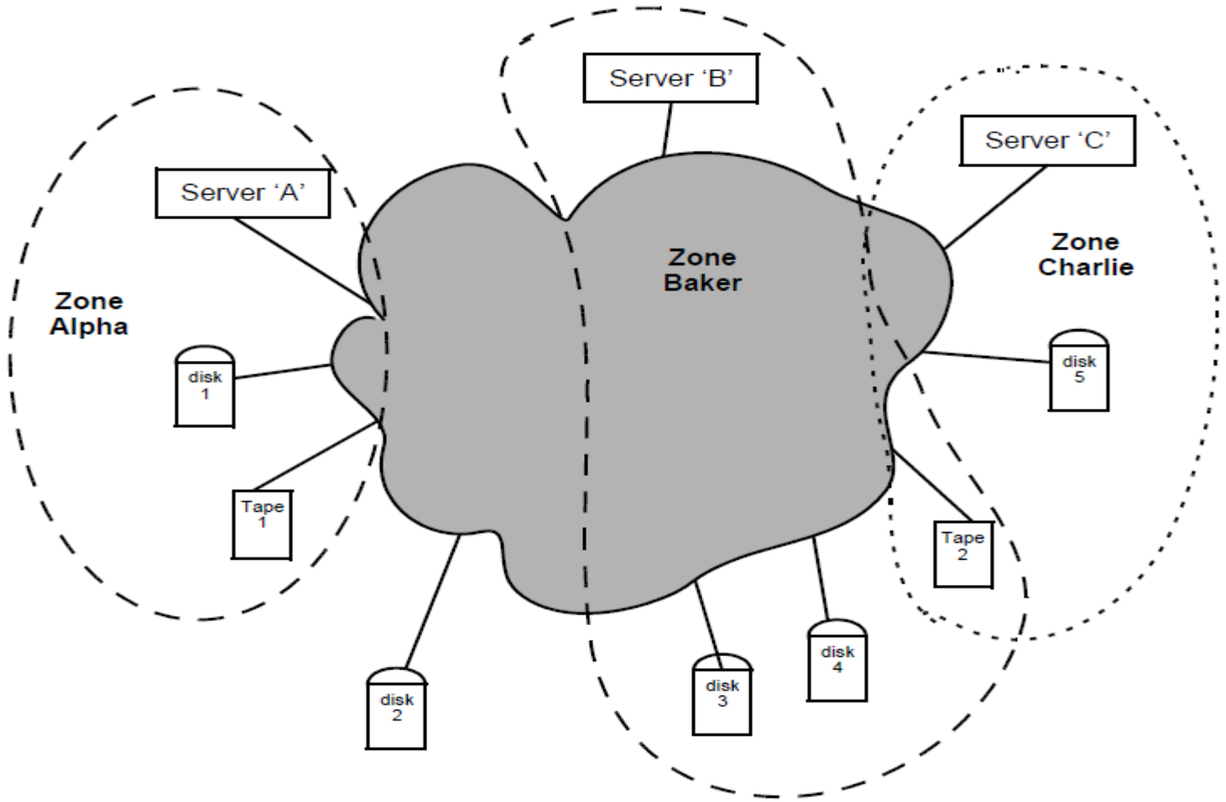
Terminology – continued…



- **Zoning Database -** A database containing all:
  - zonesets (active or not)
  - zones
  - FC alias
  - Attributes
- **RSCN – Registered State Change Notification**
  - Message sent by switch to end device notifying it that a device it is zoned with has either entered or left the fabric
  - Only sent when end device registers
- **SCR – State Change Registration**
  - Request sent from end device to switch requesting RSCNs

What is Zoning?

Sample Zone Set containing 3 Zones from FC-GS



	Zone Set		
Zone Set Name	**"OS_partition"**		
Zone Names	**"Alpha"**	**"Baker"**	**"Charlie"**
Zone Members	Server A	Server B	Server C
	disk 1	disk 3	disk 5
	tape 1	tape 2	tape 2
		disk 4	

What is Zoning?

Zoning Framework

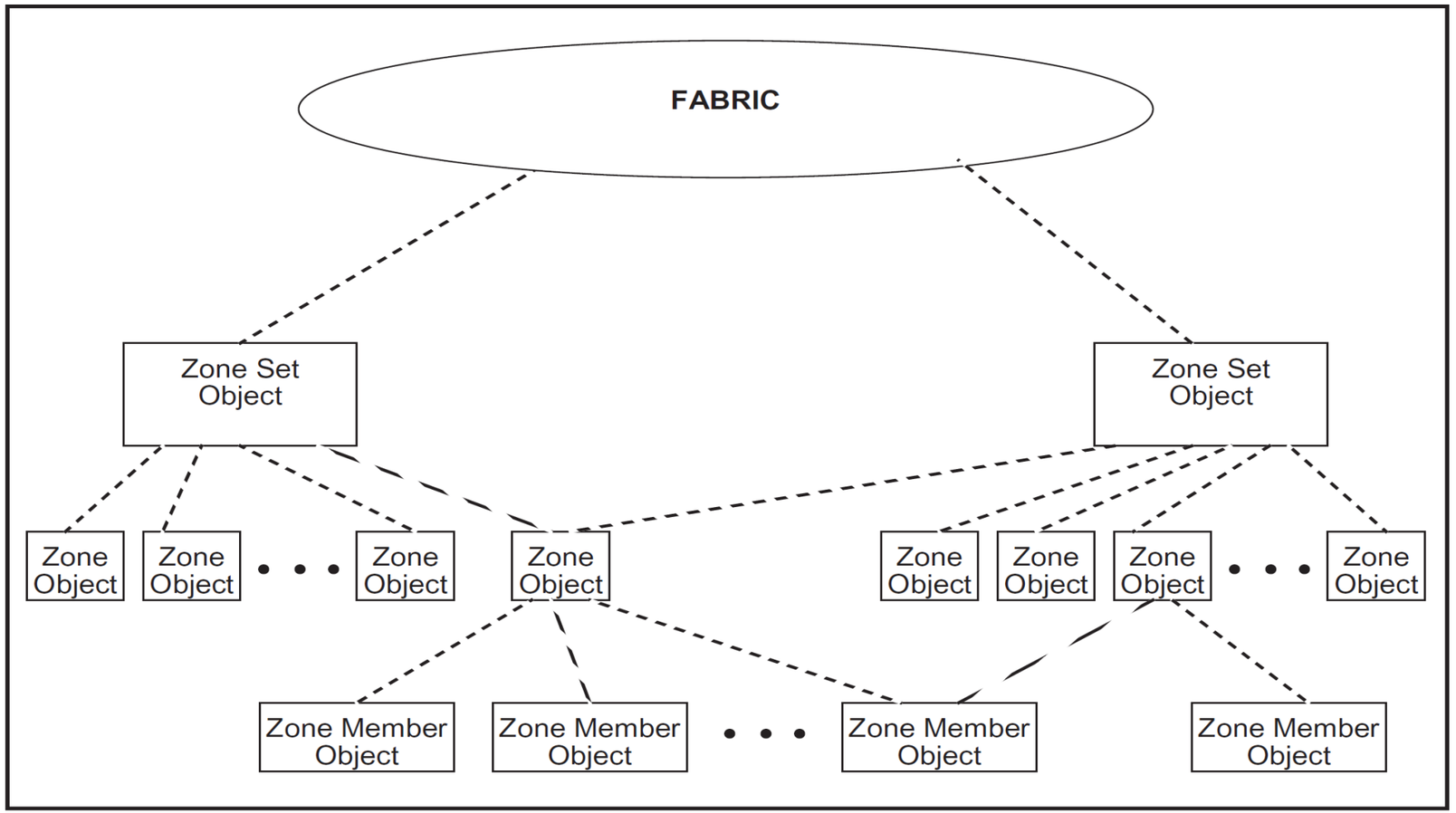
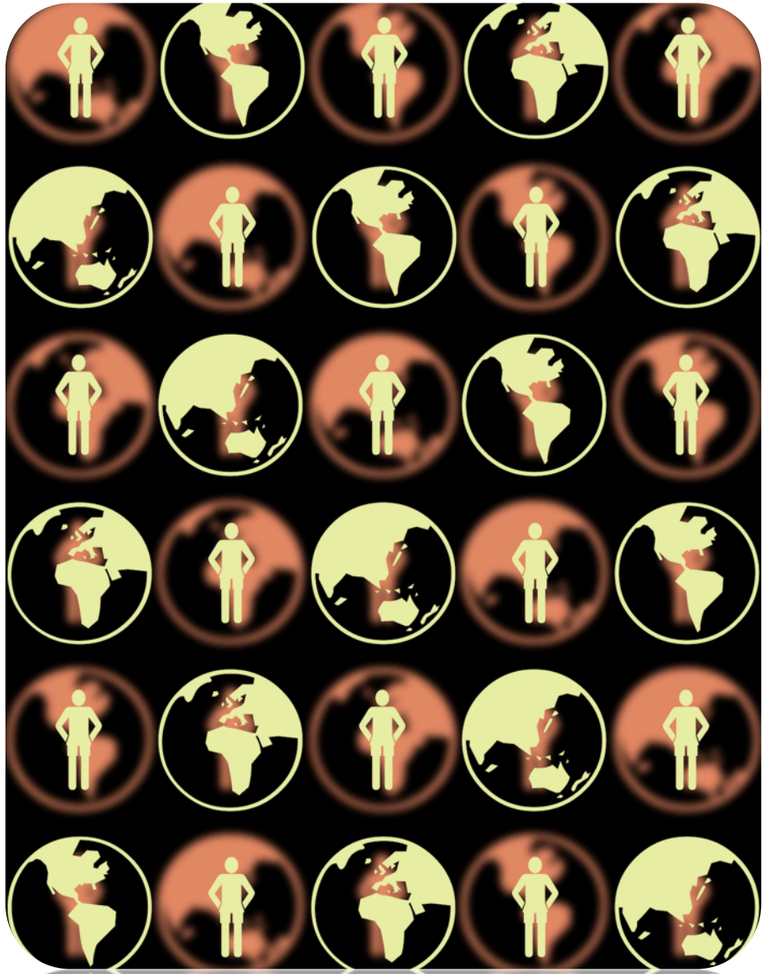


Figure 17 — Fabric Zone Server Object Model

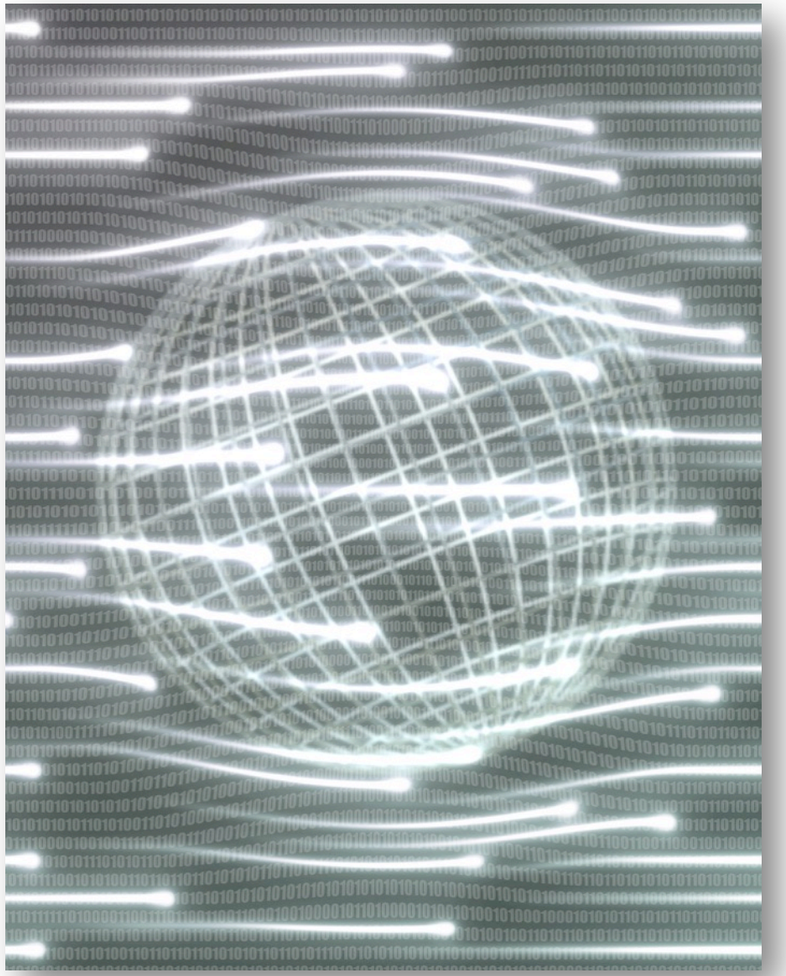
What is Zoning?

Zone Member Types

- PWWNs (WWPN) – Port WW name
- Switch/domain-id + physical port/interface
- N_Port_ID (FCID)
- NWWN - Node WW Name
- FC Alias
  - Contains one or more zone member types
- Other vendor specific types are allowed



What is Zoning?
Why is zoning needed?



- Access Control Security (only devices in a zone can communicate)
- Device/Group Isolation:
  - Less device chatter (fewer discovery queries, PLOGIs)
  - Fewer RSCNs
- If default-zone deny is configured (or defaulted) then devices will not be able to communicate without zoning

What is Zoning?

The Different Types of Zoning

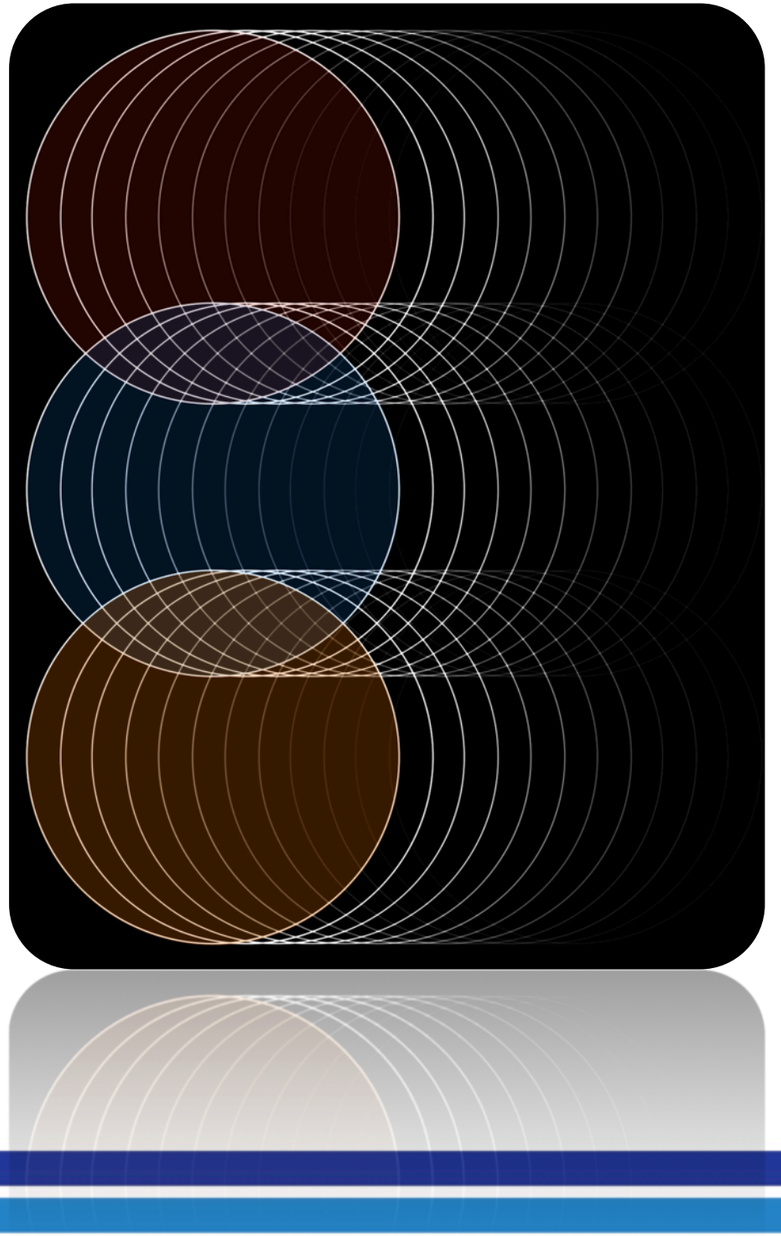
Soft Zoning

- The Fabric enforces the Zoning configuration through Name Server (FCNS) visibility

Hard Zoning

- The Fabric enforces the Zoning configuration by frame-by-frame filtering

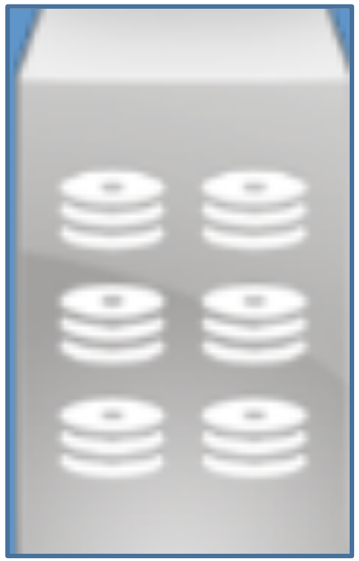
- **Normally both Hard and Soft zoning are both in effect**



What is Zoning?

The Different Types of Zoning

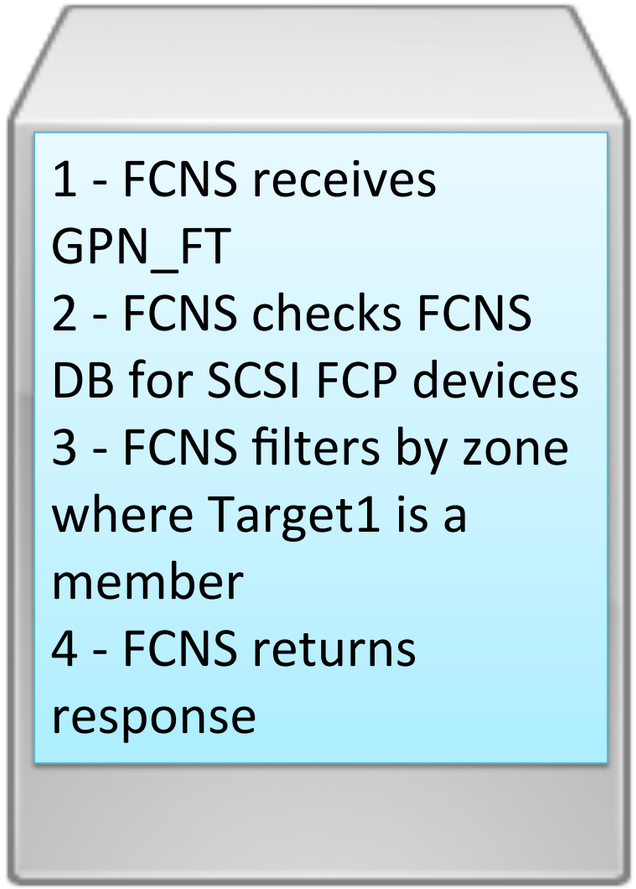
Soft Zoning



GPN_FT (SCSI FCP)

ACC (GPN_FT)
(Host1, Host3)

Target1



Zoneset

Zone1
Member host1
Member Target1

Zone2
Member host3
Member Target1

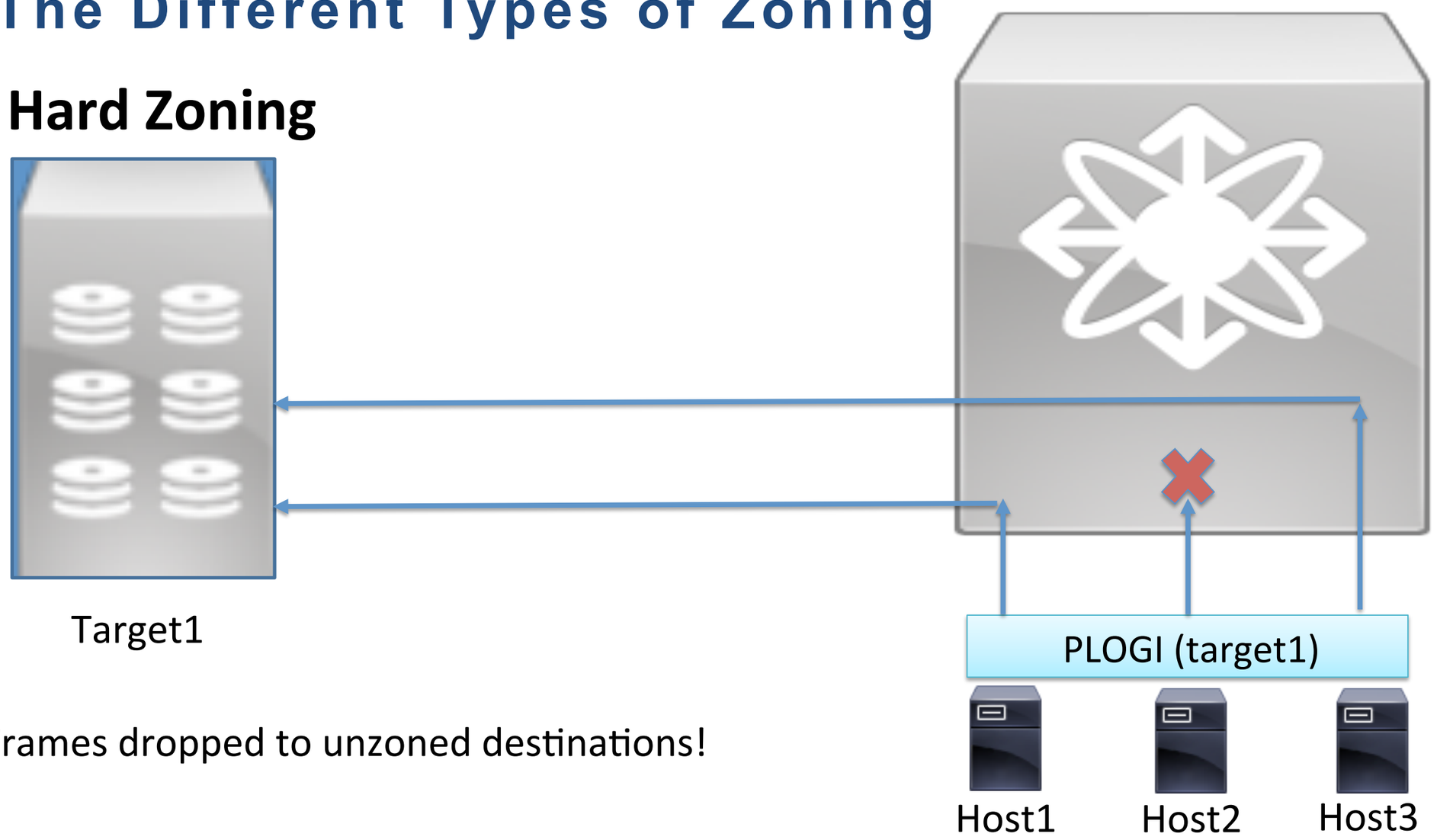
Zone3
Member host2
Member Target2

FCNS only returns information for zoned destinations!

What is Zoning?

The Different Types of Zoning

Hard Zoning



Zoneset

Zone1
Member host1
Member Target1

Zone2
Member host3
Member Target1

Zone3
Member host2
Member Target2

Frames dropped to unzoned destinations!

How does Zoning work?

- Zoning Configuration Flow
- Zoneset Activation Flow
- Results of Zoning

How does Zoning work?

Zoning Configuration Flow

5 (or 6) Steps

1. Create zoneset or use existing zone
2. Create zone using new name
3. Add members to zone
4. Add zone to zoneset
5. Activate zoneset
6. If enhanced mode then commit char
   (may be implicit)

How does Zoning work?

Zoneset Activation Flow

1. **ACA - Acquire Change Authorization Request**
   - Locks the fabric
   - Sent to all switches in fabric
2. **SFC - Stage Fabric Configuration Update Request**
   - Zoning data is sent to all switches
3. **UFC Update Fabric Configuration Request**
   - Once all switches acknowledge SFCs, update zone info
4. **RCA - Release Change Authorization Request**
   - Unlock the fabric

All SW_ILS frames sent from/to Domain Controller WKA 0xFFFCxx
All SW_ILS frames are acknowledged by an ACCept

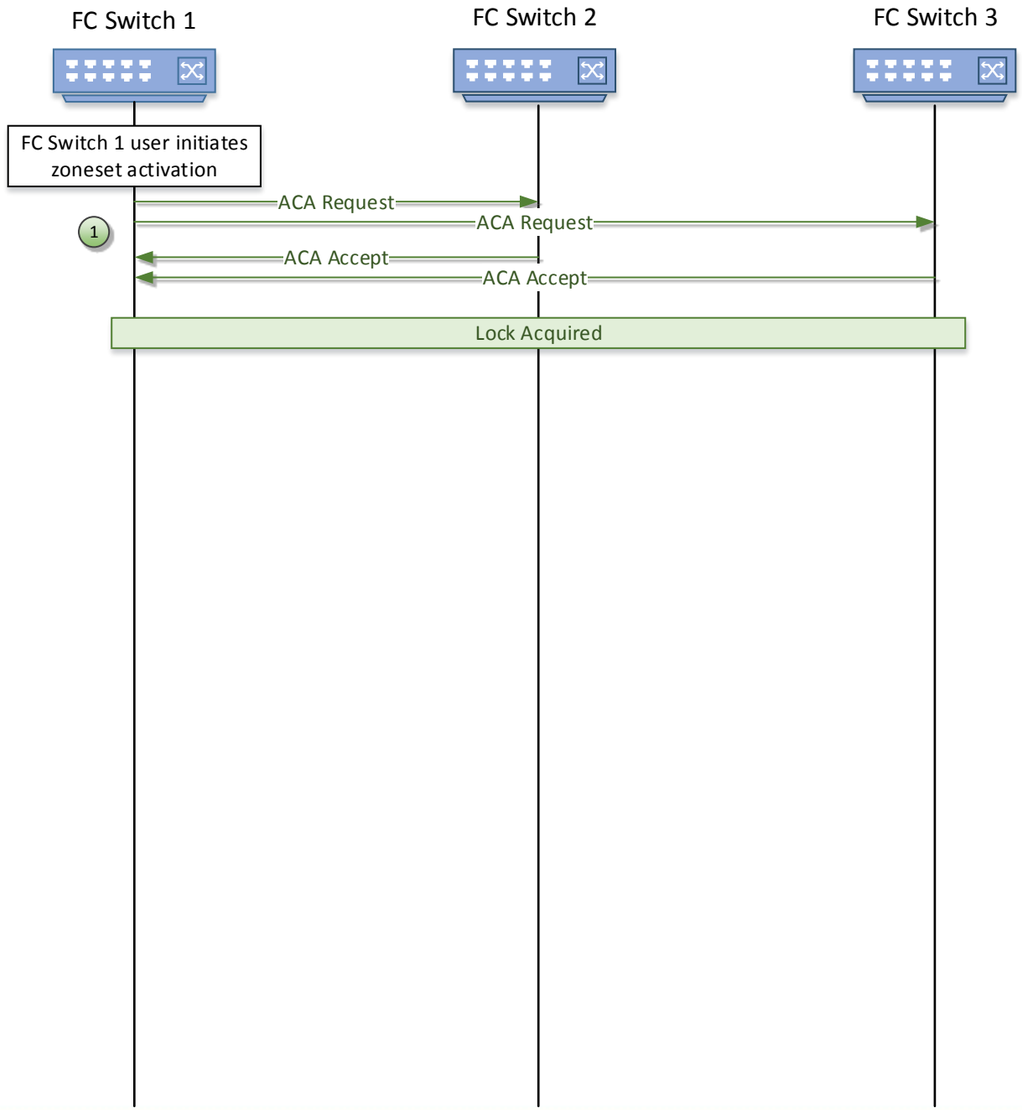
How does Zoning work?

Zoneset Activation Flow

Activation Example – Phase 1

1. ACA - Acquire Change Authorization Request

- Locks the fabric
- Sent to all switches in fabric
- If lock is available, switch sends an Accept.
- If lock is not available, switch sends a Reject.



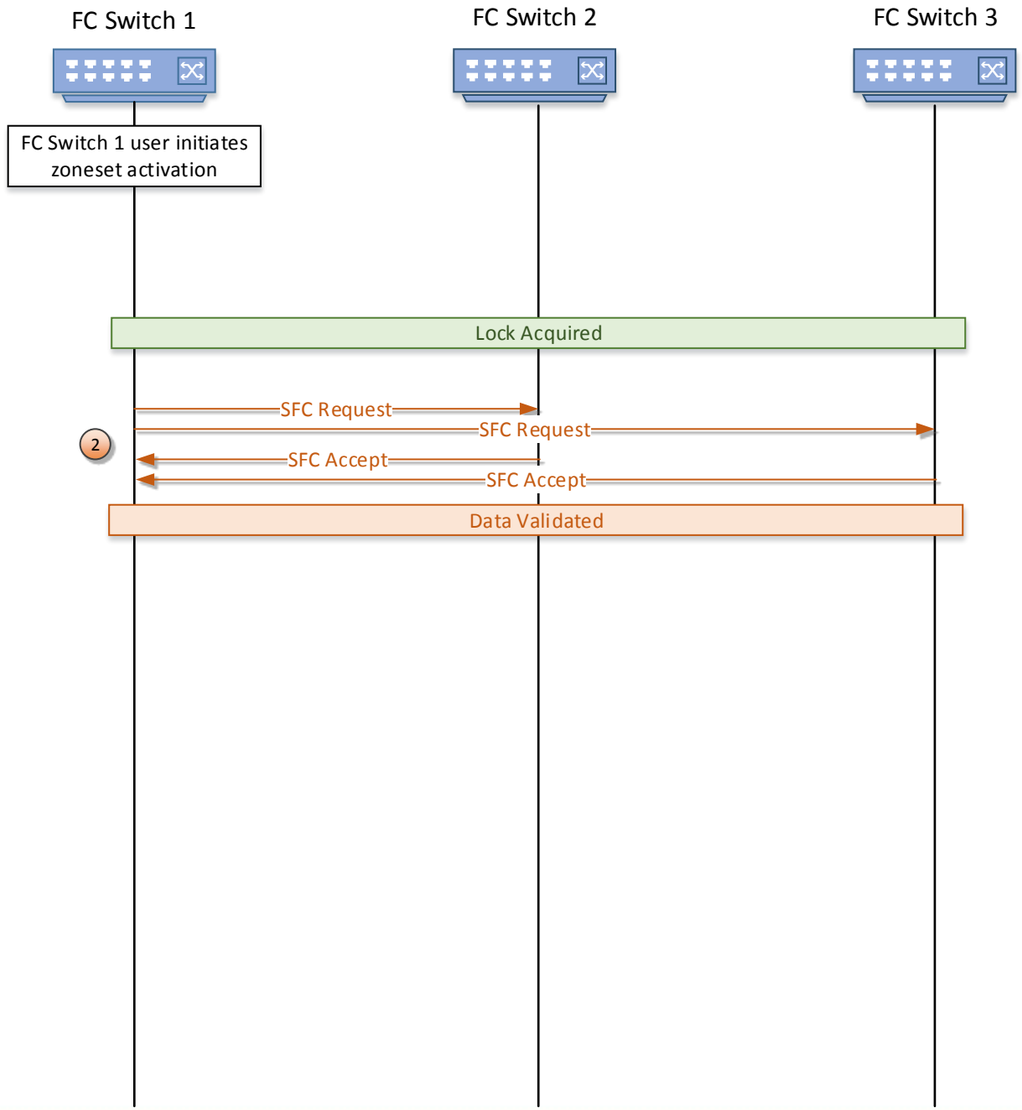
How does Zoning work?

Zoneset Activation Flow

Activation Example – Phase 2

2. SFC - Stage Fabric Configuration Update Request

- Zoning data is sent to all switches
- Switches validate that data can be committed. After validation is complete, send an Accept.
- If data fails validation a Reject is sent.



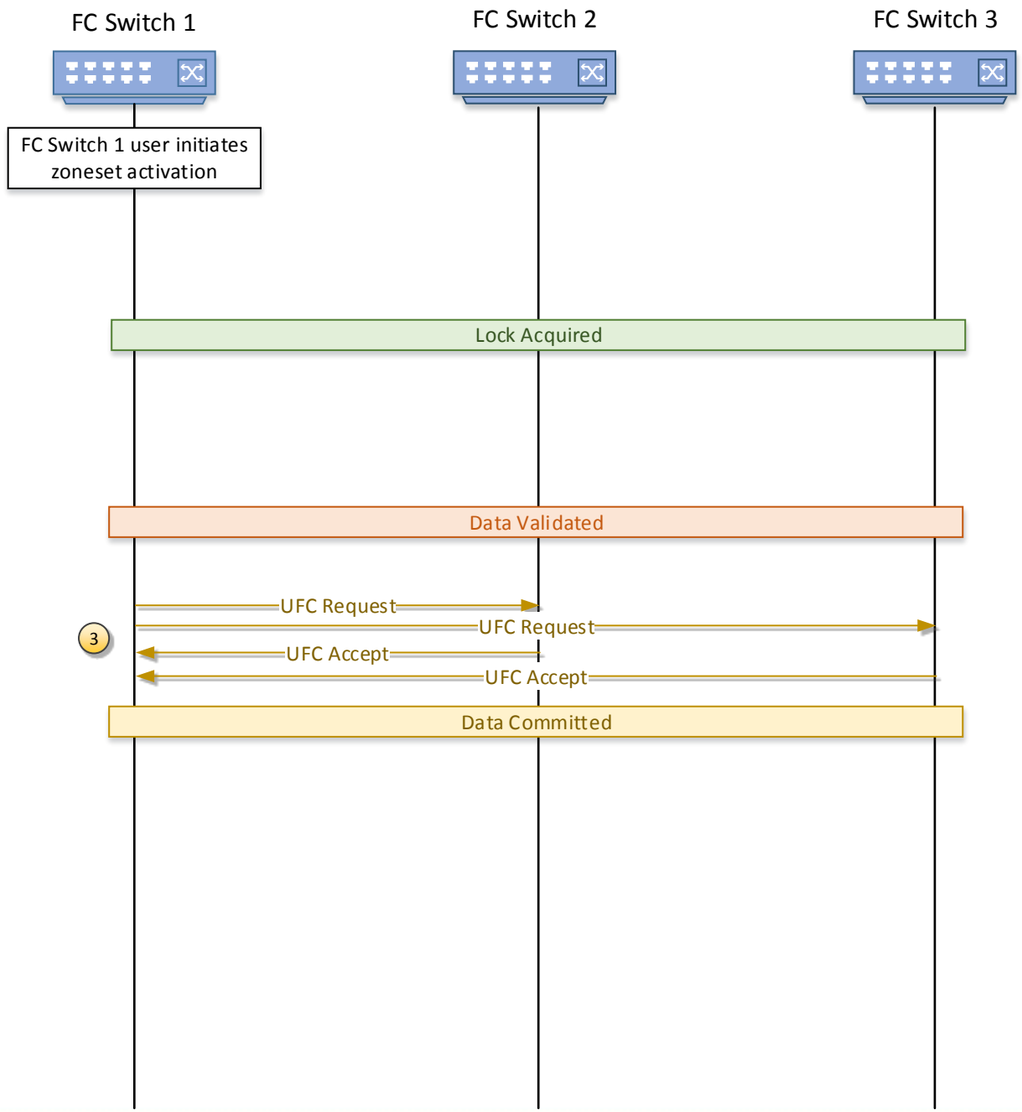
How does Zoning work?

Zoneset Activation Flow

Activation Example – Phase 3

3. UFC - Update Fabric Configuration Request

- Switches commit the zone data and send an Accept after commit is complete.



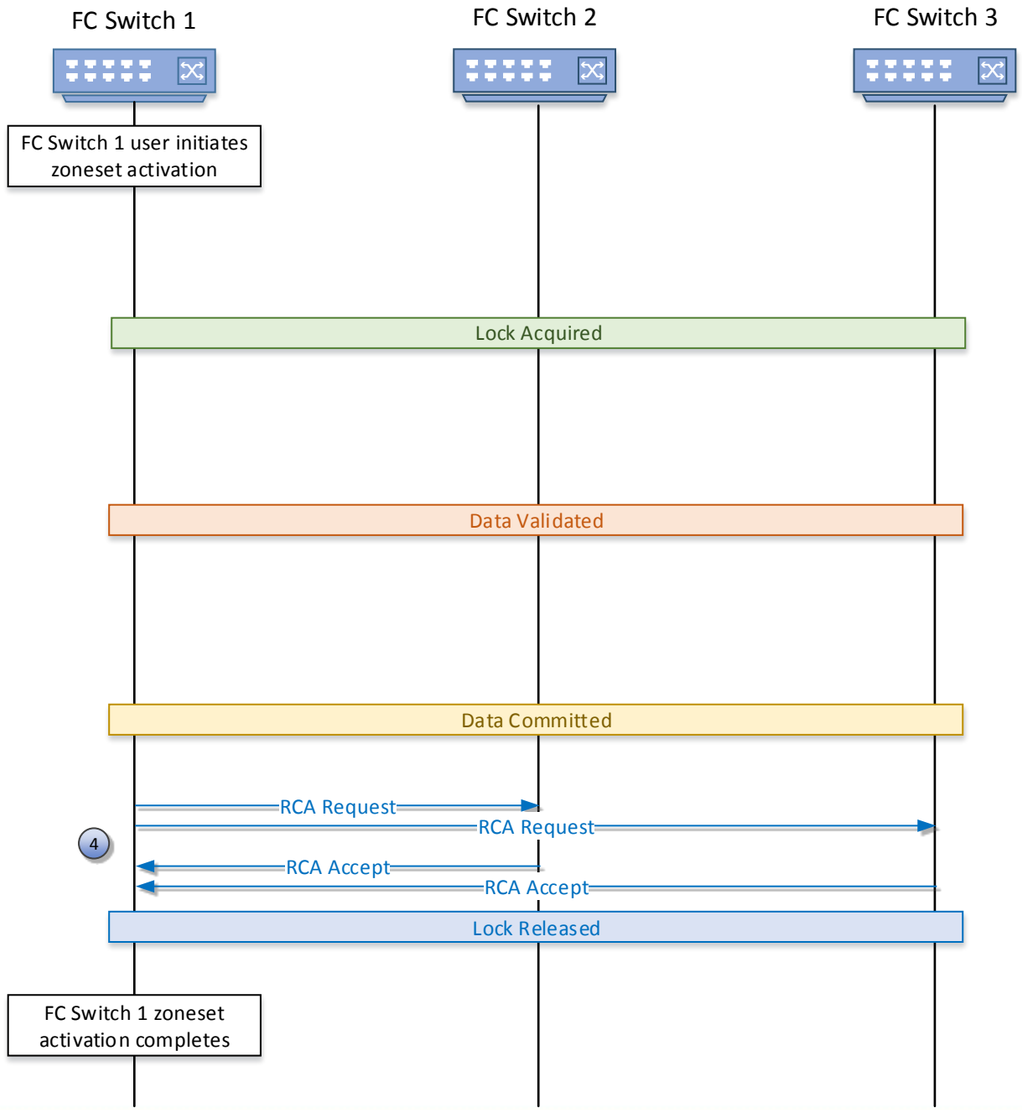
How does Zoning work?

Zoneset Activation Flow

Activation Example – Phase 4

4. RCA - Release Change Authorization Request

- Once all switches accept, the fabric is unlocked.
- If the ACA or SFC requests are rejected, the RCA phase will commence.

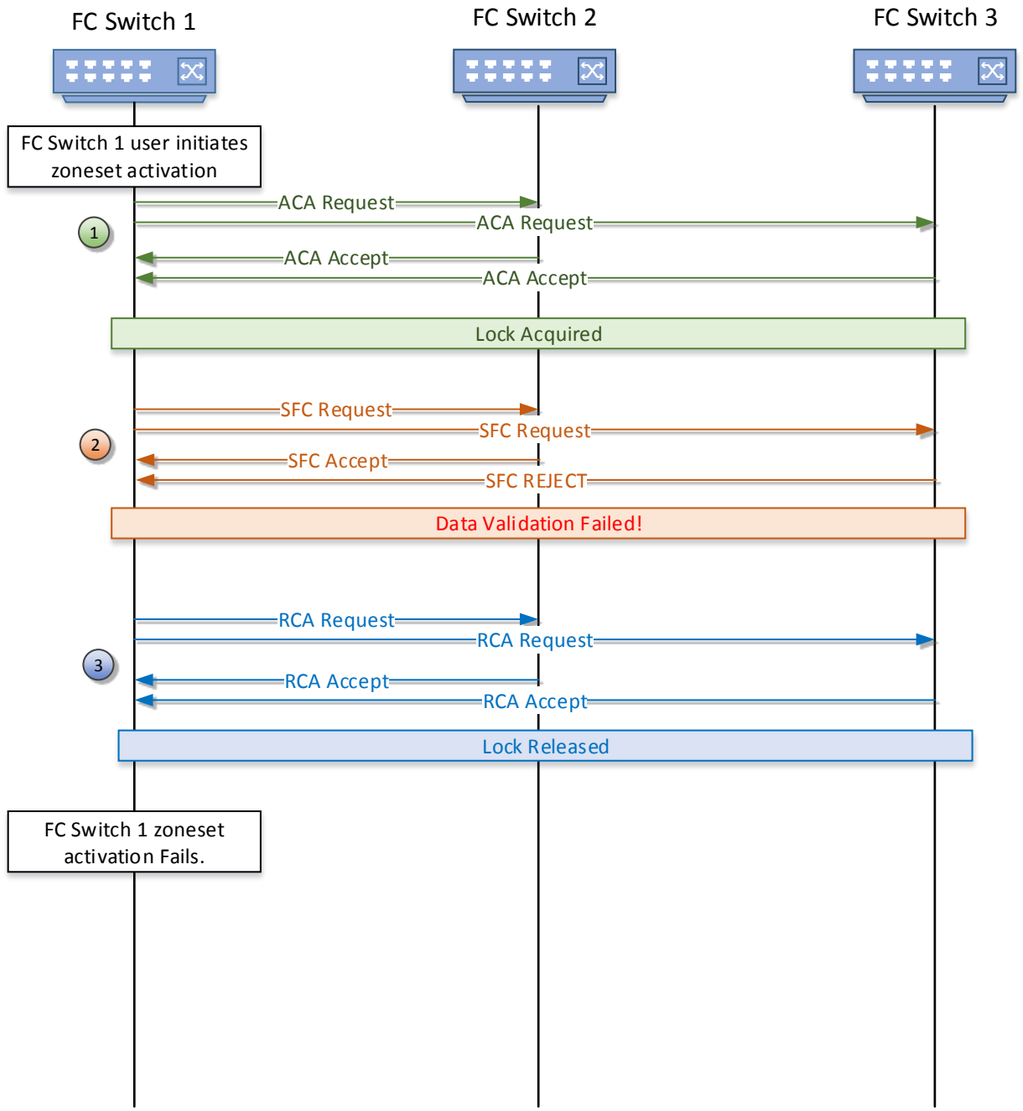


How does Zoning work?

Zoneset Activation Flow

Activation Failure Example

Switch 3 rejects SFC due to a failed validation (e.g. exceeds max zone size limits)



How does Zoning work?

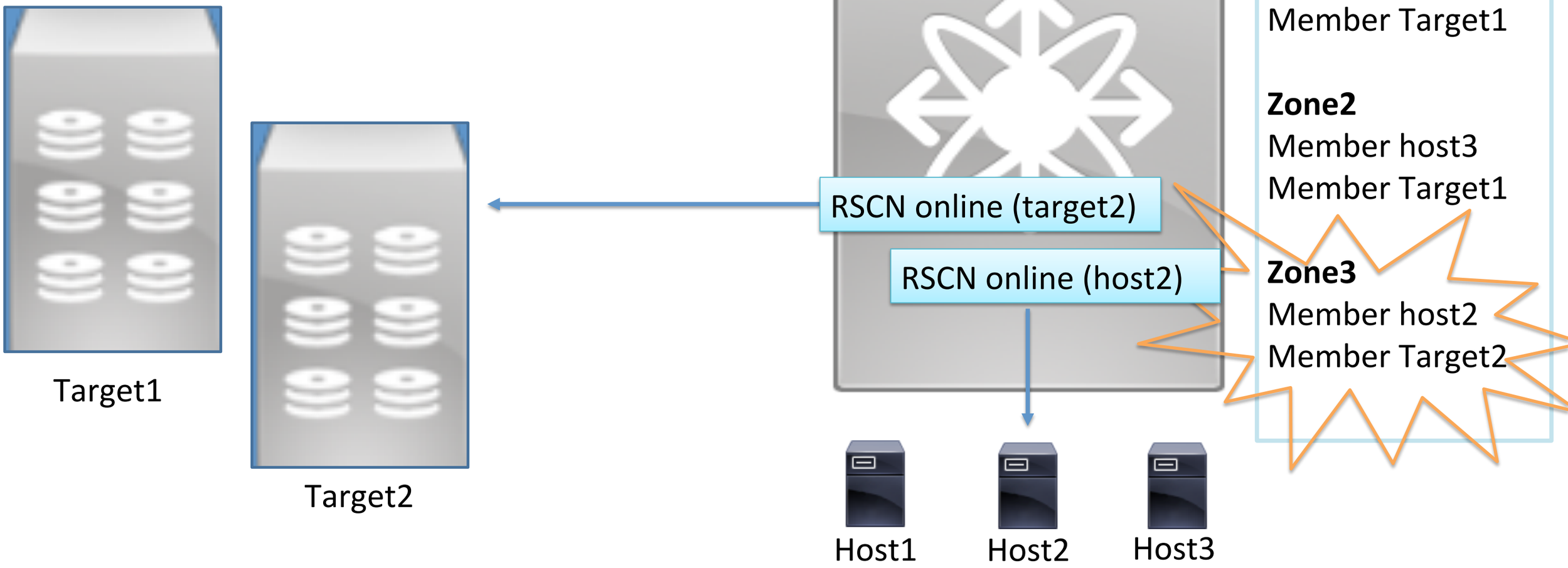
Results of Zoning

- Zone databases are updated throughout the fabric
- Hard zoning Access Control Lists are updated
- Registered State Change Notifications (RSCNs) are generated to end devices involved in the change
  - If new associations are added “online” RSCNs are sent
  - If associations are removed “offline” RSCNs are sent
- Once device receives RSCN it sends queries to FCNS

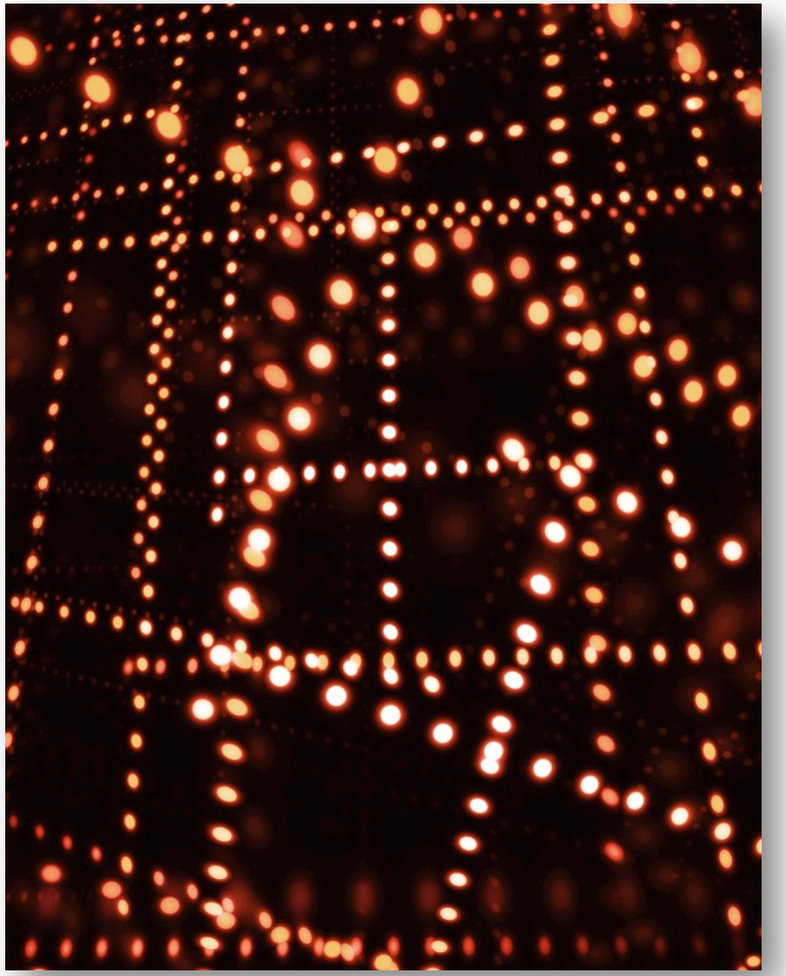
How does Zoning work?

Results of Zoning

New Zone3 added



Connecting Switches via ISLs



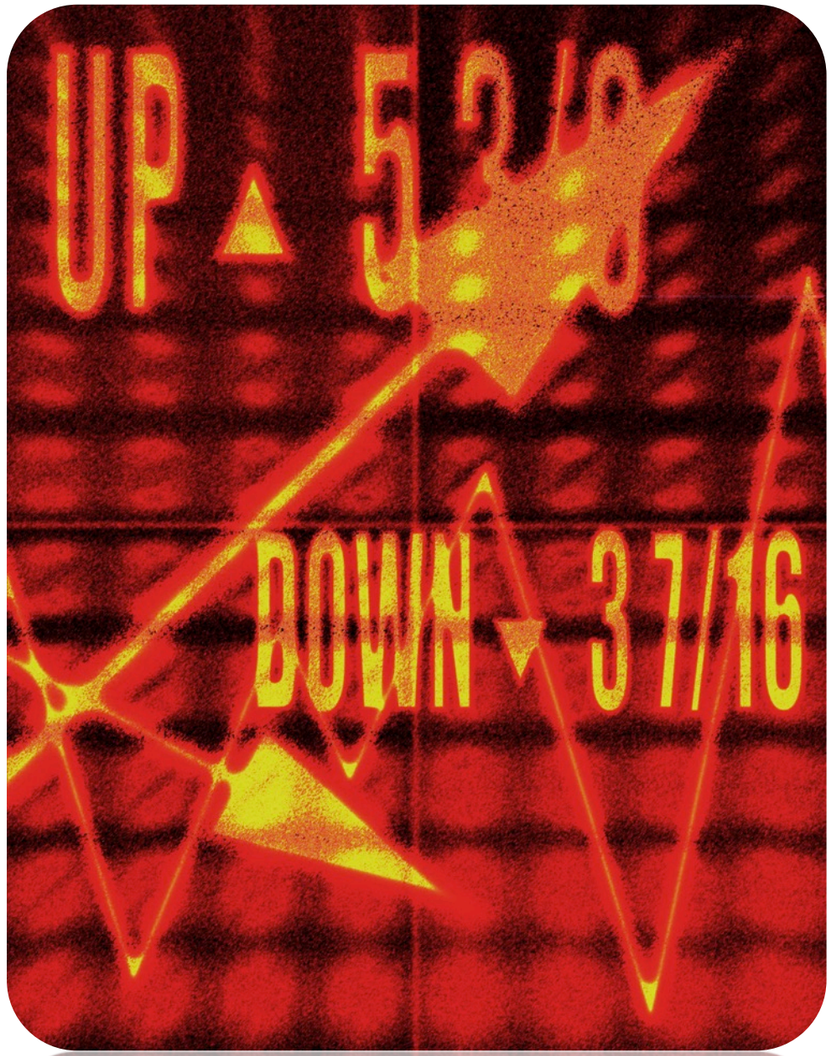
Inter-Switch Links (ISLs) are activated to form multi-switch fabrics

- Merge request is sent to merge two zoning databases
- If zone DBs are the same then ISL comes up
- If zone DBs are *mergeable* then ISL comes up
- If zone DBs are not *mergeable* then isolate ISL

Connecting Switches via ISLs

Consistency checks

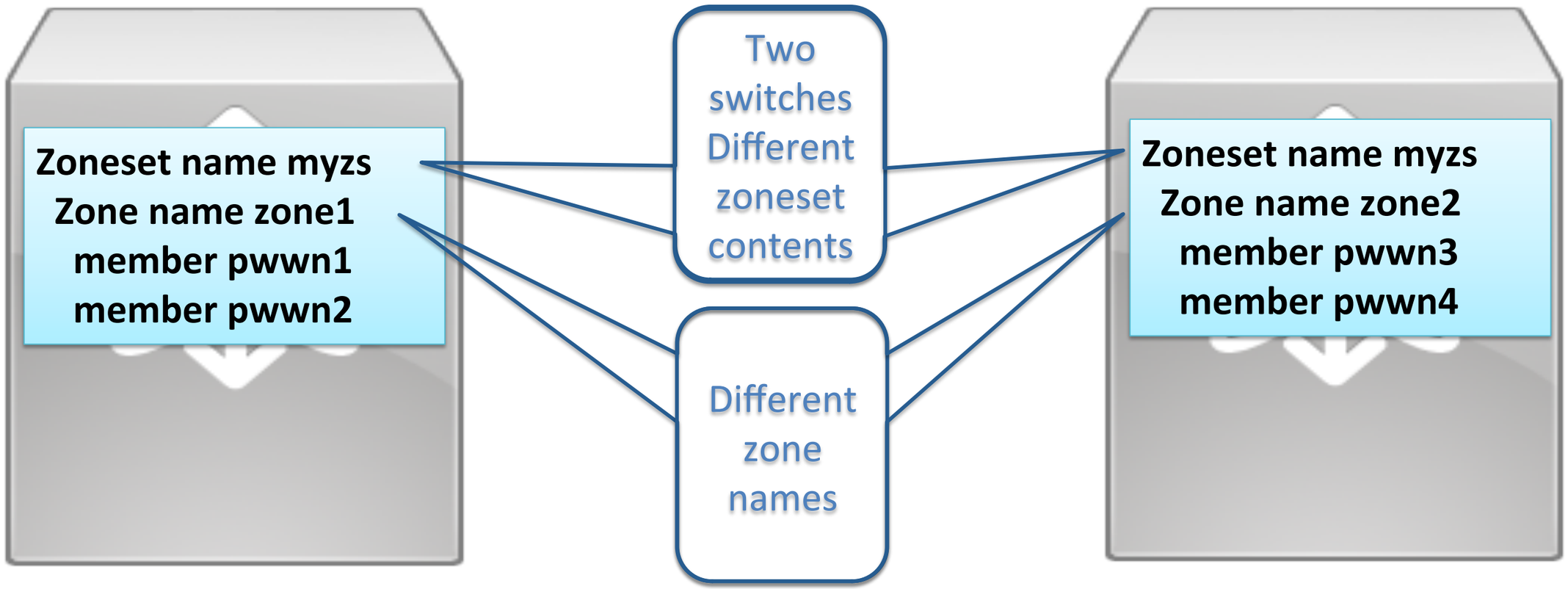
- Consistency checks for zone settings can involve the following:
  - Default-zone – Permit or Deny
  - Merge Control - Allow or Restrict
    - Restrict – zone DBs must be exact for ISL to come up
    - Allow – If zone DBs are “mergeable” ISL comes up
  - Zones with the same zone name but dissimilar
    - Members, Definitions, Attributes
- Check switch’s error logs for messages when merge fails



Connecting Switches via ISLs

Example – Successful Merge

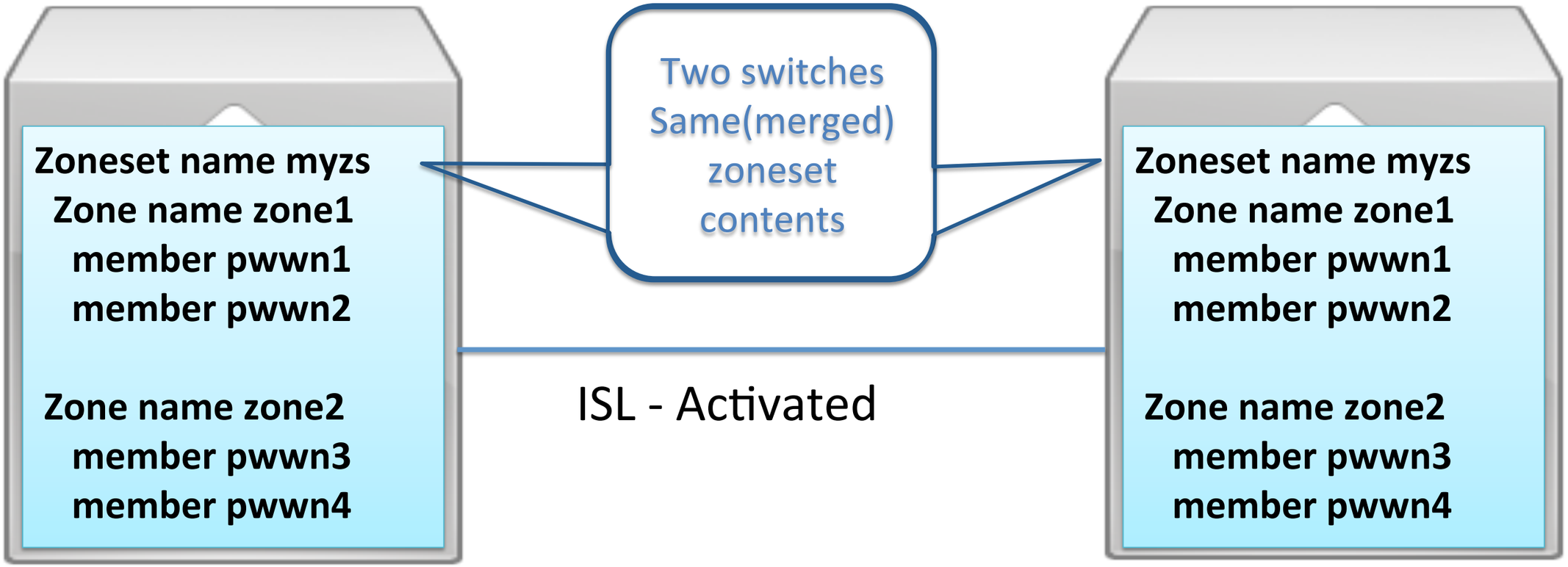
Two switches prior to ISL activation



Connecting Switches via ISLs

Example – Successful Merge

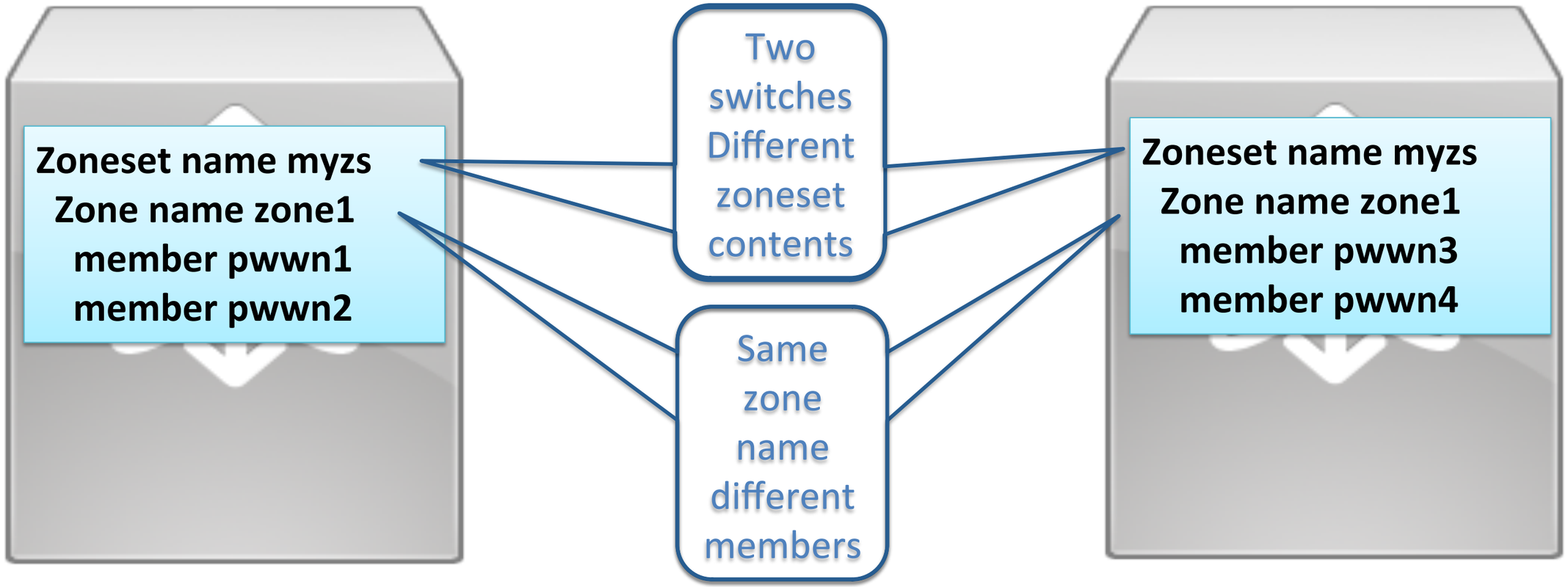
Two switches after to ISL activation



Connecting Switches via ISLs

Example – Failed Merge

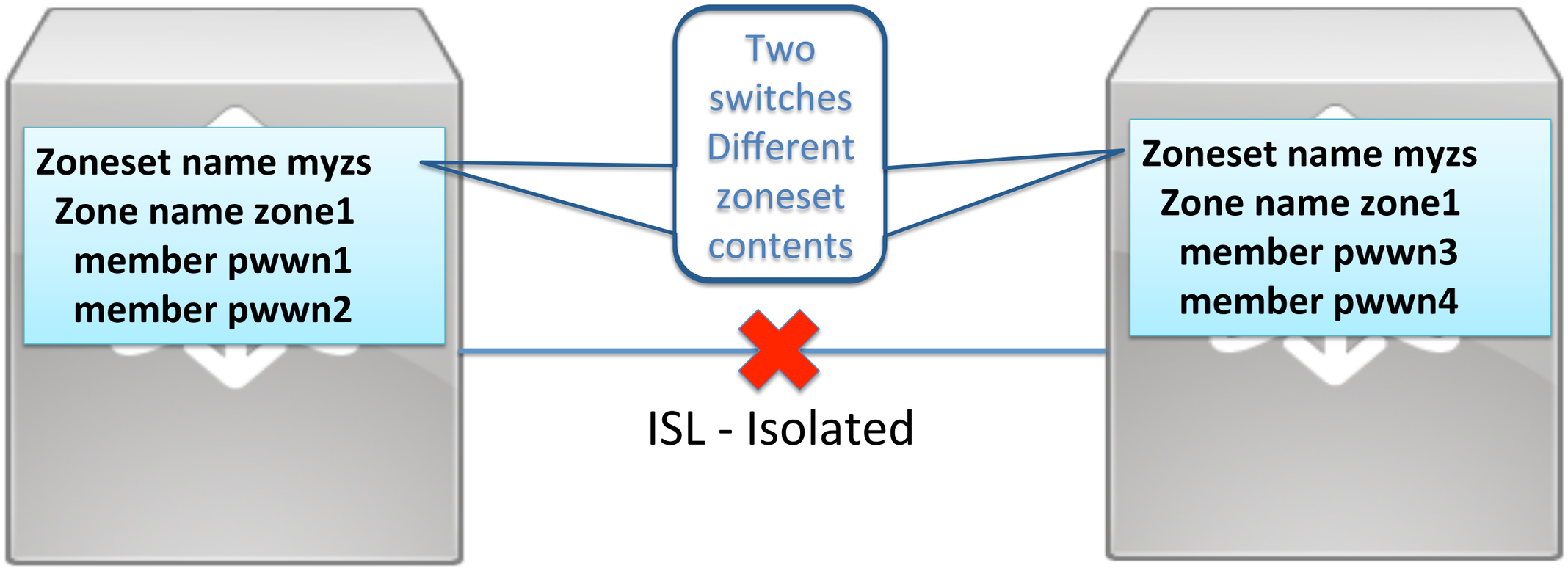
Two switches prior to ISL activation



Connecting Switches via ISLs

Example – Failed Merge

Two switches after to ISL activation and isolation



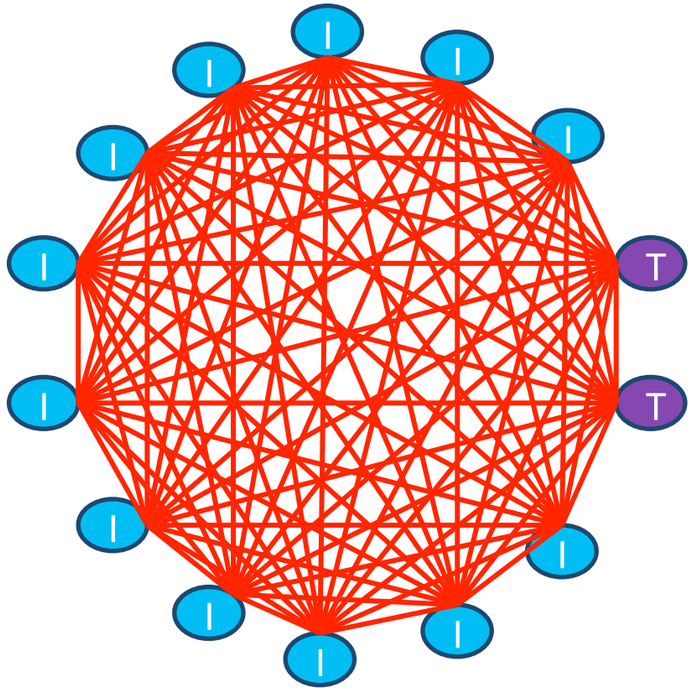
Zoning best practices

Single Initiator / Single Target zones

When zones contain more than 2 members all members are allowed to communicate with each other

zone name *myzone*
  member alias init1
  …
  member alias init12
  member alias target1
  member alias target2

12 x I
2 x T

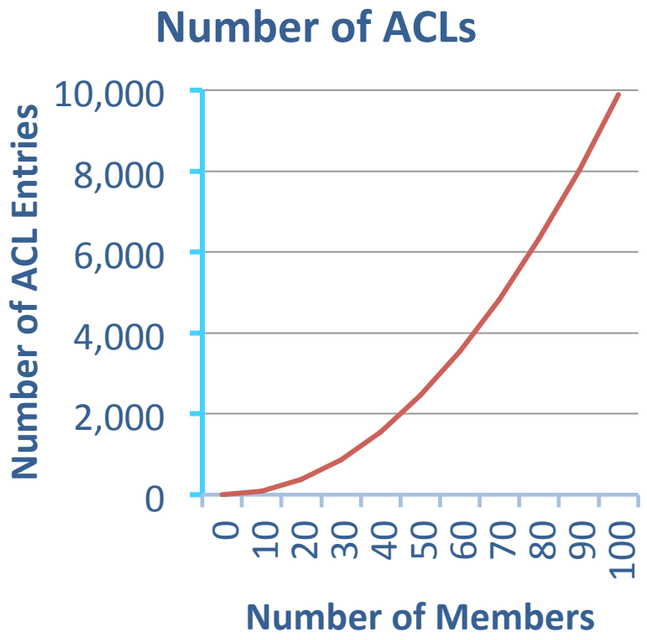


Above allows all members to communicate with each other!
This can increase cross talk

Zoning best practices

Single Initiator / Single Target zones

- ACL entries for hard zoning result in n*(n-1) entries per zone
- Each pair consumes two ACL entries in hardware
  - Result: n*(n-1) entries per zone
- Greatly increased Name Server queries
- Zones should contain 2 members:
  - Initiator – PWWN or Alias
  - Target – PWWN or Alias
  - “Single initiator / Single target scheme”

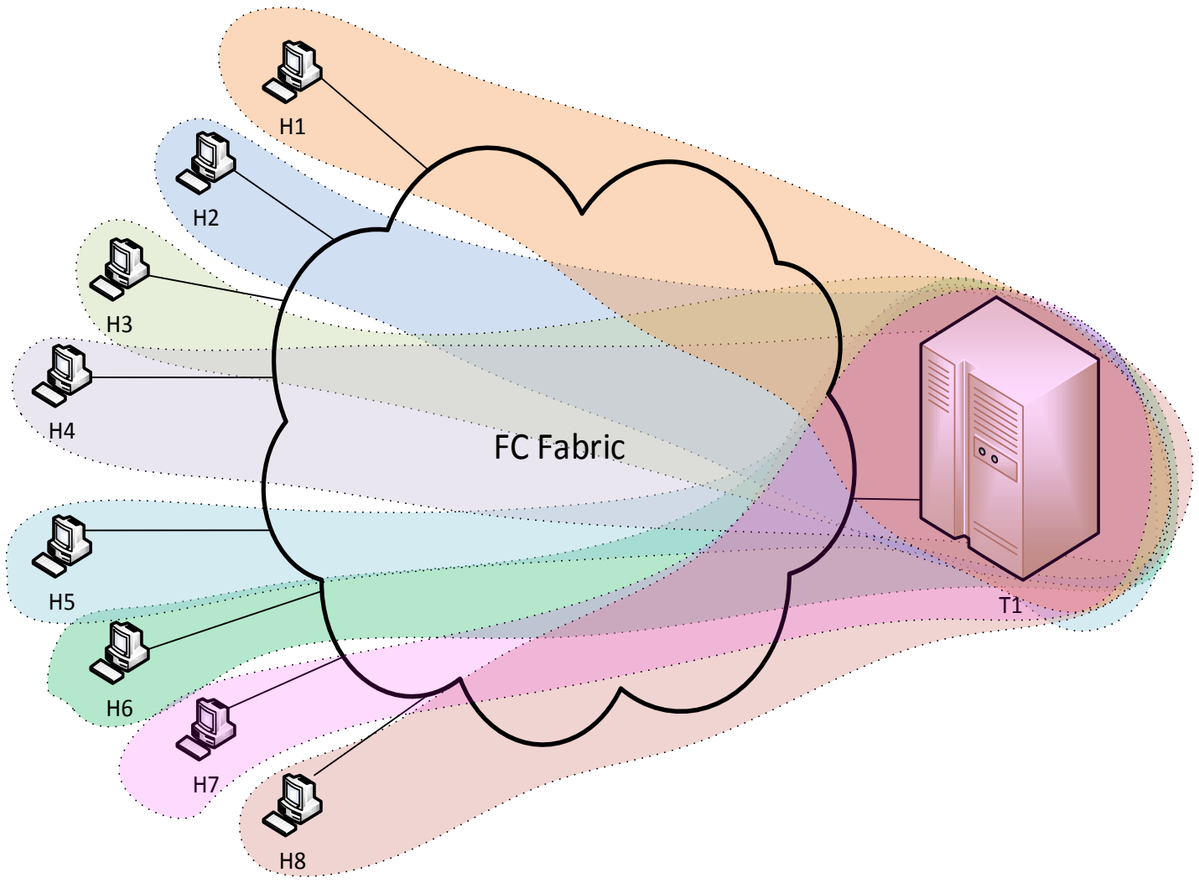


Single Initiator / Single Target Zones

- A zoning best practice

- Limits each zone to two members
  - Initiator – PWWN or Alias
  - Target – PWWN or Alias

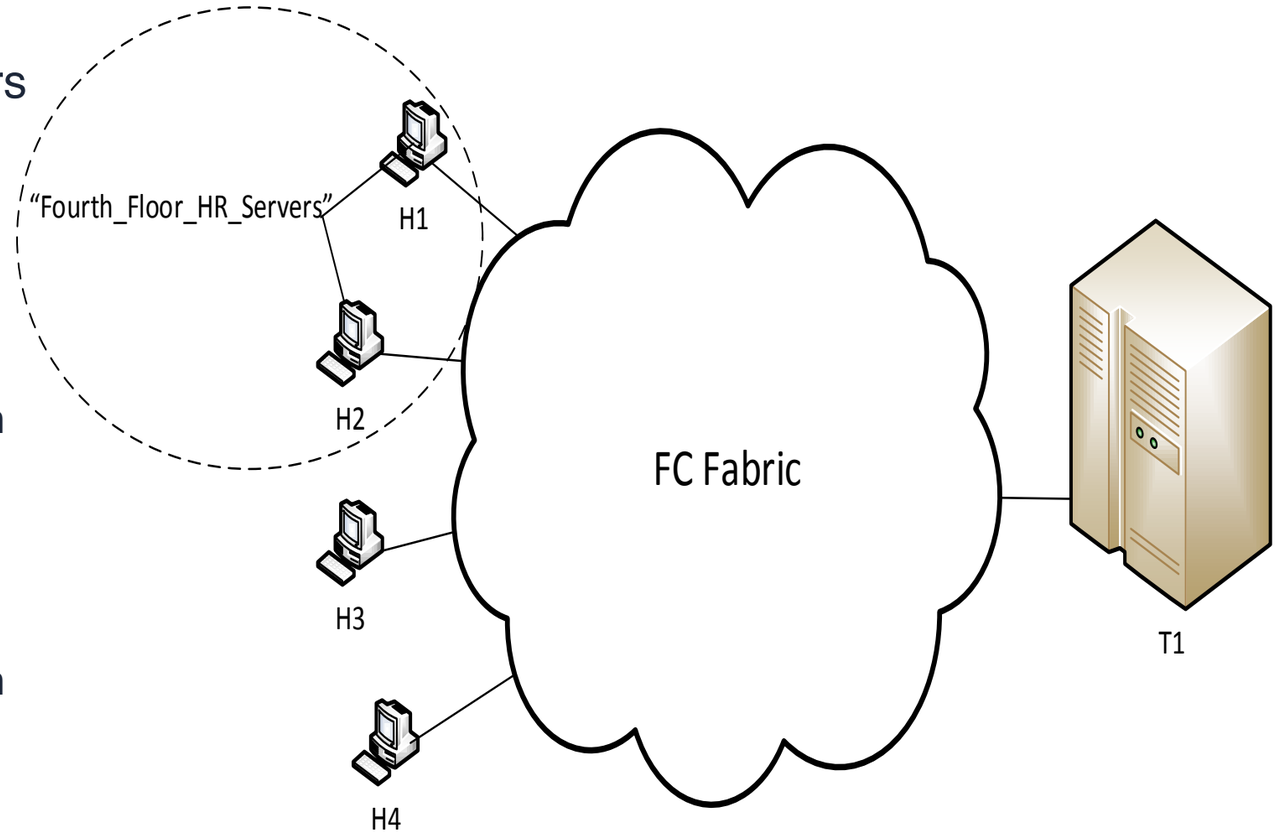
- Isolates access control and reduces communication
  - Only the devices that “care” about each other



Zoning best practices

Zone Alias

- Aliases are alternative names for zone members
- **User Friendly**
  - Administrators can assign a descriptive name to a member or group of members
- **Simpler Zone Creation**
  - Adding devices to multiple zones can be done with one alias instead of manually adding individual WWNs repetitively
- **Device Replacement**
  - If a device needs to be replaced, a single alias can be changed instead of changing numerous zones



Example: The alias "*Fourth_Floor_HR_Servers*"

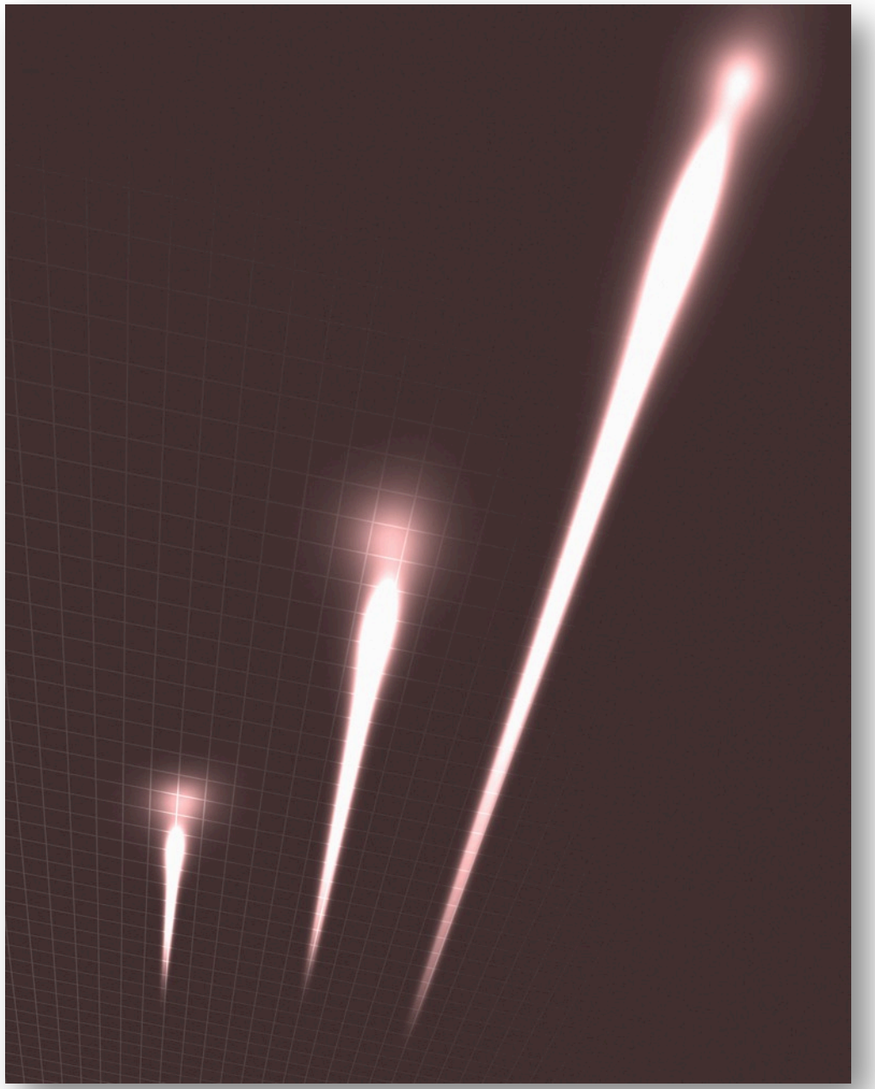
contains the members Host1_WWN; Host2_WWN

Zoning best practices

Continued…

- Be consistent with zone types (try to use WWPN, alias)
- Use default zone deny mode
  - FICON may need to use default zone permit
- Back up your zone set periodically
- Keep zone object names as concise as possible
- Remove zones that are no longer needed
- Allow time for zone changes to propagate through the fabric
  - Do each fabric separately, verify function prior to next fabric

Advances in Zoning



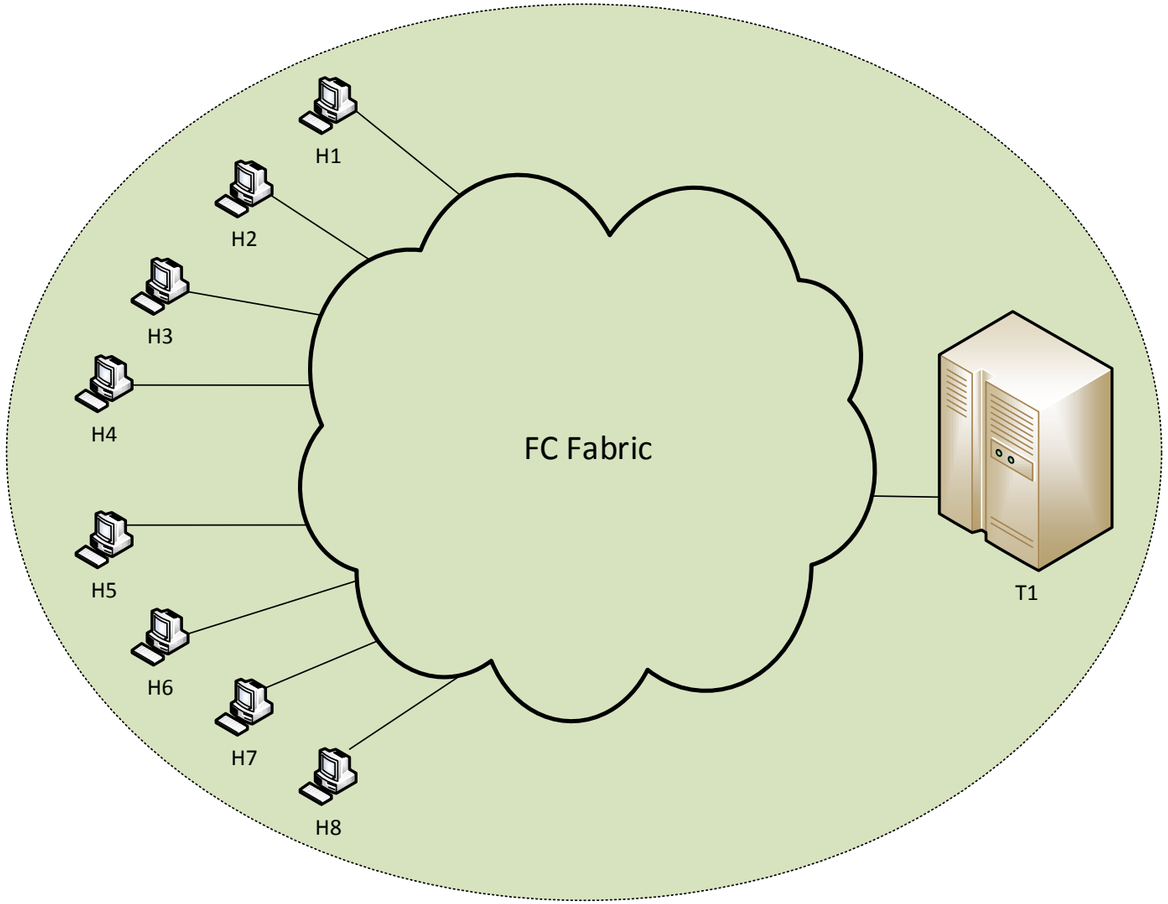
- **Peer Zoning**
  - Allows a Principal device to communicate with peer devices in the zone.
  - Peer devices cannot communicate with each other.
  - Benefits over Single Initiator zoning scheme:
    - Fewer zones to be created compared to Single Initiator zoning.
    - Uses less zone database space since one zone can take the place of multiple Single Initiator zones.
    - No communication between Peer-to-Peer or Principal-to-Principal members.
    - Optimal hardware resource utilization – Same as single initiator scheme
  - New in FC-GS-7

Peer Zones

- Peer Zones are formalized “single initiator / single target” zones

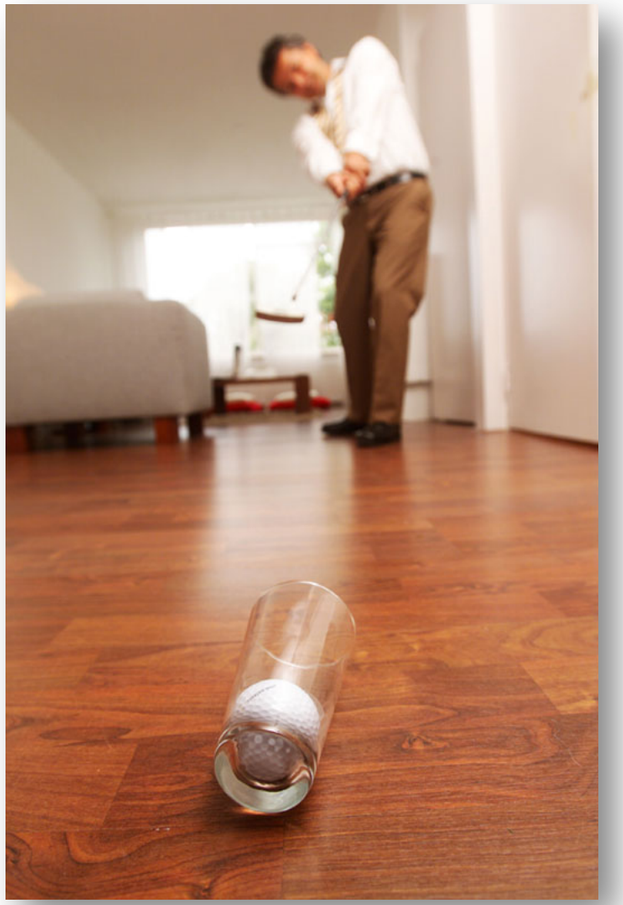
- Zones with Principal and Peer members
  - Connectivity Rules:
    - Principal member(s) can communicate with all Peer members in the zone. Principal-to-Principal communication is not allowed.
    - Peer-to-Peer communication is not allowed.

  - Advantages:
    - Easier to configure and manage due to requiring fewer zones to be created compared to Single Initiator zoning.
    - Smaller memory footprint (zone database and hardware) compared to Single Initiator zoning.
    - More efficient ACL entry usage compared to similar 1-to-Many zoning scheme.
    - Less RSCN-related traffic compared to similar 1-to-Many zoning scheme.



Summary

- Zoning provides a secure method of ensuring only certain devices communicate with each other
- Zoning database will be uniform throughout fabric switches
- Use Single Initiator / Single Target zones whenever possible
- Follow other best practices



Q & A

If you have questions…

…We have answers!

Our Next FCIA Webcast:

Fibre Channel and Security

August 27, 2019

10:00 am PT/1:00 pm ET

Register at:

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