FC-SW-6
HOW IT WORKS WHEN IT BREAKS

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T11/13-032v3
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Virtual Domain Deterioration Behavior

• Review
  • The Last Agreement on the Rules

• Response to 13-407
  • Two solutions

"This is like déjà vu all over again."
– Yogi Berra
"You can observe a lot just by watching."
– Yogi Berra
Virtual Domain Operations
Non-Primary cSwitch Membership Rules

- Membership is gained when:
  - The Augmented ISL “set” becomes non-NULL

- Membership is lost when:
  - The Augmented ISL “set” becomes NULL
    - The non-Primary cSwitch no longer has an Augmented ISL path to the Primary cSwitch.
    - The path still exists if it traverses an intermediate non-Primary cSwitch.
  - *And*, the A_Port ISL path becomes NULL
    - The non-Primary cSwitch no longer has an A_Port ISL path to the Primary cSwitch.
    - The path still exists if it traverses an intermediate FCDF.

- When membership is lost:
  - The non-Primary cSwitch isolates itself from the Virtual Domain.
    - Isolates all of the attached elements (eNodes and FCDFs).
    - I/O for the portion of the Virtual Domain accessible only through the affected non-Primary cSwitch is terminated.
  - The non-Primary cSwitch remains in the fabric if connectivity exists.
Use Cases

Review Full Redundancy Then Some Things Break
Redundant Virtual Domain

Initial Configuration

• Configuration
  • B and C are traditional ISLs.
  • A is an augmented ISL.
  • D, E, and F are A_Port ISLs.
Virtual Domain Remains Redundant
Remains intact over A_Port ISL

• ASL Failures
  • If A fails then LSR’s are sent to update topology.
  • Primary cSwitch sends NPRD updates.

• Route Updates
  • A fails
    • cSW1 sends LSR to fabric.
    • cSW2 sends LSR to fabric.
    • cSW1 and FCDF-B use DF.
    • cSW2 and FCDF-A use EF.
    • cSW1 and cSW2 use DFE.

• Virtual Domain
  • Remains redundant since link F is intact
Use Cases

Full Redundancy, but Disconnected Fabric (13-407)
Redundant Virtual Domain

Initial Configuration

- Configuration
  - B and C are traditional ISLs.
  - A is an augmented ISL.
  - D, E, and F are A_Port ISLs.

- Note
  - Topology is a string
  - Virtual Domain “hangs” from middle of the string
Virtual Domain Redundancy
Can remain intact over A_Port ISL?

- **ASL Failures**
  - If A fails then LSR’s are sent to update topology.
  - Primary cSwitch sends NPRD updates.

- **Route Updates**
  - A fails
    - cSW1 sends LSR to fabric.
    - cSW2 sends LSR to other fabric.
    - cSW1 and FCDF-B use DF.
    - cSW2 and FCDF-A use EF.
    - cSW1 and cSW2 use DFE.

- **Virtual Domain**
  - Remains redundant since link F is intact

- **Problem**
  - LSR’s from FC Fabric terminate at the Virtual Domain
  - FCDF-A will send LSR’s back to primary cSW1 for WKA processing to occur
  - Thus, flooding is circumvented as noted in 13-407
Options

Routing LSR’s over FCDF

"I want to thank you for making this day necessary."
– Yogi Berra
Virtual Domain Stability
Disruptive Action

- ASL Failures
  - If A fails then LSR’s are sent to update topology.
  - Primary cSwitch sends NPRD updates.
    - Primary cSwitch initiates Virtual Domain segmentation.

- Route Updates
  - A fails
    - cSW1 sends LSR to fabric.
    - cSW2 sends LSR to other fabric.
    - cSW1 updates FCFD-A to segment F.
    - cSW2 becomes primary and creates Virtual Domain m.

- Virtual Domain
  - Fabric segments
  - Two independent Virtual Domains are formed.
Virtual Domain Stability

Non-disruptive Action

• ASL Failures
  - If A fails then LSR’s are sent to update topology.
  - Primary cSwitch sends NPRD updates.

• Route Updates
  - A fails
    • cSW1 sends LSR to fabric.
    • cSW2 sends LSR to other fabric.
    • cSW1 and FCDF-B use DF.
    • cSW2 and FCDF-A use EF.
    • cSW1 and cSW2 use DFE.

• Virtual Domain
  - Remains redundant since link F is intact.

• LSR Routing
  - Change LSR D_ID addressing inside Virtual Domain
    • Define DS,ILS version of LSR
    • Use Domain Controller instead

• Extend DELS
  • Allow D_ID to indicate a specific cSW
  • Define payload as LSR
Virtual Domain AISL Set Relationship

Summary

• Presented Solutions
  • Segment the Virtual Domain
    • The Primary cSwitch causes the FCDF to segment from the secondary cSwitch.
    • Segmentation is between the FCDF and the secondary FCF.

  • Maintain the Fabric
    • Define mechanism to transfer LSR’s thru a Virtual Domain over A_Port ISLs.

• Alternative Solution (Discussion 12/3/2013 of 13-441v0)
  • Segment the Fabric
    • The Secondary cSwitch logically segments from the fabric.
    • The Secondary cSwitch remains connected to the Virtual Domain.
End of Frame

Thank You
References

Notes from June Meeting
"If you don't know where you are going, you will wind up somewhere else."
– Yogi Berra
Virtual Domain Operations

Operational Rules

• Internal Virtual Domain I/O occurs independent of external fabric.
  • Put another way, a Virtual Domain can stand on its own.

• Any non-primary cSwitch must have a path to the primary cSwitch to maintain membership in the Virtual Domain.
  • The non-Primary cSwitch has greater affinity to the fabric.

• The identify of a cSwitch establishes the behavior during integration and degradation.
  • The redundancy protocol is allowed to flow over an A_Port ISL after the cSwitch is part of a Virtual Domain.
Virtual Domain Operations
Non-Primary cSwitch Membership Rules

• Membership is gained when:
  • The Augmented ISL “set” becomes non-NULL

• Membership is lost when:
  • The Augmented ISL “set” becomes NULL
    • The non-Primary cSwitch no longer has an Augmented ISL path to the Primary cSwitch.
    • The path still exists if it traverses an intermediate non-Primary cSwitch.
  • And, the A_Port ISL path becomes NULL
    • The non-Primary cSwitch no longer has an A_Port ISL path to the Primary cSwitch.
    • The path still exists if it traverses an intermediate FCDF.

• When membership is lost:
  • The non-Primary cSwitch isolates itself from the Virtual Domain.
    • Isolates all of the attached elements (eNodes and FCDFs).
    • I/O for the portion of the Virtual Domain accessible only through the affected non-Primary cSwitch is terminated.
  • The non-Primary cSwitch remains in the fabric if connectivity exists.
Use Cases

Full Redundancy Then Some Things Break
Redundant Virtual Domain

Initial Configuration

- Configuration
  - B and C are traditional ISLs.
  - A is an augmented ISL.
  - D, E, and F are A_Port ISLs.
Virtual Domain Remains Redundant
Remains intact over A_Port ISL

• ASL Failures
  • If A fails then LSR’s are sent to update topology.
  • Primary cSwitch sends NPRD updates.

• Route Updates
  • A fails
    • cSW1 sends LSR to fabric.
    • cSW2 sends LSR to fabric.
    • cSW1 and FCDF-B use DF.
    • cSW2 and FCDF-A use EF.
    • cSW1 and cSW2 use DFE.

• Virtual Domain
  • Remains redundant since link F is intact
Use Cases

Full Redundancy Then Things Break
Redundant Virtual Domain

Initial Configuration

- Configuration
  - B and C are traditional ISLs.
  - A is an augmented ISL.
  - D, E, and F are A_Port ISLs.
Redundant Virtual Domain
Agreed Behavior

• ASL and A_Port ISL Failures
  • If A & F fail then LSR’s are sent to update topology.
  • Primary cSwitch sends NPRD updates.
  • Secondary cSwitch *isolates* from the Virtual Domain.

• Route Updates
  • A & F fail
    • cSW1 sends LSR to fabric.
    • cSW2 sends LSR to fabric.
    • cSW2 *isolates* FCFD-B.
Use Cases

No Redundancy Then Some Things Form
Virtual Domain – Not Yet Redundant

Initial Configuration

• Configuration
  • B and C are traditional ISLs.
  • D and E are A_Port ISLs.
  • F becomes an A_Port ISLs.

• Actions
  • cSW2 becomes active
  • FCDF-B becomes active
  • F becomes active
Potential Redundancy – Link Order Issue

A_Port ISL connects the parts of a Virtual Domains

• Behavior
  • ISL Instantiation
    • When F becomes active
      • FCDF-A and FCDF-B determine that they are in the same membership list, but belong to different Virtual Domains.
      • FCDF-A and FCDF-B isolate the link.
  • Virtual Domain
    • Two unique domains remain.

• Agreement
  • Merge over A_Port ISL is not allowed.
  • Becoming redundant over an A_Port ISL is not allowed.
Clarifications

I think we’re close ;-) 

"You've got to be very careful if you don't know where you're going, because you might not get there." – Yogi Berra
Virtual Domain Operations

Questions and Answers

• Is the redundancy protocol allowed to flow over Augmented ISL paths AND A_Port ISL paths?
  • Yes

• Can a redundant Virtual Domain form with no direct connection between the Primary cSwitch and a non-Primary cSwitch?
  • No

• Is an “Augmented ISL” required to “define” a non-Primary cSwitch?
  • Yes on integration (going up).
  • No on degradation (coming down).

• What is the state of a non-Primary cSwitch when no Augmented ISL path exists?
  • It depends.

• What DS_ILSs are unique to the redundancy protocol?
  • R_Hello
  • Database synchronization
    • i.e. ERP, GFTS, GFNS, etc

"Yeah, but we're making great time!" -- In reply to "Hey Yogi, I think we're lost."
– Yogi Berra
Questions

Or “Confusions”

"I knew I was going to take the wrong train, so I left early."
– Yogi Berra
Virtual Domain – Not Yet Redundant

Initial Configuration

• Configuration
  • B and C are traditional ISLs.
  • D and E are A_Port ISLs.

• Actions
  • cSW1 and FCDF-A are active.
  • cSW2 becomes active.
  • FCDF-B becomes active.

• Questions
  • Does cSW2 allow E to become active?
  • Can cSW2 become a Primary and form a unique Virtual Domain m?
Virtual Domain – Not Yet Redundant

Initial Configuration

- **Configuration**
  - B and C are traditional ISLs.
  - D and E are A_Port ISLs.

- **Actions**
  - cSW2 becomes active
  - FCFDF-B becomes active
  - cSW2 creates a Virtual Domain m

- **Questions**
  - The fundamental question is “when is the role of a cSwitch established?”
"It was impossible to get a conversation going; everybody was talking too much."
– Yogi Berra
Virtual Domain Operations
Non-Primary cSwitch Membership Agreements

• Membership is lost when:
  • The Augmented ISL “set” becomes NULL
    • The non-Primary cSwitch no longer has an Augmented ISL path to the Primary cSwitch.
    • The path still exists if it traverses an intermediate non-Primary cSwitch.
  • And, the A_Port ISL path becomes NULL
    • The non-Primary cSwitch no longer has an A_Port ISL path to the Primary cSwitch.
    • The path still exists if it traverses an intermediate FCDF.

• When membership is lost:
  • The non-Primary cSwitch issues clear virtual links.
    • Sent to all of the attached elements (eNodes and FCDFs).
    • I/O for the portion of the Virtual Domain accessible only through the affected non-Primary cSwitch is terminated.
  • The non-Primary cSwitch remains in the fabric if connectivity exists.
Redundant Virtual Domain

Initial Configuration

- **Configuration**
  - B and C are traditional ISLs.
  - A is an augmented ISL.
  - D, E, and F are A_Port ISLs.
Redundant Virtual Domain

Suggested Behavior

• ASL and A_Portal ISL Failures
  • If A & F fail then LSR’s are sent to update topology.
  • Primary cSwitch sends NPRD updates.
  • Secondary cSwitch sends clear virtual links.

• Route Updates
  • A & F fail
    • cSW1 sends LSR to fabric.
    • cSW2 sends LSR to fabric.
    • cSW2 sends clear virtual links to Fcdf-B.
Assumptions
And the Implications

"When you come to a fork in the road, take it."
– Yogi Berra
Virtual Domain Operations

Implications of the Rules and Agreements

• Assumptions
  • The redundancy protocol flows over Augmented ISL paths AND A_Port ISL paths

• Implication
  • A redundant Virtual Domain can form with no direct connection between the Primary cSwitch and a non-Primary cSwitch
Redundant Virtual Domain

Initial Configuration

• Configuration
  • B and C are traditional ISLs.
  • A is an augmented ISL.
  • D, E, and F are A_Port ISLs.
Virtual Domain Remains Redundant
Remains intact over A_Port ISL

- **ASL Failures**
  - If A fails then LSR’s are sent to update topology.
  - Primary cSwitch sends NPRD updates.

- **Route Updates**
  - A fails
    - cSW1 sends LSR to fabric.
    - cSW2 sends LSR to fabric.
    - cSW1 and FCDF-B use DF.
    - cSW2 and FCDF-A use EF.
  - cSW1 and cSW2 use DFE.

- **Virtual Domain**
  - Remains redundant since link F is intact

- **Question**
  - Is the inverse true?
Virtual Domain – Not Yet Redundant

Initial Configuration

• Configuration
  • B and C are traditional ISLs.
  • D and E are A_Port ISLs.
  • F becomes an A_Port ISLs.

• Actions
  • ScSW becomes active
  • FCFD-B becomes active
  • F becomes active
Virtual Domain Becomes Redundant
Becomes Redundant over A_Port ISL

• ISL Instantiation
  • When F becomes active then LSR’s are sent to update topology.
  • Primary cSwitch sends NPRD updates.

• Route Updates
  • F becomes active
    • cSW1 sends LSR to fabric.
    • cSW2 sends LSR to fabric.

• Virtual Domain
  • Secondary cSwitch is established
  • Virtual Domain becomes redundant
  • Redundancy protocol flows over F
Alternative

Implications of the Alternative

"I made a wrong mistake."
– Yogi Berra
Virtual Domain Operations
Implications of the Rules and Agreements

• Assumptions
  • The redundancy protocol cannot flow over A_Port ISL paths

• Implication
  • An “Augmented ISL” required to “define” a non-Primary cSwitch

• Question
  • What is the state of a non-Primary cSwitch when no Augmented ISL path exists?
Virtual Domain Becomes Non-redundant

ASL Associated with Redundancy-capable

- **ASL Failures**
  - If A fails then LSR’s are sent to update topology.
  - Primary cSwitch sends NPRD updates.
  - Secondary cSwitch sends clear virtual links.

- **Route Updates**
  - A fails
    - cSW1 sends LSR to fabric.
    - cSW2 sends LSR to fabric.
    - cSW2 sends clear virtual links to FCF-D-F.

- **Virtual Domain**
  - ScSW remains in fabric
  - ScSW no longer provides redundancy to the Virtual Domain
References

Notes from February Meeting
Use Cases

Full Redundancy and then Things Break
Redundant Virtual Domain

Initial Configuration

- Configuration
  - B and C are traditional ISLs.
  - A is an augmented ISL.
  - D, E, F, G, and H are A_Port ISLs.
**Redundant Virtual Domain**

Internal A_Port ISL Failure Occurs

- **ASL Failures**
  - When D fails then only routing updates are necessary.
  - FCDF’s resort to secondary paths upon detection of failure.
  - Primary cSwitch sends NPRD updates.

- **Route Updates**
  - D fails
    - cSW1 and FCFDF-A use AH or FG.
Redundant Virtual Domain
Any Internal Virtual Domain Failures Not Affecting Topology

- **ASL Failures**
  - If D, E, F, G, or H fails then only routing updates are necessary.
  - FCDF’s resort to secondary paths upon detection of failure.
  - Primary cSwitch sends NPRD updates.

- **Route Updates**
  - D fails
    - cSW1 and FCDF-A use AH or FG.
  - E fails
    - cSW2 and FCDF-B use AG or FH.
  - F fails
    - FCDF-A FCDF-B use EH or DG.
  - G fails
    - cSW1 and FCDF-B use AE or DF
  - H fails
    - cSW2 and FCDF-A use AD or EF
Redundant Virtual Domain

Virtual Domain Failures Affecting Topology

- **AISL Failures**
  - If A fails then LSR’s are sent to the fabric to update the topology.
  - Primary cSwitch sends NPRD updates.

- **Route Updates**
  - A fails
    - cSW1 sends LSR to fabric.
    - cSW2 sends LSR to fabric.
    - cSW1 and cSW2 use DH or EG.
Redundant Virtual Domain
Fabric Failures Affecting Topology

• ISL Failures
  • If B fails then LSR’s are sent to update topology.
  • Primary cSwitch sends NPRD updates.

• Route Updates
  • B fails
    • cSW1 sends LSR to cSW2.
    • Fabric sends LSR to cSW2.
    • cSW1 uses AC.
  • C fails
    • cSW2 sends LSR to cSW1.
    • Fabric sends LSR to SW1.
    • cSW2 use AB.
Redundant Virtual Domain

Fabric Failures Affecting Topology

- ISL Failures
  - If C fails then LSR’s are sent to update topology.
  - Primary cSwitch sends NPRD updates.

- Route Updates
  - B fails
    - cSW1 sends LSR to cSW2.
    - Fabric sends LSR to cSW2.
    - cSW1 uses AC.
  - C fails
    - cSW2 sends LSR to cSW1.
    - Fabric sends LSR to SW1.
    - cSW2 use AB.
Use Cases

Partial Redundancy and then Things Break
Redundant Virtual Domain
Initial Configuration

- Configuration
  - B and C are traditional ISLs.
  - A is an augmented ISL.
  - D, E, and F are A_Port ISLs.
Redundant Virtual Domain

Internal Virtual Domain Failures Not Affecting Topology

• **ASL Failures**
  - If F fails then only routing updates are necessary.
  - FCDF’s resort to secondary paths upon detection of failure.
  - Primary cSwitch sends NPRD updates.

• **Route Updates**
  - F fails
    - cSW1 uses AE.
    - cSW2 uses AD.
    - FCDF-A and FCDF-B use DAE.
Redundant Virtual Domain

Virtual Domain Failures Affecting Topology

• ISL Failures
  • If A fails then LSR’s are sent to update topology.
  • Primary cSwitch sends NPRD updates.

• Route Updates
  • A fails
    • cSW1 sends LSR to fabric.
    • cSW2 sends LSR to fabric.
    • cSW1 and FCFDF-B use DF.
    • cSW2 and FCFDF-A use EF.
    • cSW1 and cSW2 use DFE.
Use Cases

No Redundancy and then Things Break
Redundant Virtual Domain

Initial Configuration

• Configuration
  • B and C are traditional ISLs.
  • A is an augmented ISL.
  • D and E are A_Port ISLs.
Redundant Virtual Domain
Virtual Domain Failures Affecting Topology

- **ASL Failure**
  - If A fails then LSR’s are sent to update topology.
  - Primary cSwitch sends NPRD updates.
  - Secondary cSwitch segments from the fabric.

- **Route Updates**
  - A fails
    - cSW1 sends LSR to fabric.
    - cSW2 segments from fabric.
    - Fabric sends LSR to cSW1.

- **Operation**
  - Secondary cSwitch becomes primary in segmented fabric.
Redundant Virtual Domain

Initial Configuration

- Configuration
  - B and C are traditional ISLs.
  - D, E, and F are A_Port ISLs.
Redundant Virtual Domain
Internal Virtual Domain Failures Affecting Topology

• **A_Port ISL Failure**
  • If F fails then LSR’s are sent to update topology.
  • Primary cSwitch sends NPRD updates.
  • Secondary cSwitch segments from the fabric.

• **Route Updates**
  • F fails
    • cSW1 sends LSR to fabric.
    • cSW2 segments from fabric.
    • Fabric sends LSR to cSW1.
Redundant Virtual Domain
Alternative Behavior

• ASL and A_Port ISL Failures
  • If A & F fail then LSR’s are sent to update topology.
  • Primary cSwitch sends NPRD updates.
  • Secondary cSwitch sends clear virtual links.

• Route Updates
  • A & F fail
    • cSW1 sends LSR to fabric.
    • cSW2 sends LSR to fabric.
    • cSW2 sends clear virtual links to FCFDF-B.
Virtual Domain Operations

NULL AISL Set Agreement

• After much discussion, I summarized the options discussed for the case when the Augmented ISL set becomes NULL (i.e. the non-Primary cSwitch does not have an Augmented ISL path to the Primary cSwitch):
  • The non-Primary cSwitch segments from the fabric and becomes the Primary cSwitch in its own Virtual Domain.
    • The Virtual Domain has the same switch name and Domain ID as the original Virtual Domain.
    • I/O within the Virtual Domain remains intact except for access outside of the new instanced of the Virtual Domain.
  • The non-Primary cSwitch remains in the fabric, segments from the existing Virtual Domain, and creates a new Virtual Domain for all of its attached eNodes.
    • The new Virtual Domain has a new switch name and new Domain ID.
    • The attached eNodes are cleared and rediscovered to allocate new addresses.
    • I/O within the new Virtual Domain resumes after it has been instantiated and the eNodes have logged into the new Virtual Domain.
  • The non-Primary cSwitch stays in the fabric, but issues a clear virtual links to all of the attached elements (eNodes and FCDFs).
    • I/O for the portion of the Virtual Domain accessible only through the affected non-Primary cSwitch is terminated.

• The group expressed a preference for option 3.
Sublime

Advice from Yogi
• "This is like deja vu all over again."

• "You can observe a lot just by watching."

• "He must have made that before he died." -- Referring to a Steve McQueen movie.

• "I want to thank you for making this day necessary." -- On Yogi Berra Appreciation Day in St. Louis in 1947.

• "I'd find the fellow who lost it, and, if he was poor, I'd return it." – When asked what he would do if he found a million dollars.

• "Think! How the hell are you gonna think and hit at the same time?"

• "You've got to be very careful if you don't know where you're going, because you might not get there."

• "I knew I was going to take the wrong train, so I left early."

• "If you don't know where you are going, you will wind up somewhere else."
• "If you can't imitate him, don't copy him."
• "You better cut the pizza in four pieces because I'm not hungry enough to eat six."
• "Baseball is 90% mental -- the other half is physical."
• "It was impossible to get a conversation going; everybody was talking too much."
• "Slump? I ain't in no slump. I just ain't hitting."
• "A nickel isn't worth a dime today."
• "Nobody goes there anymore; it's too crowded."
• "It gets late early out there." -- Referring to the bad sun conditions in left field at the stadium.
• Once, Yogi's wife Carmen asked, "Yogi, you are from St. Louis, we live in New Jersey, and you played ball in New York. If you go before I do, where would you like me to have you buried?" Yogi replied, "Surprise me."

• "Do you mean now?" -- When asked for the time.

• "I take a two hour nap, from one o'clock to four."

• "When you come to a fork in the road, take it."

• "You give 100 percent in the first half of the game, and if that isn't enough in the second half you give what's left."

• "90% of the putts that are short don't go in."

• "I made a wrong mistake."

• "Texas has a lot of electrical votes." -- During an election campaign, after George Bush stated that Texas was important to the election.
• "Thanks, you don't look so hot yourself." -- After being told he looked cool.
• "I always thought that record would stand until it was broken."
• "Yeah, but we're making great time!" -- In reply to "Hey Yogi, I think we're lost."
• "If the fans don't come out to the ball park, you can't stop them."
• "Why buy good luggage? You only use it when you travel."
• "It's never happened in the World Series competition, and it still hasn't."
• "How long have you known me, Jack? And you still don't know how to spell my name." -- Upon receiving a check from Jack Buck made out to "bearer."
• "I'd say he's done more than that." -- When asked if first baseman Don Mattingly had exceeded expectations for the current season.
• "The other teams could make trouble for us if they win."
"He can run anytime he wants. I'm giving him the red light." -- On the acquisition of fleet Ricky Henderson.

"I never blame myself when I'm not hitting. I just blame the bat, and if it keeps up, I change bats. After all, if I know it isn't my fault that I'm not hitting, how can I get mad at myself?"

"It ain't the heat; it's the humility."

"The towels were so thick there I could hardly close my suitcase."

"You should always go to other people's funerals; otherwise, they won't come to yours."

"I didn't really say everything I said."
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Thank You