# Customer Deployment Examples for FICON Technologies

Mike Blair – mblair@cisco.com
Howard Johnson - hjohnson@Brocade.COM

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Session 9933
Room Europe 7

# Abstract

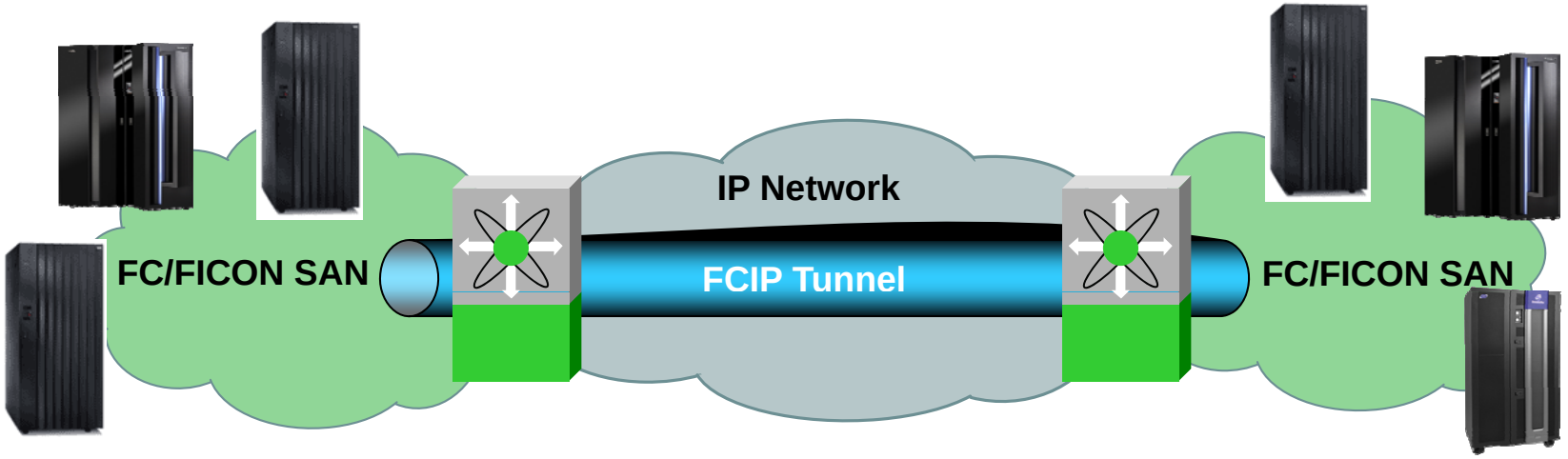

- Extending a cascaded storage area network over long distances requires specific technologies suited for the purpose. Fibre Channel over Internet Protocol (FCIP) is the fundamental technology used to drive these solutions. This technology allows FICON to be extended in order to meet the disaster recovery and business continuance needs of today's enterprise environments. In this session, we explore several customer deployments using FCIP and FCIP based products. Please join industry experts from Brocade, Cisco, and IBM as we delve into the nuances of this critical technology.

# Agenda

- **FCIP Overview**
- FCIP Topologies
- Cisco FCIP – explanations
  - Customer 1 – Prioritized workload with QOS ~ 1000 miles
  - Customer 2 – STK extension over 1000 miles
  - Customer 3 – Overcome DWDM switchover issue – 80km
- Brocade FCIP – explanations
  - Customer 1 – Extension for asynchronous replication
  - Customer 2 – XRC emulation for remote vaulting
  - Customer 3 – Extension solution differences
- IBM comments
  - System z Requirements
- Q & A

# FCIP Overview

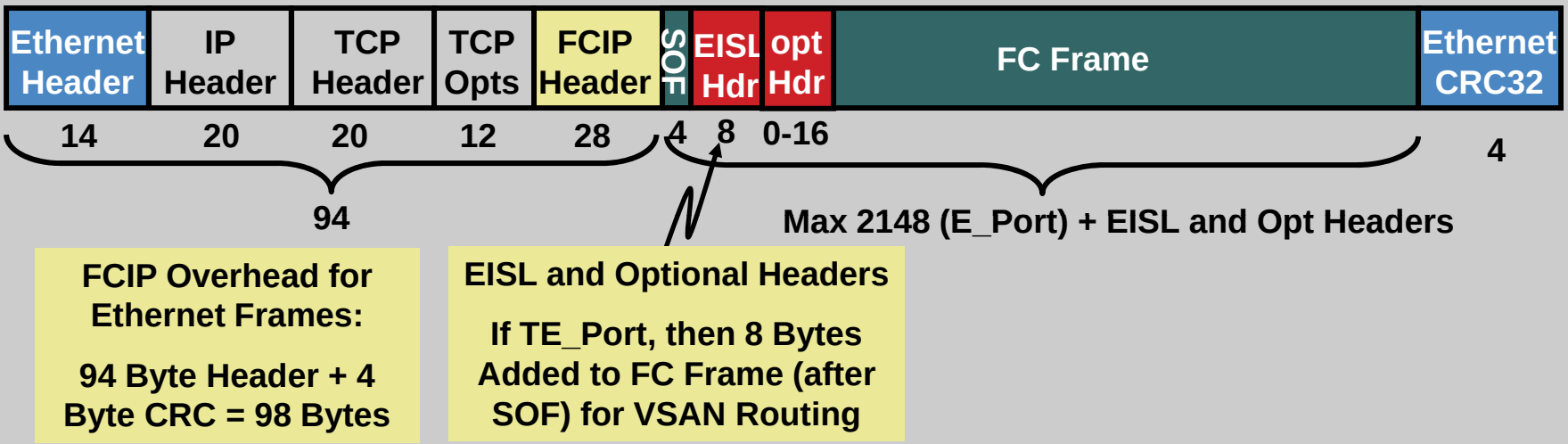
## *Fibre Channel over IP*




**FCIP Is a Standard from the IETF IP Storage WG for Linking FibreChannel SANs over IP (RFCs 3821 and 3643)**

- Point-to-point tunnel between FCIP link end-points
- Appears as one logical FC fabric with single FSPF routing domain

# FCIP Overview
## *FCIP Frame Detail*




- Max FibreChannel frame is 2148 bytes plus optional extras
- FC frames are segmented and reassembled if MTU too small (TCP payload on second or subsequent packets)
- Jumbo frames may increase performance
  - IP MTU of 2300 avoids splitting of TCP frames

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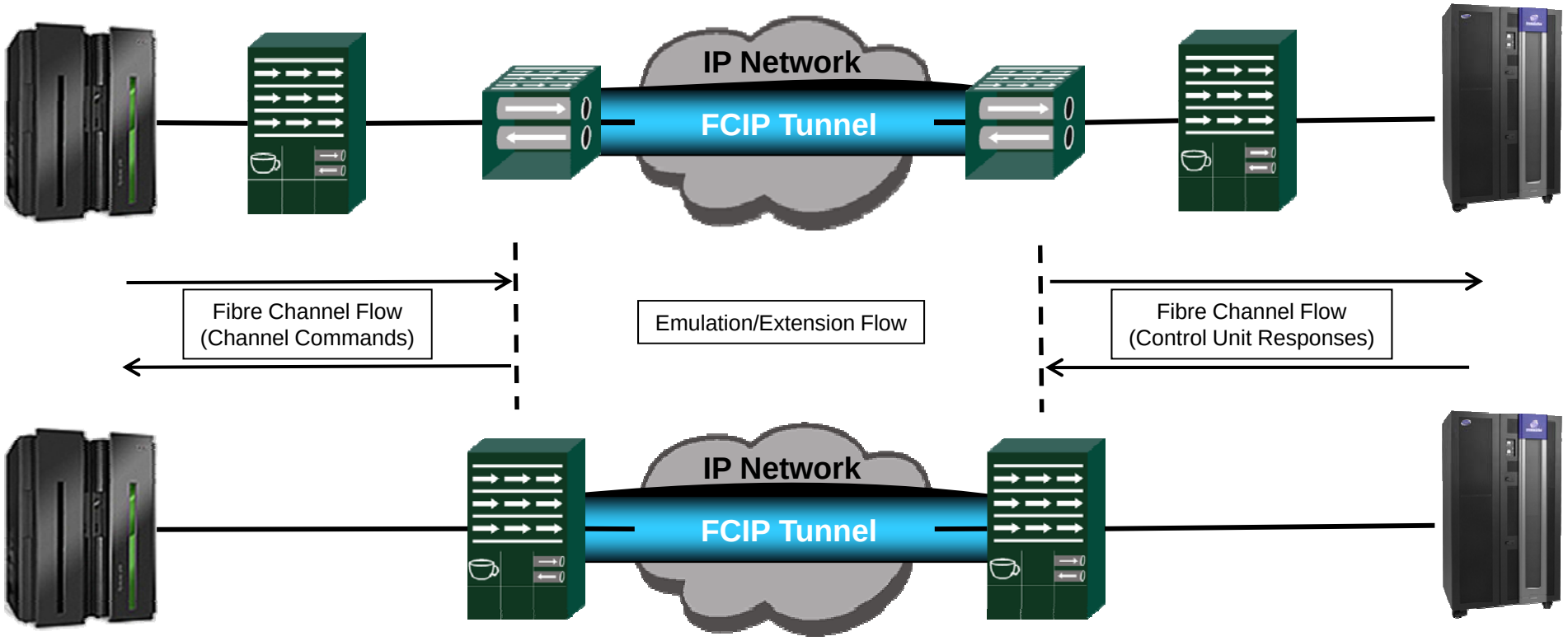
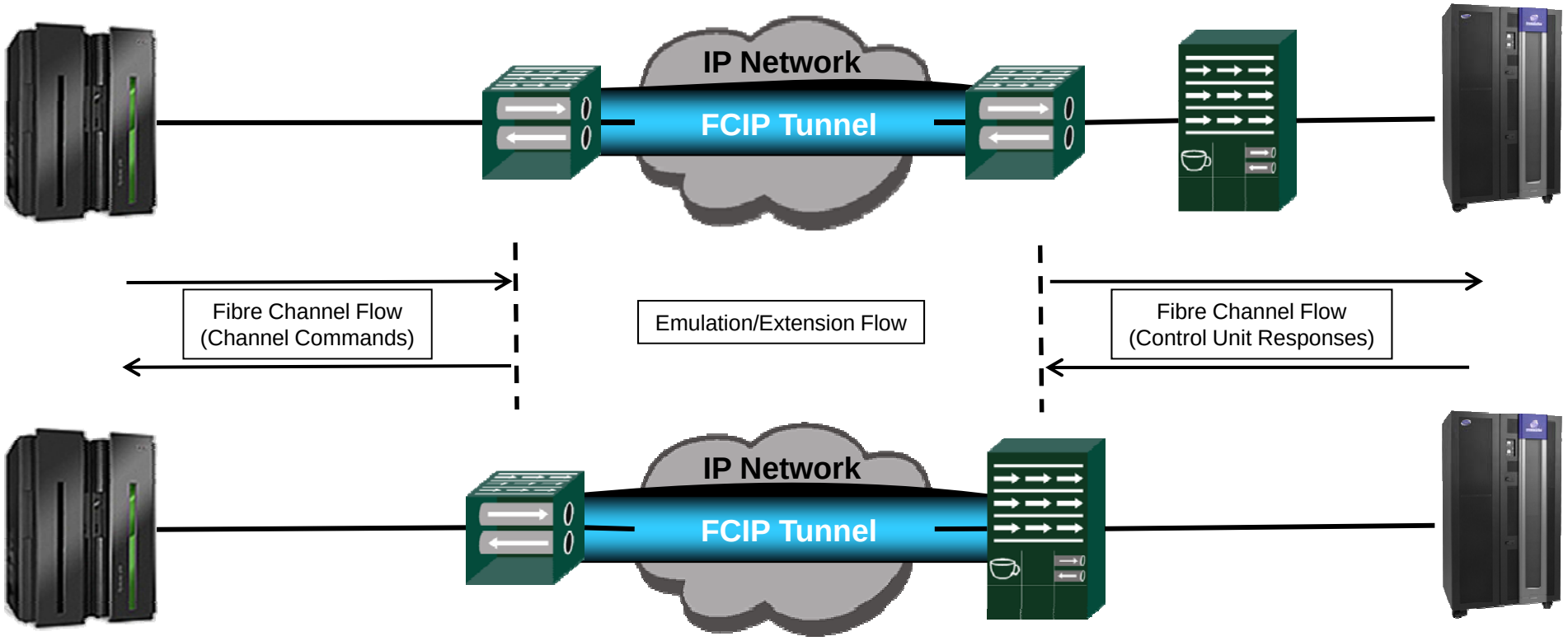
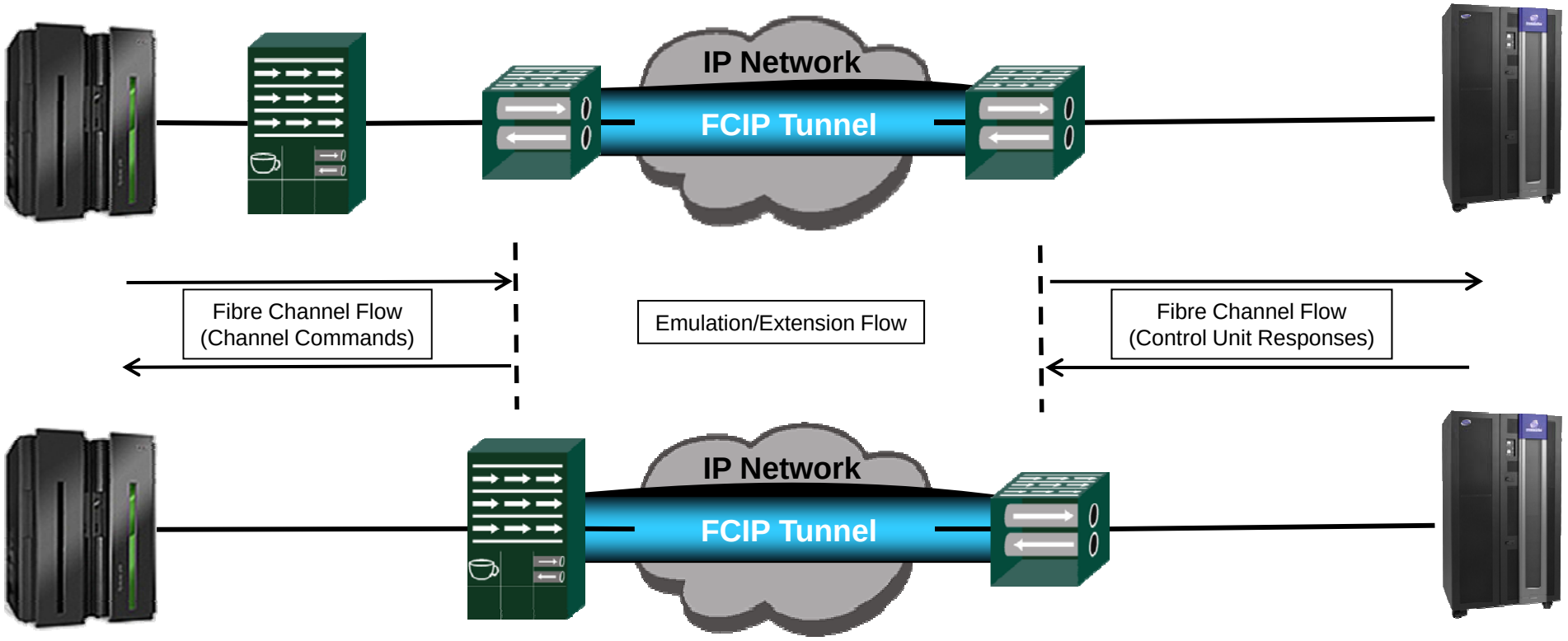
# FCIP Topologies
## *ISL Link Extension*



# FCIP Topologies
## *Channel Link Extension*

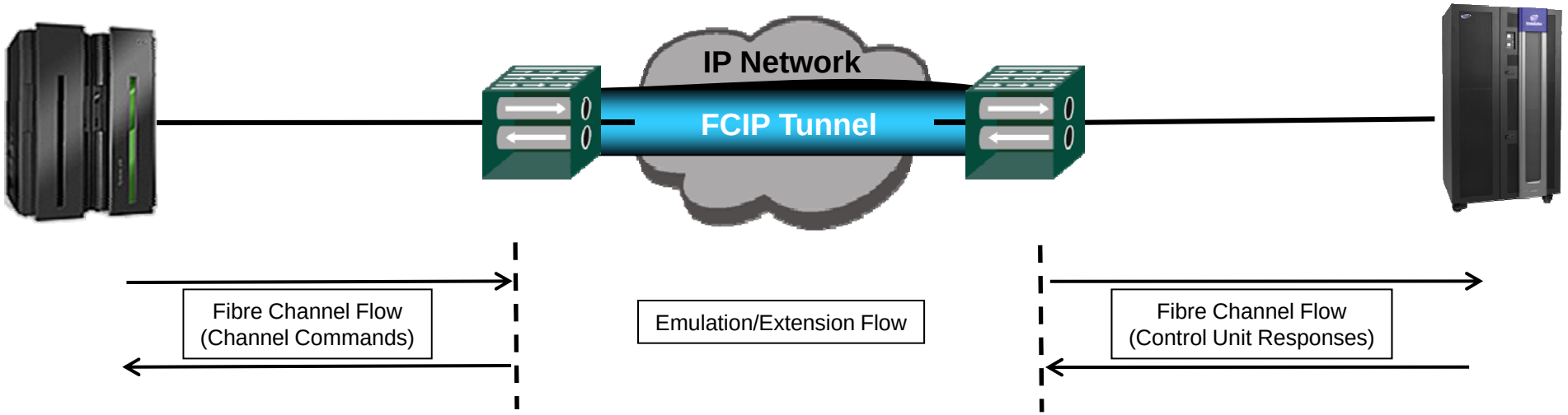


# FCIP Topologies
## *Control Unit Link Extension*



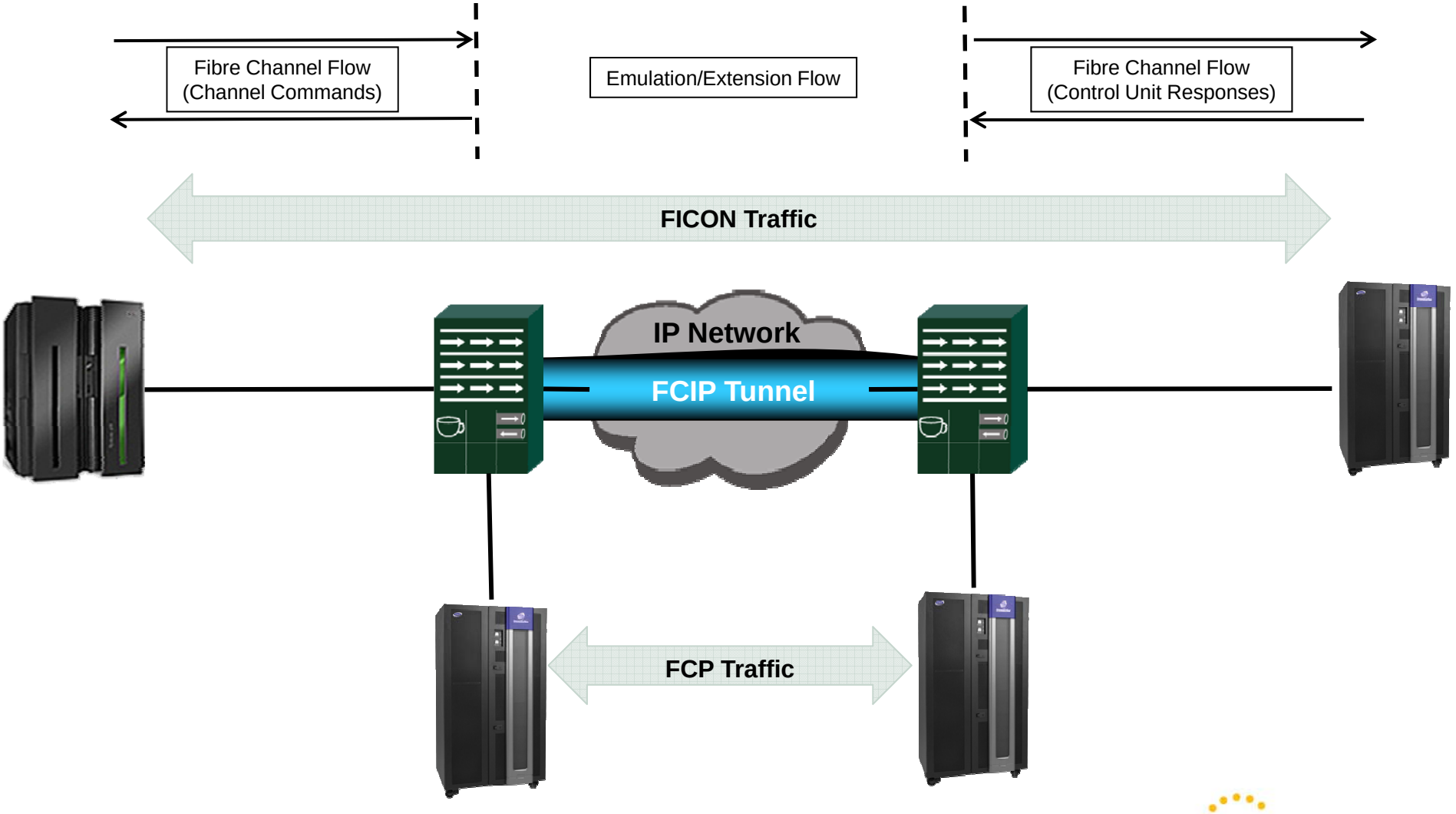
# FCIP Topologies

## *Point to Point Link Extension*



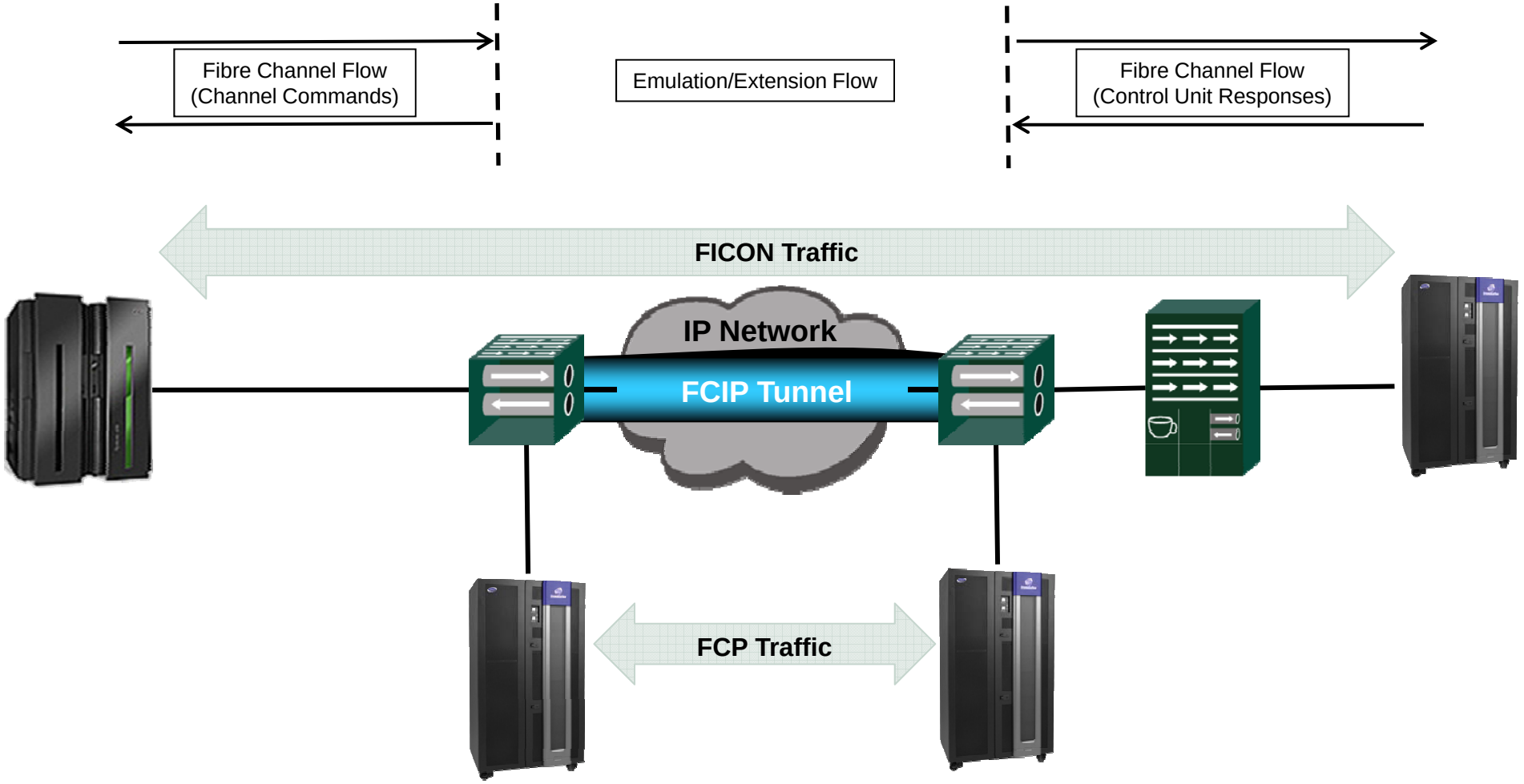
# FCIP Topologies

## *ISL Link Extension with Storage Replication*



# FCIP Topologies

*Channel / Control Unit Link Extension with Storage Replication*



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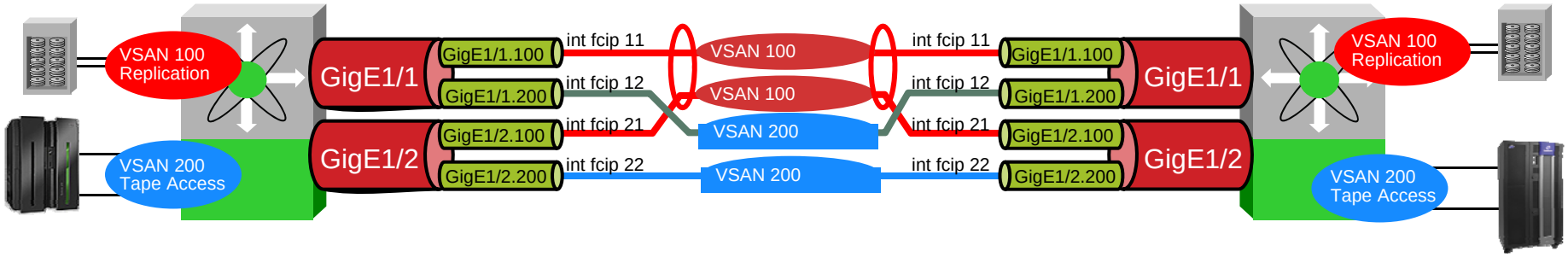
# *Cisco MDS FCIP TCP Behavior*

- Reduce probability of drops
  - Bursts controlled through per flow shaping and congestion window control → less likely to overrun routers
- Increased resilience to drops
  - Uses SACK, fast retransmit and shaping
- Aggressive slow start q
  - Initial rate controlled by “min-available-bandwidth”
  - Max rate controlled by “max-bandwidth”

Differences with Normal TCP:

- When congestion occurs with other conventional TCP traffic, FCIP is more aggressive during recovery (“bullying” the other traffic)
  - Aggression is proportional to the min-available-bandwidth configuration

# Cisco FCIP – Multiple FCIP Tunnels




Now, Configure QOS based on business priorities of data

- VSAN 100 – high priority – disk mirroring
- VSAN 200 – med priority – Tape backups
- VSAN 300 (not shown) – low priority (open systems SAN stuff)

Making the assumption that this is a dedicated SAN WAN infrastructure – but within that, prioritization is needed.

Note: Routers and Switches MUST be QOS aware.

# Cisco FCIP QoS Markings

Customer networks can have several types of business-critical traffic, including voice over IP (VoIP), video, FCIP, business applications, etc…

Traffic is normally classified as it enters the network, where it is marked for appropriate treatment.

High →

| Application | L3 Classification | | | L2 CoS |
|---|---|---|---|---|
| | IPP | PHB | DSCP | |
| Routing/FCIP control | 6 | CS6 | 48 | 6 |
| Voice | 5 | EF | 46 | 5 |
| Video Conferencing | 4 | AF41 | 34 | 4 |
| Streaming Video | 4 | CS4 | 32 | 4 |
| FCIP SYNC | 3 | AF31 | 26 | 3 |
| Call Signaling | 3 | CS3 | 24 | 3 |
| FCIP ASYNC | 2 | AF21 | 18 | 2 |
| Network Management | 2 | CS2 | 16 | 2 |
| FCIP backup/FCIP ASYNC | 1 | AF11 | 10 | 1 |
| Scavenger | 1 | CS1 | 8 | 1 |
| Best Effort | 0 | 0 | 0 | 0 |

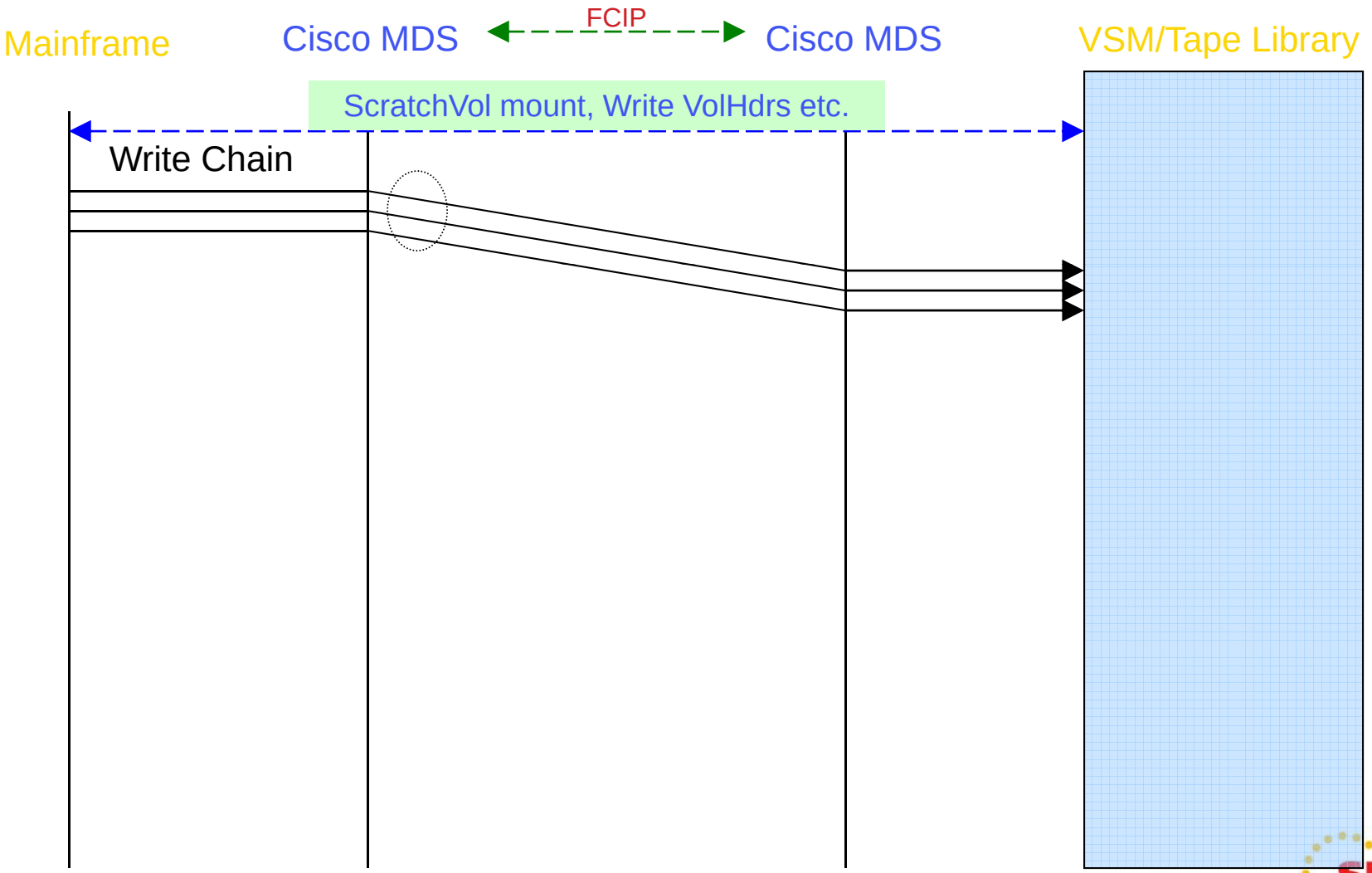
← Med

Low →

# Cisco's FICON Tape Acceleration

- Accelerates Writes by means of local acknowledgement
  - Command Response
  - Status
  - Write data never fully owned by FTA
    - Sync command is not emulated – insures data integrity
- Accelerated Reads by means of pre-fetching of data
  - Watches first read(s) to learn
  - Pre-reads to help fill the data pipe
  - Re-position logic to handle if we pre-read too far
- Tape control, label processing, etc are not accelerated

# Backup protocol without acceleration



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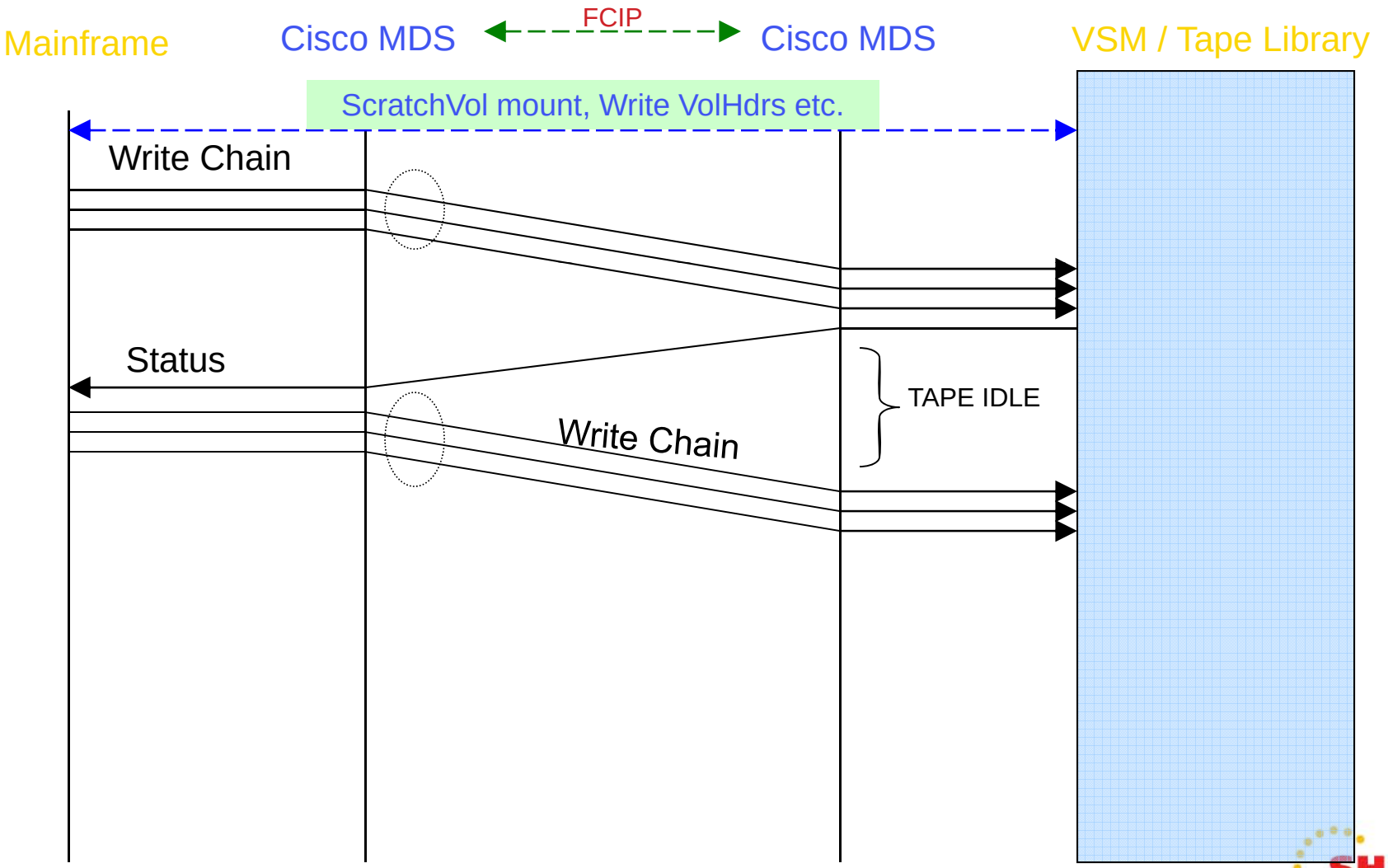

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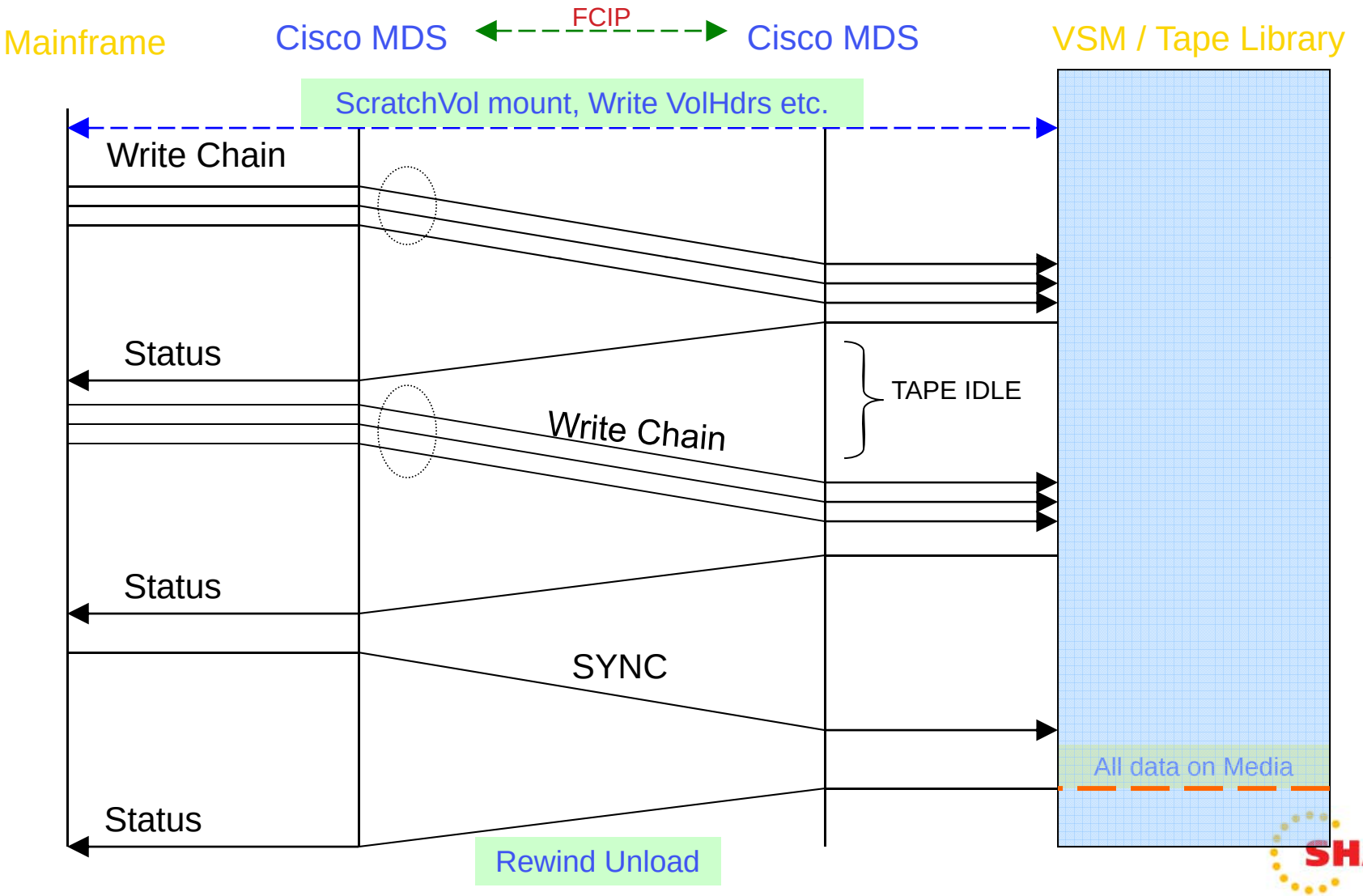

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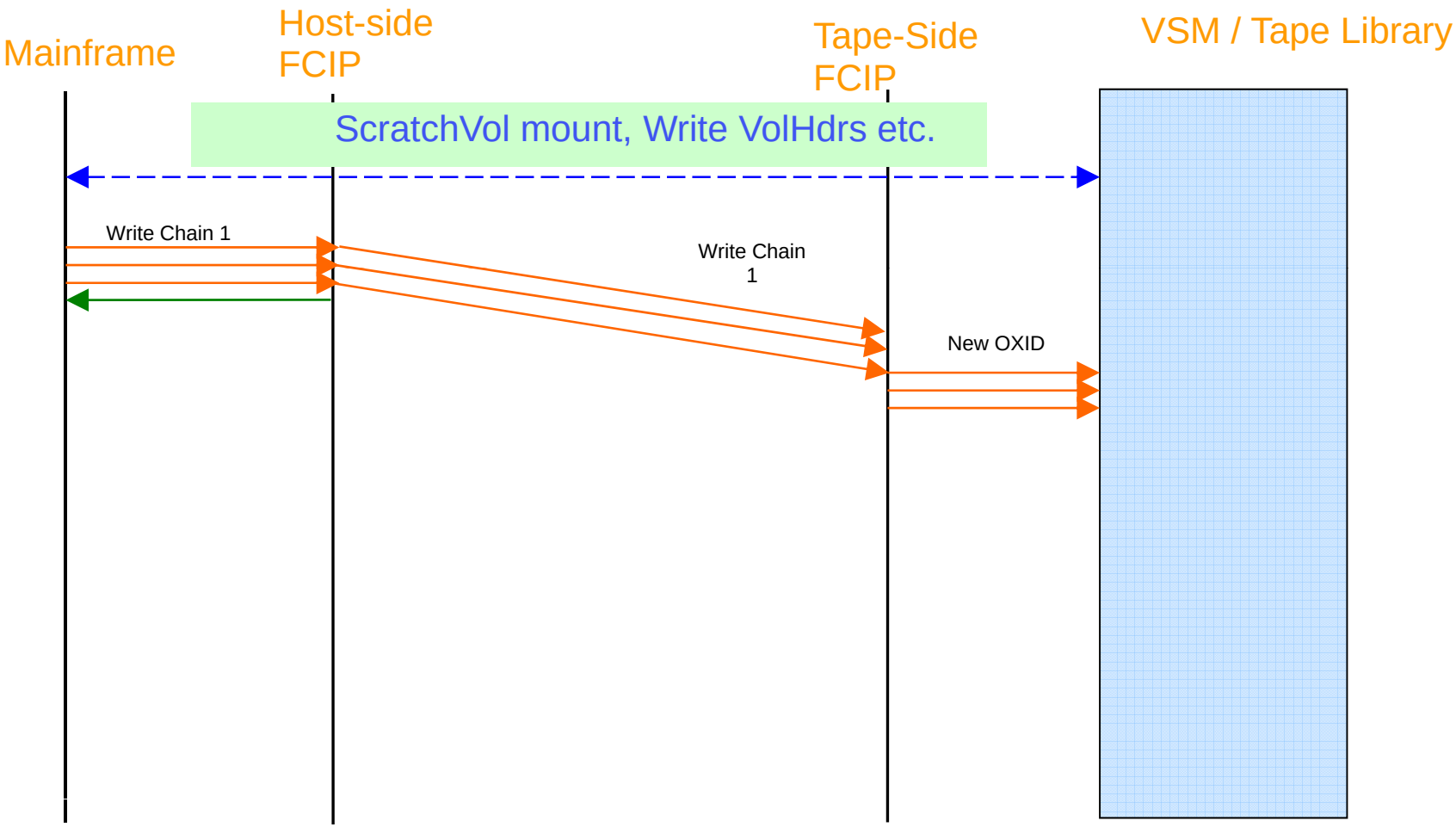

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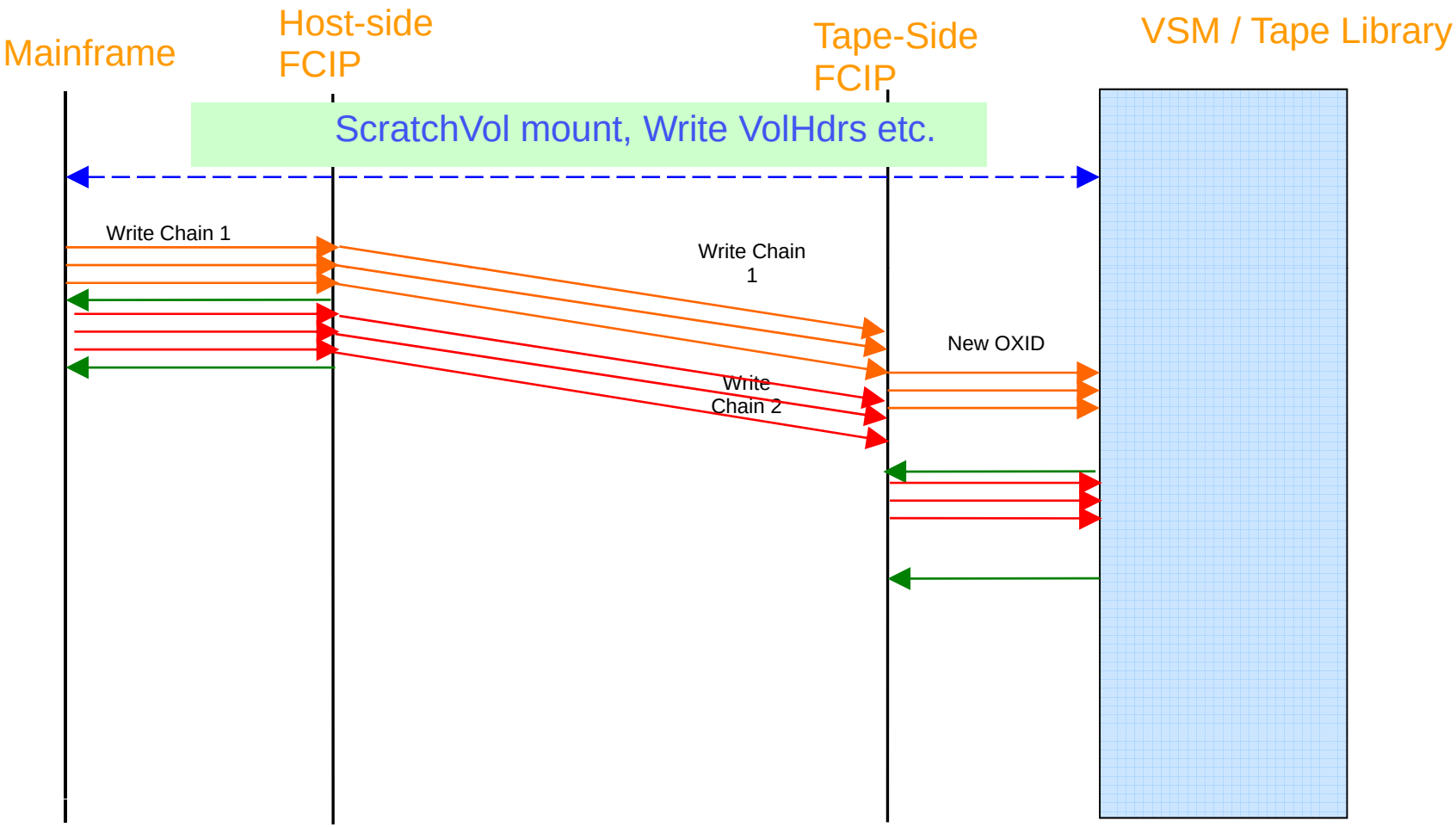

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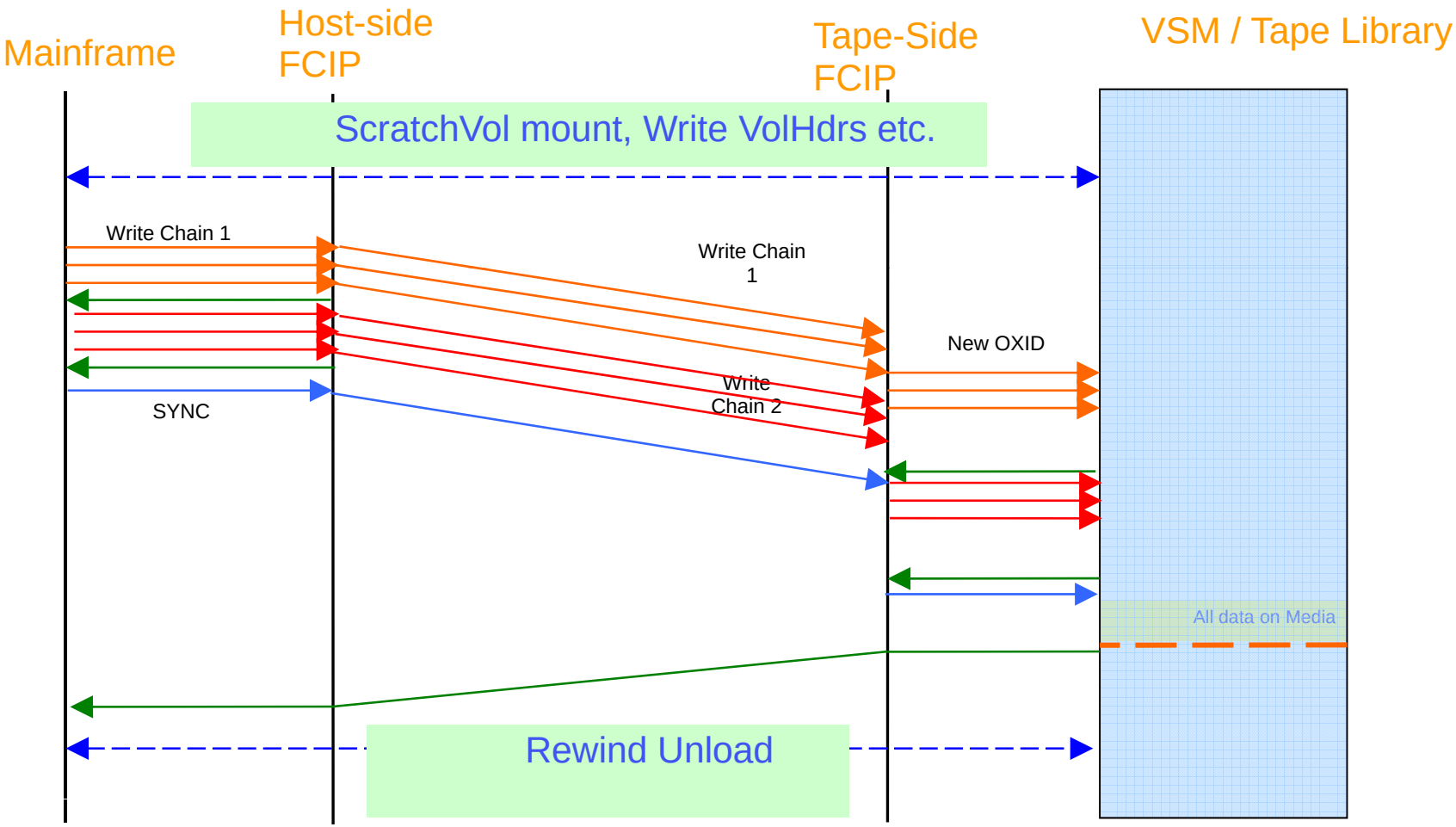
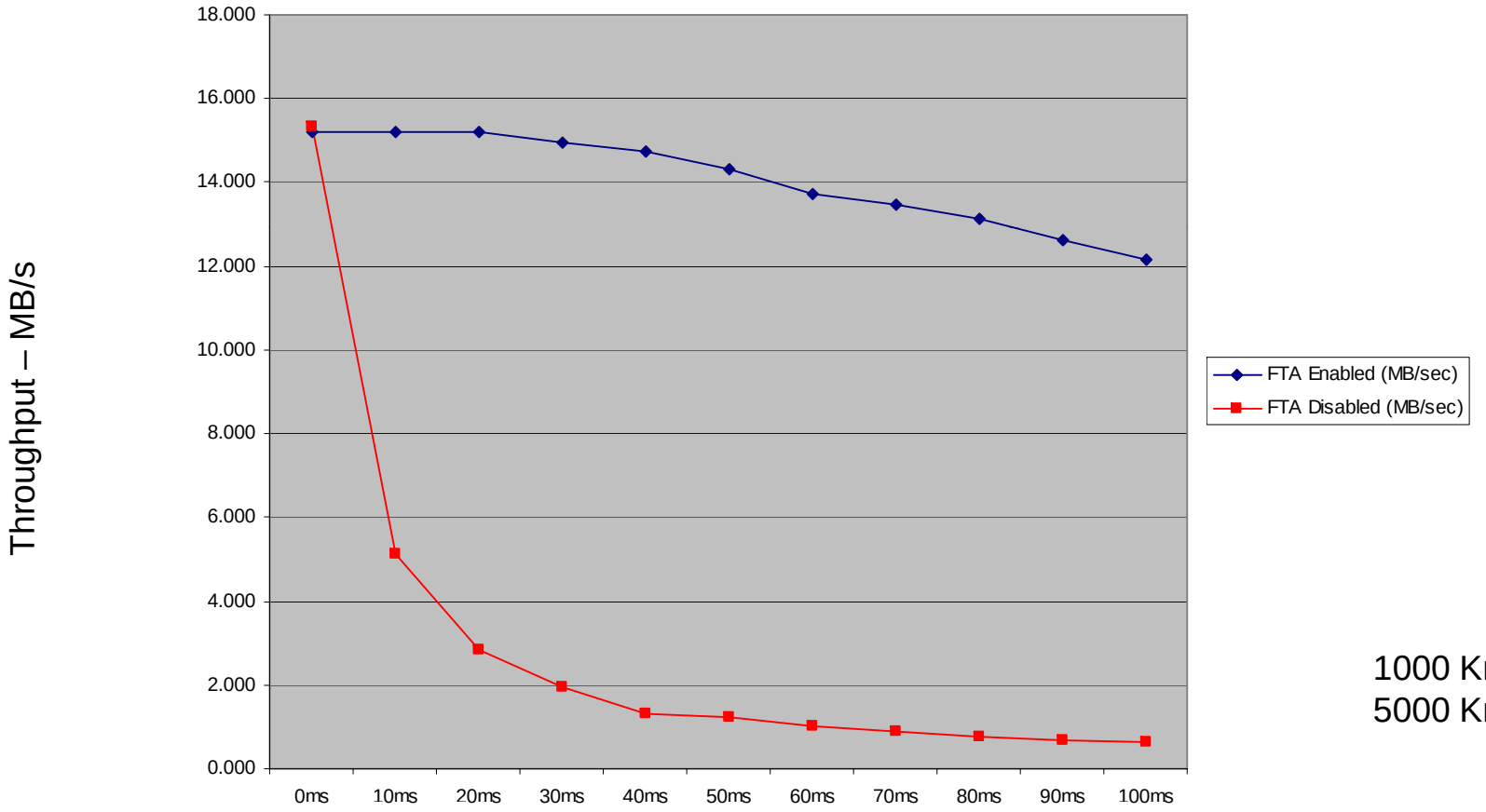


# Sample Results: Write Throughput

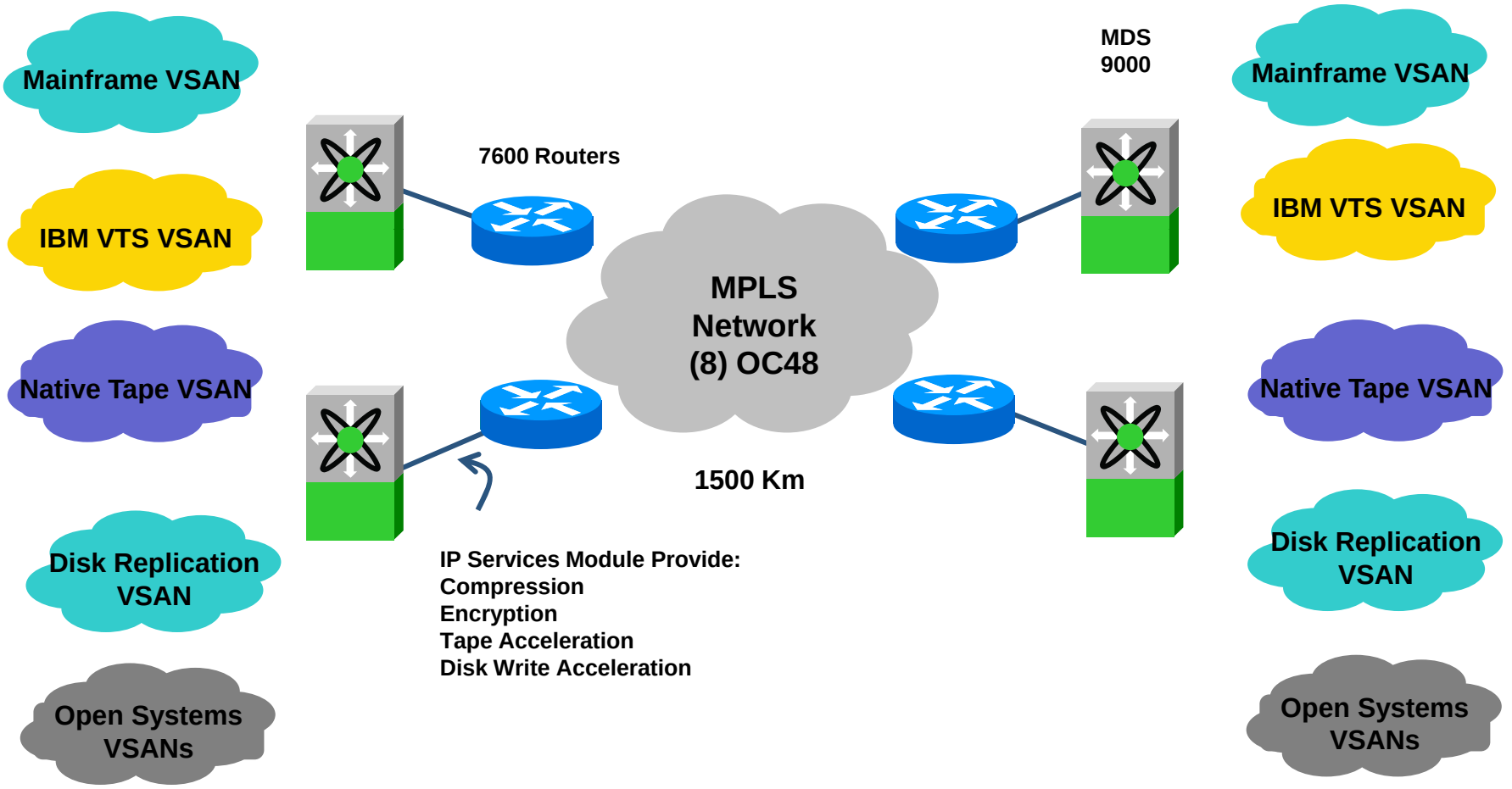



1000 Km – 10ms
5000 Km – 50ms

# Cisco's XRC Acceleration

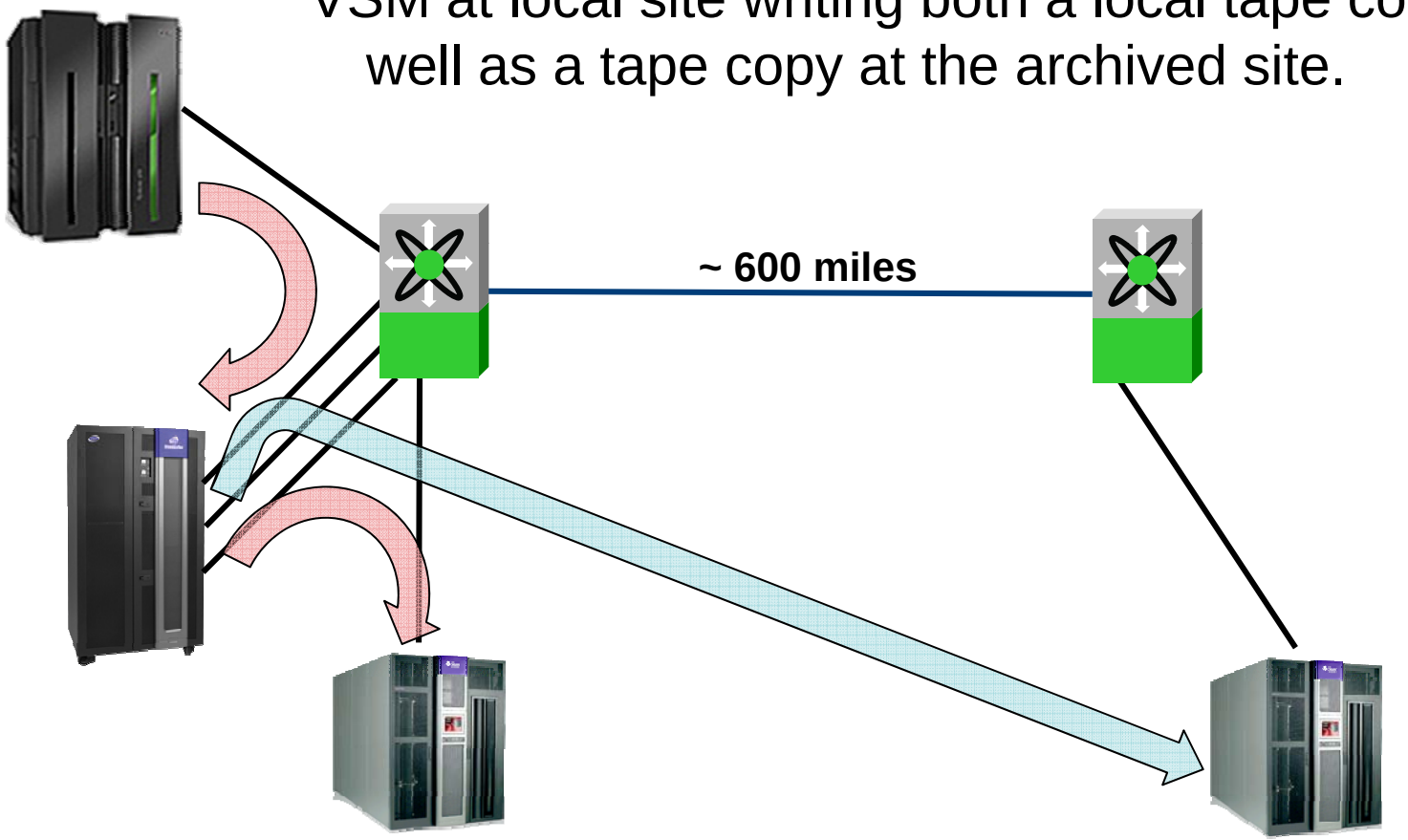
- Flow based acceleration to accelerate RRS commands
  - SDM indicates how many RRS commands in a chain
  - Remote Cisco MDS pre-issues these RRS commands
  - Helps to fill the pipe – working around IU pacing
- Fully supports Cisco Port channels (bundled ISLs)
  - Less disruption when WAN errors occur
- Works with all models of z Systems
  - Integrates smoothly with z10 Extended distance feature
- Can utilize integrated hardware compression / encryption
- Supports all three major vendors DASD systems

# Customer 1 - Large Provider of Business Outsourcing Services

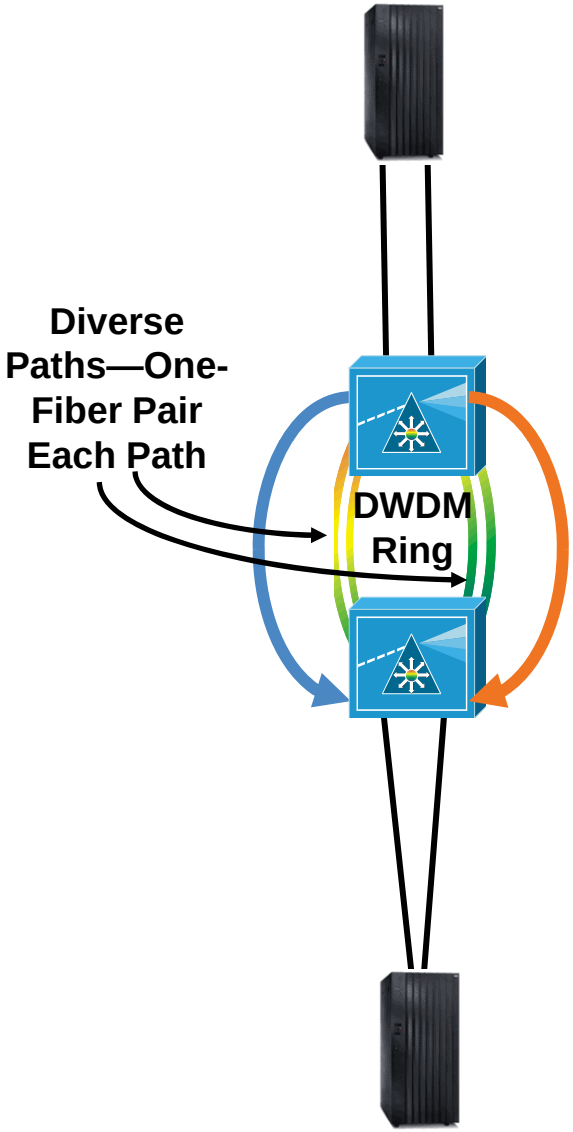


# Customer 2 – Large European Bank

VSM at local site writing both a local tape copy as well as a tape copy at the archived site.



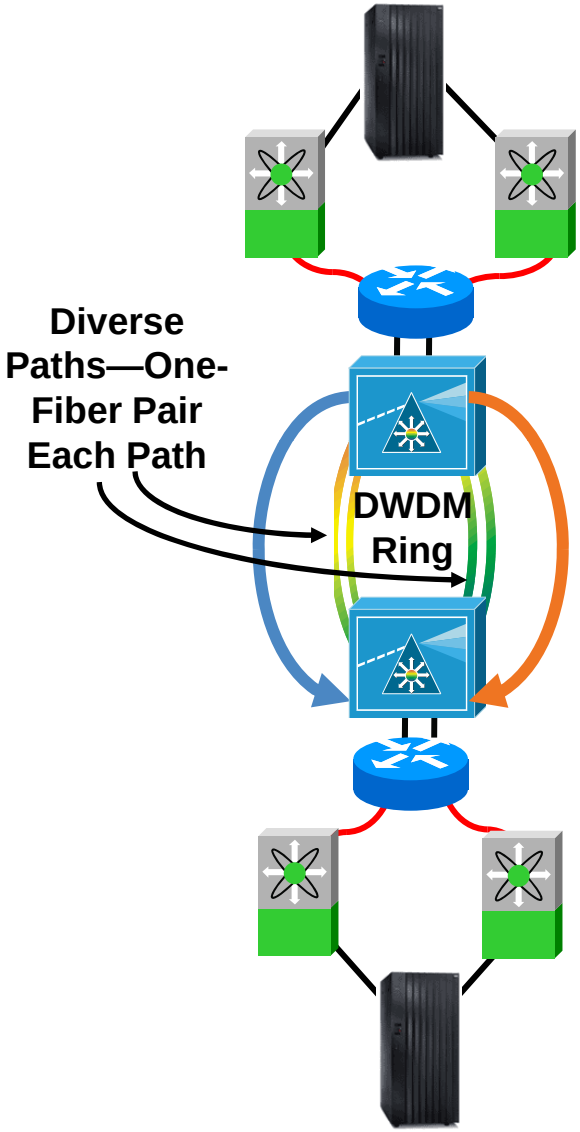
# Customer 3 – Large Financial Institution – Problem




Problem to solve:

- Disk mirroring links hooked directly to DWDM
- 50ms DWDM switchover causing mirror to drop

# Customer 3 – Large Financial Institution




Advantages:

- Consolidate to 10G Extended infrastructure
- FCIP retry logic masks optical switchover

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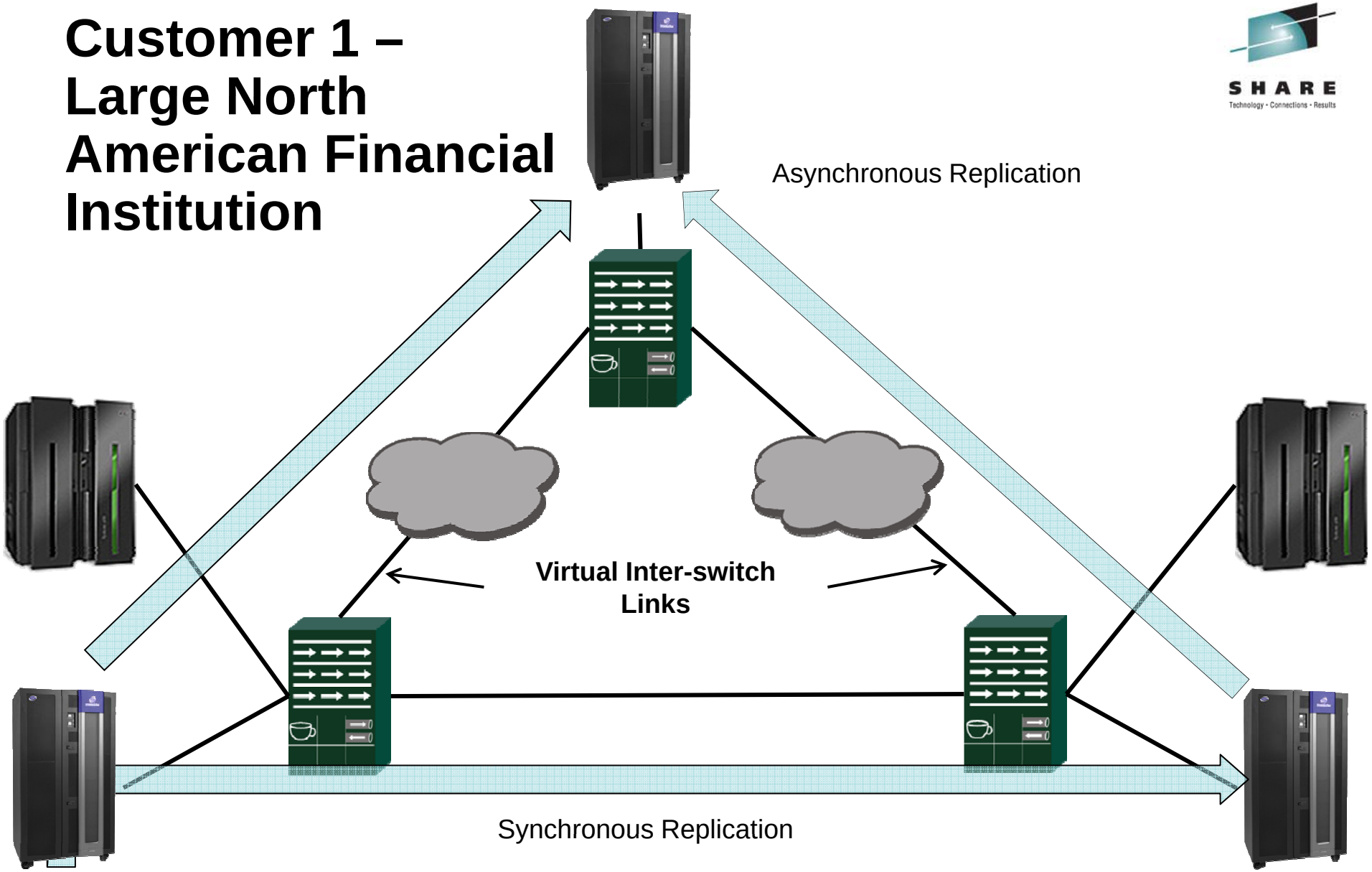
# Brocade Extension Characteristics Asynchronous Replication

- Virtual Fabric Isolation
  - Stabilizes local and remote environments
  - Isolates environments from each other
- Fabric Stability
  - Network behaviors reduced to device access
- Device Access
  - Limited to defined devices
  - Local devices isolated from remote

# Customer 1 – Large North American Financial Institution



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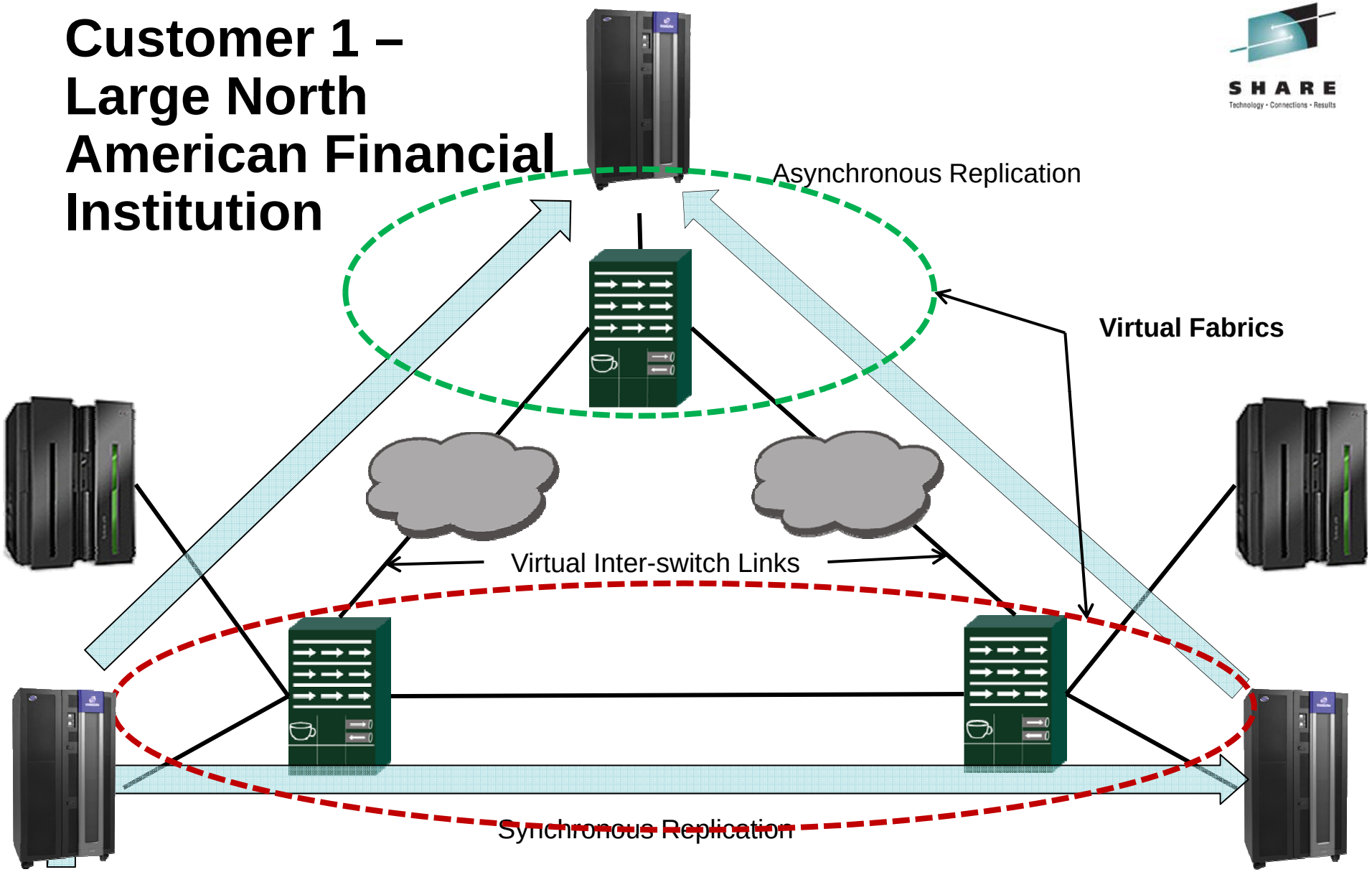

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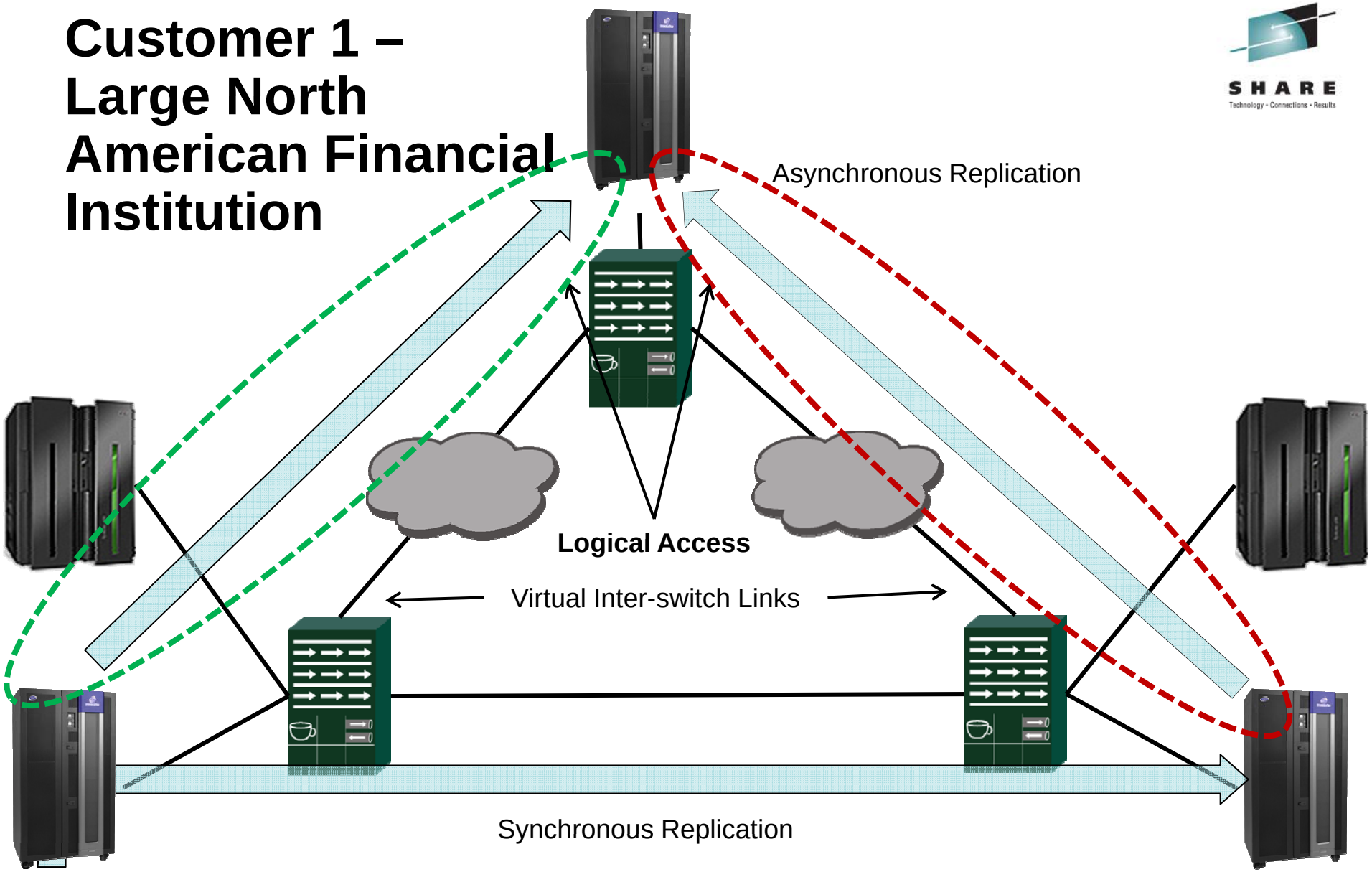
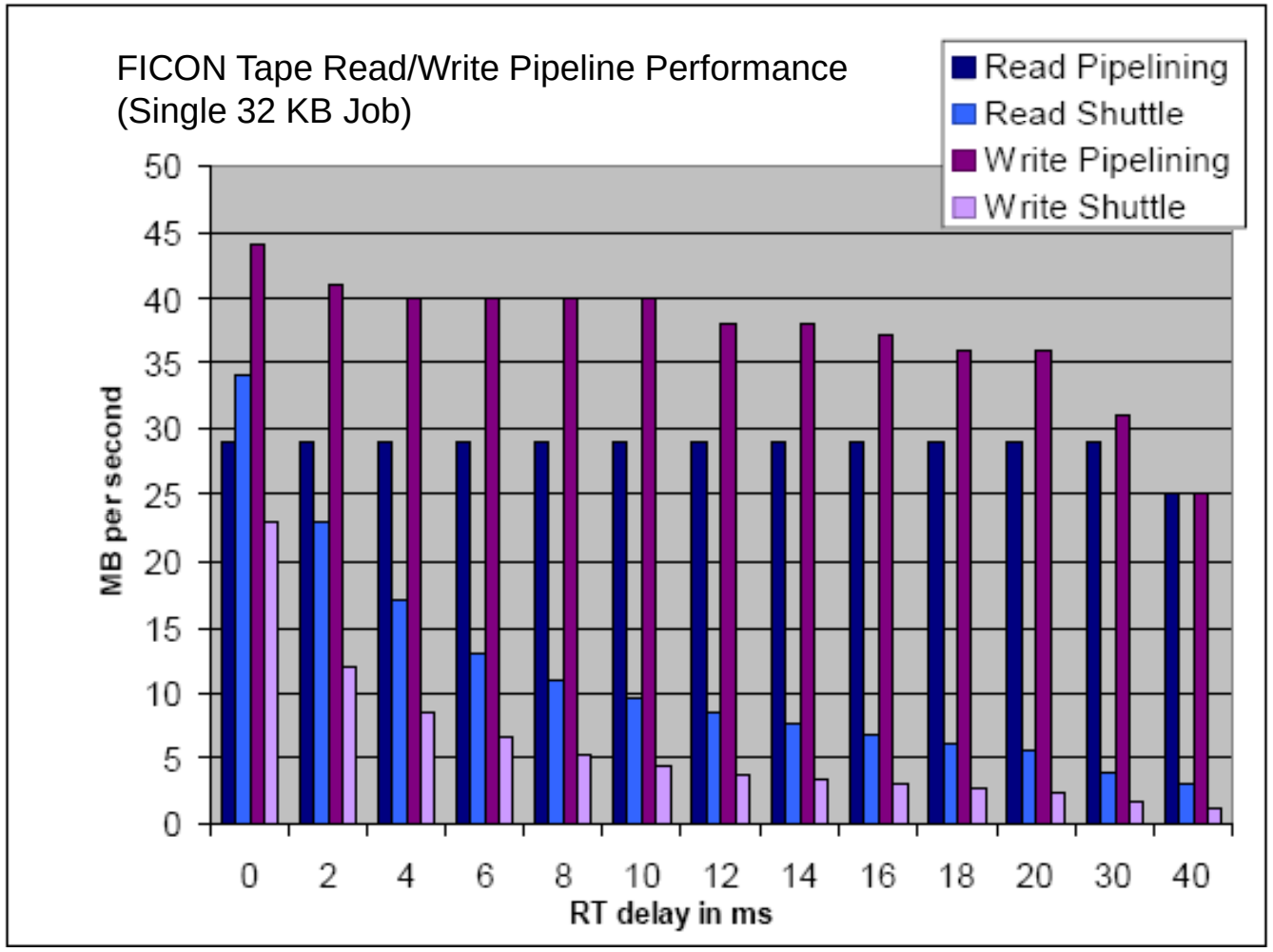


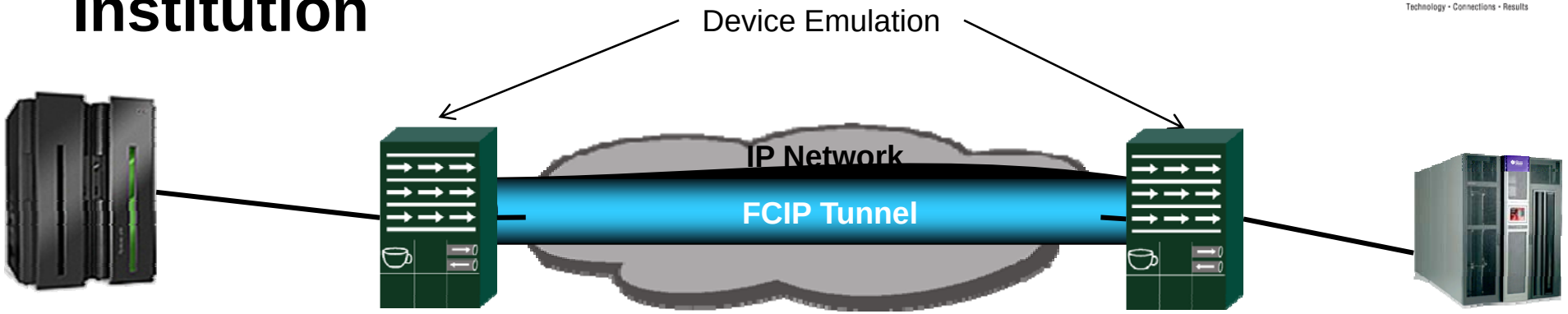
# Brocade Emulation Functions
# XRC Environment

- Serves uniquely formatted channel program
  - Identified by a uniquely prefixed DSO
    - Defined Subsystem Operation command Comand-Data IU
  - All other channel programs are shuttled across WAN
    - No additional processing
- Seeks to alleviate dormancy
  - Buffering delays
  - Signal propagation delays
  - Bandwidth restrictions of WAN links

# Brocade Performance Gains Device Emulation



# Customer 2 – American Financial Institution




1

Local Acknowledgements

2

3

Write sequences are pre-acknowledged to the host and data is continuously sent to the network

4a

Final ending status is presented to the host

1a

2a

3a

Write data is streamed to the remote emulator

4

Final ending status is returned to the local emulator

Write Commands

1b

Local Acknowledgements

2b

3b

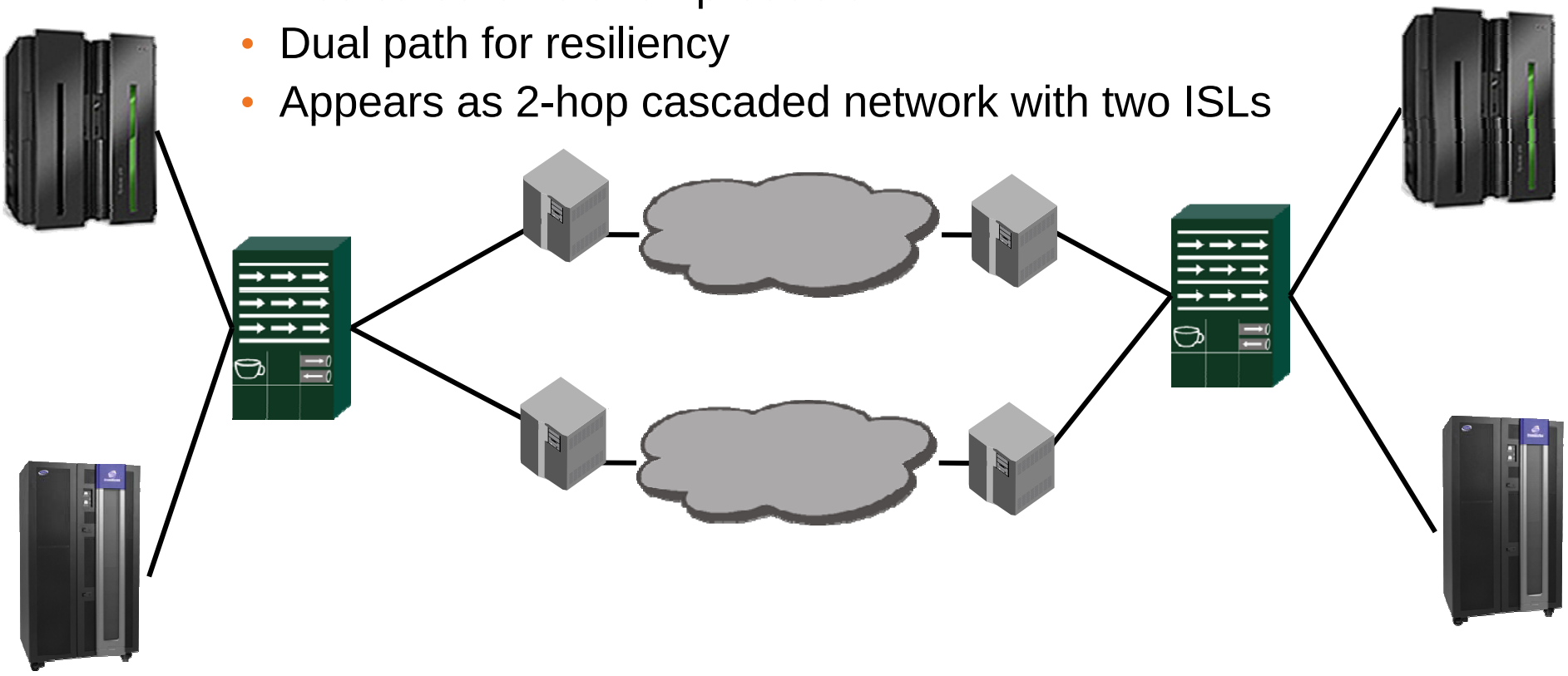
Write channel programs are presented to the tape device

# Brocade Extension and Emulation Solution Considerations

- Dedicated Emulation Products
  - These solutions appear as a “bump in the wire”
- Switched Emulation Products
  - These solutions integrate Fibre Channel switching with emulation services
    - Can be standalone switches or Directors with emulation blades
    - When emulating only they are a “hop of no concern”
- Gotcha’s
  - Mixing solutions requires an understanding of Fibre Channel routing rules

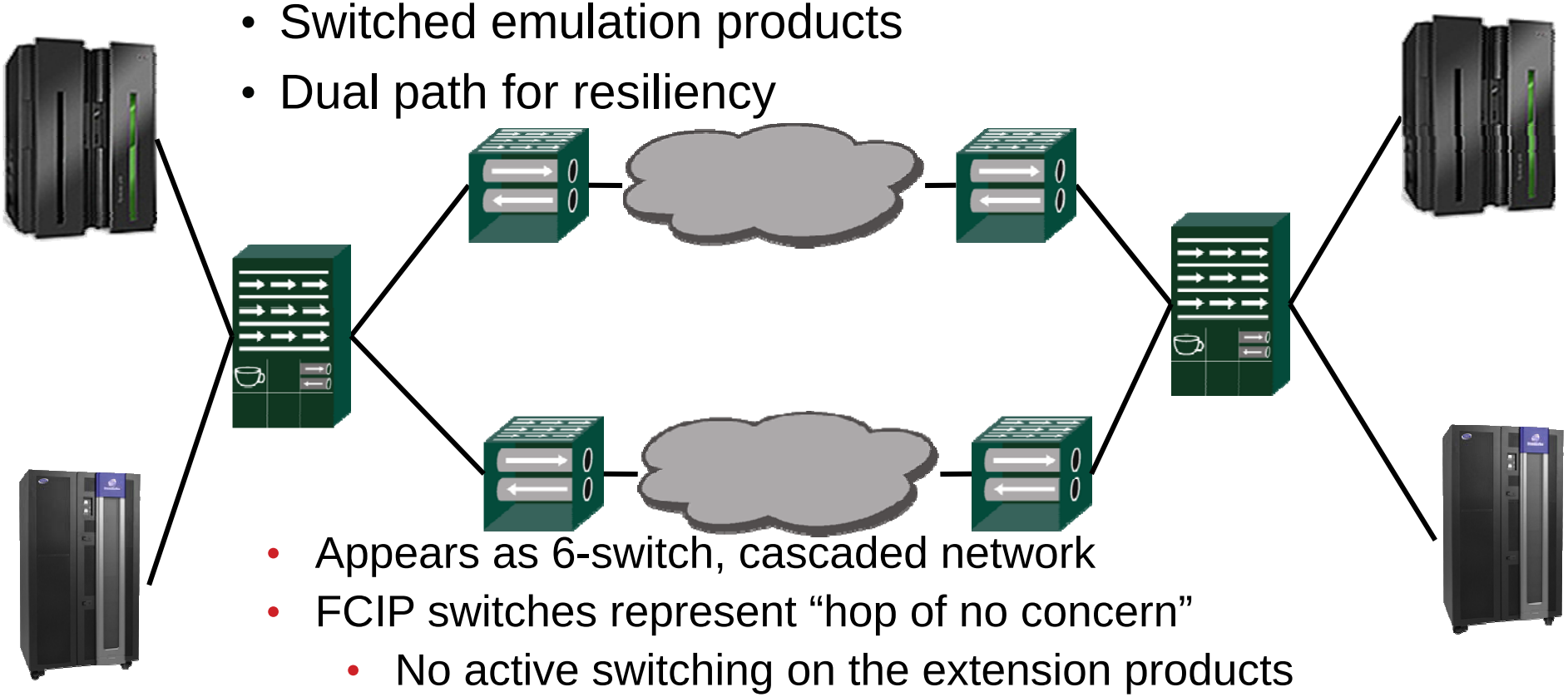
# Customer 3 – Australian Solution Provider

- Existing solution
  - Dedicated emulation products
  - Dual path for resiliency
  - Appears as 2-hop cascaded network with two ISLs



# Customer 3 – Australian Solution Provider

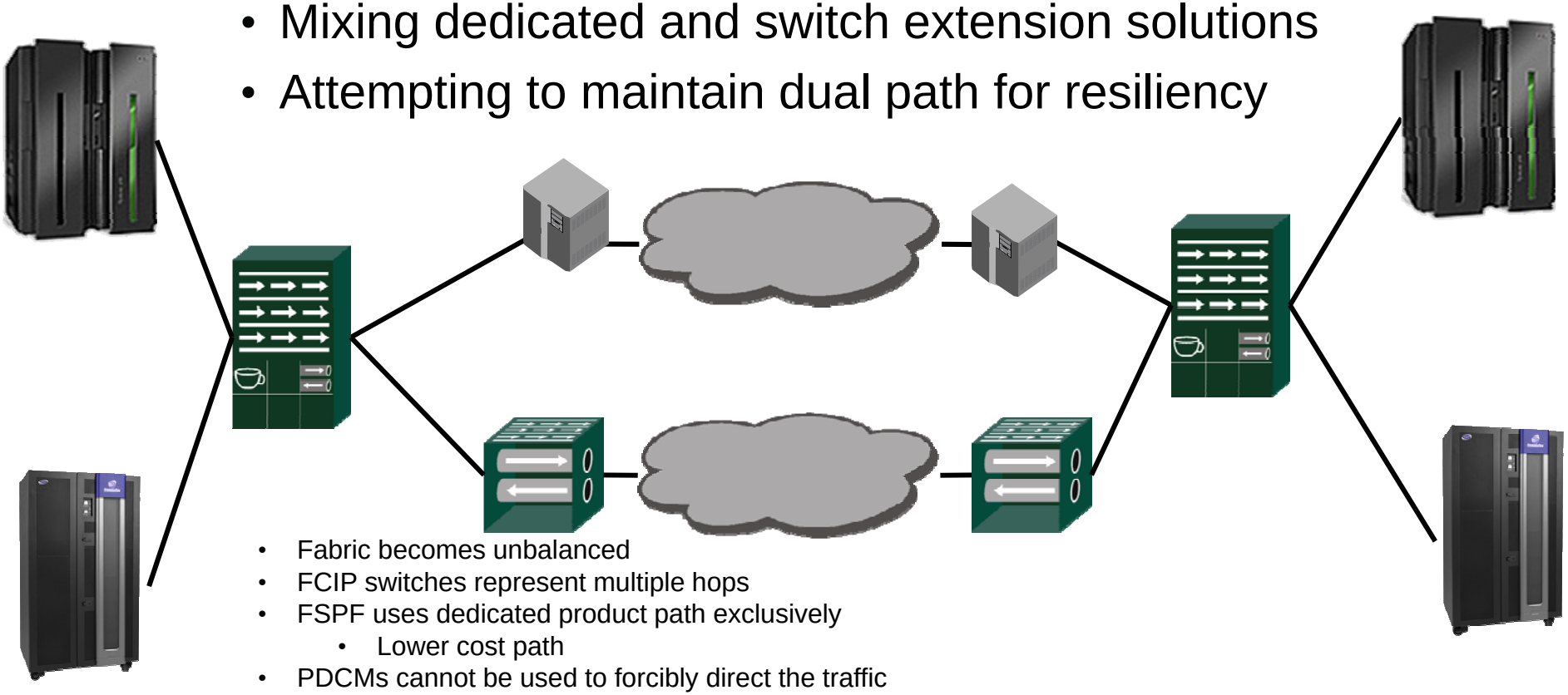
- Updated solution
  - Switched emulation products
  - Dual path for resiliency



  - Appears as 6-switch, cascaded network
  - FCIP switches represent “hop of no concern”
    - No active switching on the extension products

# Customer 3 – Australian Solution Provider

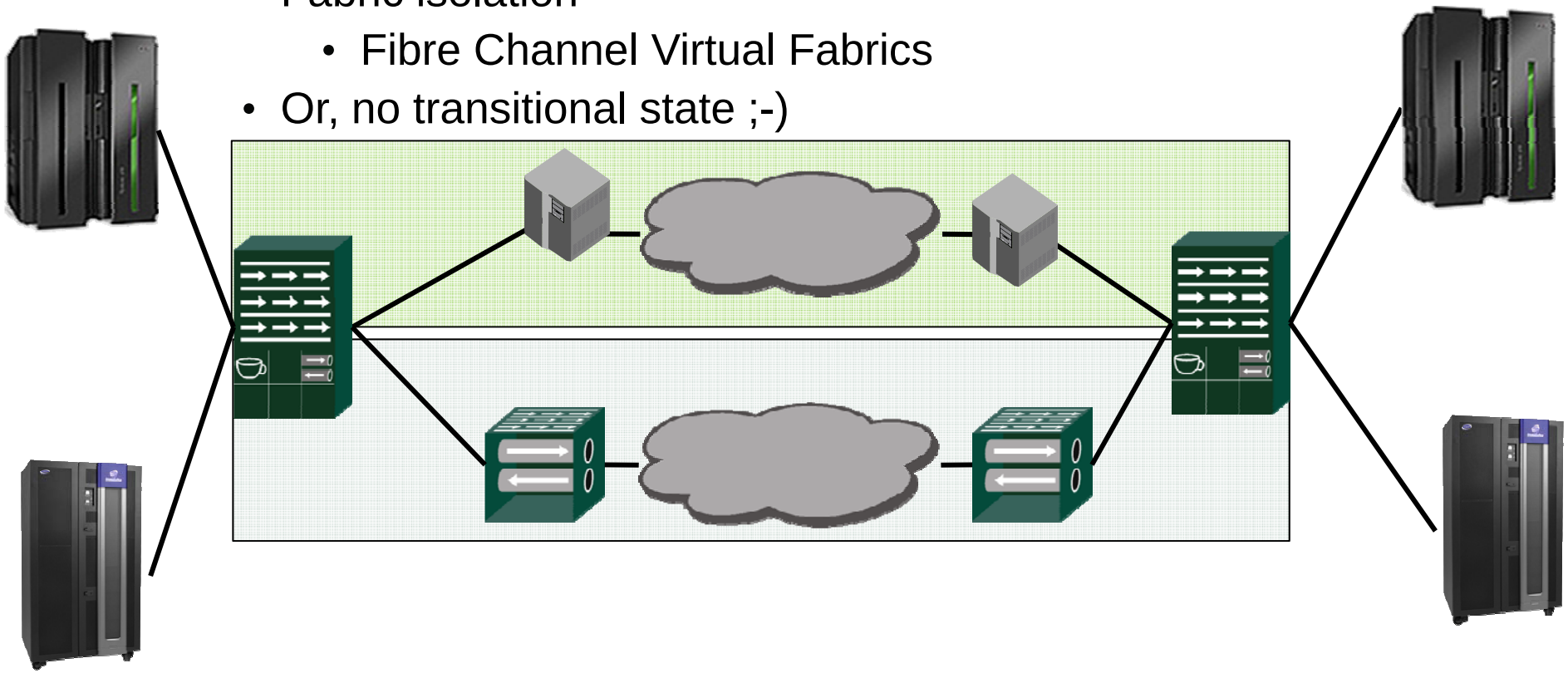
- Transitional conundrum
  - Mixing dedicated and switch extension solutions
  - Attempting to maintain dual path for resiliency



- Fabric becomes unbalanced
- FCIP switches represent multiple hops
- FSPF uses dedicated product path exclusively
  - Lower cost path
- PDCMs cannot be used to forcibly direct the traffic

# Customer 3 – Australian Solution Provider

- Resolution
  - Fabric isolation
    - Fibre Channel Virtual Fabrics
  - Or, no transitional state ;-)



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# IBM Qualification

- Moving data is easy
- Handling the unusual or error cases is HARD
- Testing is 80% Science and 20% Art
- Test to Architecture
- Plethora of error inject cases

# IBM Qualification

- IBM develops emulated control units and devices for each of the SAN traffic types (ESCON, FICON, FCP) supported on System z
- IBM develops a proprietary test tool to test the S/390 architecture
  - Performs limit testing by stressing each capability of the channel to eliminate windows of failure
  - Can run to real devices as well as emulated devices
    - Emulated devices used for error injection
  - Over 30 years of experience built in
  - Updated as architecture evolves

# IBM Qualification

- Switch Vendor Qualification Test content includes:
  - Architectural stress
  - z/OS stress
  - Serviceability
  - Fabric Security and Event Notification
  - CUP testing
  - ISL extension and balancing
  - GUI – function/human factors/ useability
  - Basic performance testing for data droop
  - Power cycling, faults, and redundant power
  - Link “up/downs” – IMLs, LPAR activate/deactivate, channel path varies
  - Improvised testing

# IBM Qualification

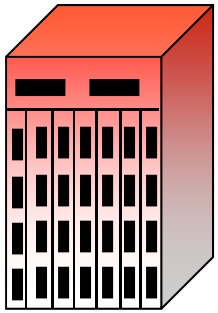
- Collaborative effort
- Exit Criteria:
  - ‘Clean’ run without un-expected errors
  - Minor exceptions documented

Duration of test can range from several weeks for a ‘minor’ release to several months for a ‘major’ release

# IBM Qualification


System z

Fibre Channel Switch



IBM Ficon Test Vehicle


## SHARE, Orlando, August 2011

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Session 9933

# THANK YOU!


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