

排除ACI中的虛擬埠通道(vPC)故障

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簡介

本文檔介紹如何識別和解決ACI中的vPC可能出現的問題。

背景資訊

虛擬埠通道(vPC)允許物理連線到兩個不同的ACI枝葉節點的鏈路顯示為連線到第三台裝置 (即網路交換機、伺服器 and 支援鏈路聚合技術的任何其他網路裝置) 的單個埠通道。vPC包括兩個指定為vPC對等交換機的ACI枝葉交換機。在vPC對等裝置中，一個為主要，另一個為輔助。由交換機構成的系統稱為vPC域

vPC對等體之間沒有專用對等鏈路；相反，交換矩陣本身充當MCT。

- 對等可達性協定 — 使用ZMQ代替CFS。
- ZMQ是一個開源的高效能消息庫，使用TCP作為傳輸。
- 此庫在交換機上打包為libzmq，並連結到需要與vPC對等體通訊的每個應用程式。

對等體可達性不是通過物理對等鏈路來處理；而是使用路由觸發器來檢測對等體可達性。

- vPC Manager向URIB註冊對等路由通知。
- 當ISIS發現到對等體的路由時，URIB會通知vPC管理器，然後嘗試開啟與對等體的ZMQ套接字。
- 當對等路由被ISIS撤銷時，vPC管理器將再次被URIB通知，並關閉MCT鏈路。

作為升級最佳實踐的一部分，建議至少在兩個不同的組中升級每個pod中的交換機，以便每個pod中有一半的枝葉和主幹節點在任意給定時間啟動。例如，一個組具有偶數編號的枝葉和主幹節點，另一個組在每個pod中具有奇數編號的枝葉和主幹。通過vPC配置裝置，我們可以將至少一個裝置置於不同的組中，以確保在升級期間至少有一個裝置處於運行狀態。這樣可防止升級期間出現任何故障，因為至少有一個裝置在升級另一個裝置時保持運行。

縮寫

ACI：以應用程序為中心的基礎設施

vPC：虛擬埠通道

MCT：多機箱EtherChannel中繼

CFS：思科交換矩陣服務

ZMQ：零消息隊列

LACP：連結彙總控制通訊協定

PDU：協定資料單元

LAG：鏈路聚合

vPC埠通道故障排除的先決條件

有關vPC配置，請參閱

https://www.cisco.com/c/en/us/td/docs/switches/datacenter/aci/apic/sw/4-x/L2-configuration/Cisco-APIC-Layer2-Configuration-Guide-42x/Cisco-APIC-Layer2-Configuration-Guide-421_chapter_0111.html

https://www.cisco.com/c/en/us/td/docs/switches/datacenter/aci/apic/sw/2-x/L2_config/b_Cisco_APIC_Layer_2_Configuration_Guide/b_Cisco_APIC_Layer_2_Configuration_Guide_chapter_0100.html

vPC驗證

1. vPC狀態：show vpc

```
FAB3-L1# show vpc Legend: (*) - local vPC is down, forwarding via vPC peer-link vPC domain id :
101 Peer status : peer adjacency formed ok vPC keep-alive status : Disabled Configuration
consistency status : success Per-vlan consistency status : success Type-2 consistency status :
success vPC role : primary Number of vPCs configured : 1 Peer Gateway : Disabled Dual-active
excluded VLANs : - Graceful Consistency Check : Enabled Auto-recovery status : Enabled (timeout
= 240 seconds) Operational Layer3 Peer : Disabled vPC Peer-link status -----
----- id Port Status Active vlans -- ---- -----
----- 1 up - vPC status -----
----- id Port Status Consistency Reason Active vlans -- ---- -----
- ----- 686 Po3 up success success 86 FAB3-L2# show vpc Legend: (*) -
local vPC is down, forwarding via vPC peer-link vPC domain id : 101 Peer status : peer adjacency
formed ok vPC keep-alive status : Disabled Configuration consistency status : success Per-vlan
```

```

consistency status : success Type-2 consistency status : success vPC role : secondary Number of
vPCs configured : 1 Peer Gateway : Disabled Dual-active excluded VLANs : - Graceful Consistency
Check : Enabled Auto-recovery status : Enabled (timeout = 240 seconds) Operational Layer3 Peer :
Disabled vPC Peer-link status -----
--- id Port Status Active vlans -- ---- -----
- 1 up - vPC status ----- id
Port Status Consistency Reason Active vlans -- ---- ----- 686
Po2 up success success 86

```

輸出顯示，使用vPC域ID 101形成對等鄰接關係，注意vPC保持活動狀態在ACI中禁用，因為不需要專用鏈路。Po3在活動VLAN 86的vPC中處於UP狀態。請注意，vPC對交換機上的埠通道號可以不同。

2. vPC角色、vPC系統mac和LAG ID:show vpc role

```

FAB3-L1# show vpc role vPC Role status ----- vPC
role : primary, operational secondary Dual Active Detection Status : 0 vPC system-mac :
00:23:04:ee:be:65 vPC system-priority : 32667 vPC local system-mac : 00:81:c4:b1:25:4f vPC local
role-priority : 101 FAB3-L2# show vpc role vPC Role status -----
----- vPC role : secondary, operational primary Dual Active Detection Status : 0 vPC
system-mac : 00:23:04:ee:be:65 vPC system-priority : 32667 vPC local system-mac :
00:5d:73:57:c4:2c vPC local role-priority : 102

```

此命令顯示L1為主路由器，L2為次路由器。

由於終端裝置連線到兩個不同的vPC交換機，因此它們必須有一種機制將vPC對等裝置標識為一個邏輯裝置。這可以通過在對等體之間共用的LAG ID中使用vPC系統MAC來實現。這使終端裝置將vPC對等裝置視為一個邏輯單元。

```

N3K# show lacp interface ethernet 1/24 Interface Ethernet1/24 is up Channel group is 1 port
channel is Po1 PDUs sent: 31726 PDUs rcvd: 31634 Markers sent: 0 Markers rcvd: 0 Marker response
sent: 0 Marker response rcvd: 0 Unknown packets rcvd: 0 Illegal packets rcvd: 0 Lag Id: [
[(7f9b, 0-23-4-ee-be-65, 82ae, 8000, 4121), (8000, 0-a6-ca-75-6f-c1, 8000, 8000, 15d)] ]
Operational as aggregated link since Fri Sep 2 08:05:52 2022 Local Port: Eth1/24 MAC Address= 0-
a6-ca-75-6f-c1 System Identifier=0x8000, Port Identifier=0x8000,0x15d Operational key=32768
LACP_Activity=active LACP_Timeout=Long Timeout (30s) Synchronization=IN_SYNC Collecting=true
Distributing=true Partner information refresh timeout=Long Timeout (90s) Actor Admin State=61
Actor Oper State=61 Neighbor: 0x4121 MAC Address= 0-23-4-ee-be-65 System Identifier=0x7f9b, Port
Identifier=0x8000,0x4121 Operational key=33454 LACP_Activity=active LACP_Timeout=Long Timeout
(30s) Synchronization=IN_SYNC Collecting=true Distributing=true Partner Admin State=61 Partner
Oper State=61 Aggregate or Individual(True=1)= 1 N3K# show lacp interface ethernet 1/25
Interface Ethernet1/25 is up Channel group is 1 port channel is Po1 PDUs sent: 31666 PDUs rcvd:
31651 Markers sent: 0 Markers rcvd: 0 Marker response sent: 0 Marker response rcvd: 0 Unknown
packets rcvd: 0 Illegal packets rcvd: 0 Lag Id: [ [(7f9b, 0-23-4-ee-be-65, 82ae, 8000, 111),
(8000, 0-a6-ca-75-6f-c1, 8000, 8000, 161)] ] Operational as aggregated link since Fri Sep 2
08:00:34 2022 Local Port: Eth1/25 MAC Address= 0-a6-ca-75-6f-c1 System Identifier=0x8000, Port
Identifier=0x8000,0x161 Operational key=32768 LACP_Activity=active LACP_Timeout=Long Timeout
(30s) Synchronization=IN_SYNC Collecting=true Distributing=true Partner information refresh
timeout=Long Timeout (90s) Actor Admin State=61 Actor Oper State=61 Neighbor: 0x111 MAC Address=
0-23-4-ee-be-65 System Identifier=0x7f9b, Port Identifier=0x8000,0x111 Operational key=33454
LACP_Activity=active LACP_Timeout=Long Timeout (30s) Synchronization=IN_SYNC Collecting=true
Distributing=true Partner Admin State=61 Partner Oper State=61 Aggregate or Individual(True=1)=
1

```

輸出顯示LAG ID(7f9b, 0-23-4-ee-be-65, 82ae, 8000, 4121)，它是作為系統ID的優先順序(32667 in Hex)、vPC系統mac(00:23:04:ee:be:65)、操作金鑰(33454 in Hex)和埠識別符號的組合。

3. Port-channel Status : show port-channel extended

```
FAB3-L1# show port-channel extended Flags: D - Down P - Up in port-channel (members) I - Individual H - Hot-standby (LACP only) s - Suspended r - Module-removed S - Switched R - Routed U - Up (port-channel) M - Not in use. Min-links not met F - Configuration failed -----
----- Group Port- BundleGrp Protocol
Member Ports Channel -----
-- 3 Po3(SU) 101-102 LACP Eth1/33(P)
```

Show port-channel extended顯示有關埠通道捆綁所包含的物理鏈路狀態的詳細資訊。

4. TEP詳細資訊和邏輯對等鏈路狀態：show system internal epm vpc

```
FAB3-L1# show system internal epm vpc Local TEP IP : 10.3.208.64 Peer TEP IP : 10.3.208.67 vPC
configured : Yes vPC VIP : 10.3.16.67 MCT link status : Up Local vPC version bitmap : 0x7 Peer
vPC version bitmap : 0x7 Negotiated vPC version : 3 Peer advertisement received : Yes Tunnel to
vPC peer : Up vPC# 686 if : port-channel3, if index : 0x16000002 local vPC state :
MCEC_STATE_UP, peer vPC state : MCEC_STATE_UP current link state : LOCAL_UP_PEER_UP vPC fast
conv : Off
```

5. ZMQ連線詳細資訊：顯示系統內部vpcm zmq統計資訊

```
FAB3-L1# show system internal vpcm zmq statistics -----
MCECM ZMQ counters ----- ZMQ server : 1 Zmq: Registered
Zmq print callback Zmq: ===== Start ZMQ statistics printing ===== Zmq: ZMQ socket type: 5,
local ID: 40d0030a Zmq: Socket base 0x1109c3b4, #endpoints 1 Zmq: Total 1 I/O pipes, CONNECT
CNT: 0, DISCONNECT CNT: 0 Zmq: RX CNT: 66, BYTES: 124132, ERRORS: 0 Zmq: TX CNT: 66, BYTES:
125096, ERRORS: 0 Zmq: Pipe tcp://10.3.208.64:5001 (ID: FD 54 flag 1 state 0): read 66 (124132
bytes) write 66 (125096 bytes) Peer I/O pipe: read 66 (125096 bytes) write 66 (124132 bytes)
Zmq: Stream engine 0xae90049c ZMQ SOCKET 0x1109c3b4 TCP FD: 54 @ 10.3.208.67:58740 Zmq: RX CNT:
72 BYTES: 124494 ERRORS: 0 TX CNT: 73 BYTES: 125458 ERRORS: 0 Zmq: CONNECT CNT: 0 DISCONNECT
CNT: 0 Zmq: ===== End ZMQ statistics printing =====
```

ZMQ統計資訊顯示ZMQ會話的狀態、連線和斷開的發生次數以及發生的任何錯誤。

排除VPC埠通道故障

1. 物理埠關閉

```
FAB3-L1# show vpc brief Legend: (*) - local vPC is down, forwarding via vPC peer-link vPC domain
id : 101 Peer status : peer adjacency formed ok vPC keep-alive status : Disabled Configuration
consistency status : success Per-vlan consistency status : success Type-2 consistency status :
success vPC role : primary Number of vPCs configured : 1 Peer Gateway : Disabled Dual-active
excluded VLANs : - Graceful Consistency Check : Enabled Auto-recovery status : Enabled (timeout
= 240 seconds) Operational Layer3 Peer : Disabled vPC Peer-link status -----
----- id Port Status Active vlans -- ---- -----
----- 1 up - vPC status -----
----- id Port Status Consistency Reason Active vlans -- ---- -----
----- 686 Po3 down* success success
```

輸出鞋Po3下降。

```
FAB3-L1# show port-channel summary Flags: D - Down P - Up in port-channel (members) I - Individual H - Hot-standby (LACP only) s - Suspended r - Module-removed S - Switched R - Routed U - Up (port-channel) M - Not in use. Min-links not met F - Configuration failed -----
----- Group Port- Type Protocol
Member Ports Channel -----
---- 3 Po3(SD) Eth LACP Eth1/33(D)
```

我們進一步瞭解作為port-channel一部分的介面狀態。這裡Eth1/33處於Down狀態。LACP被配置為繫結協定。

```
FAB3-L1# show int e1/33 Ethernet1/33 is down (notconnect) admin state is up, Dedicated Interface
Belongs to po3 Hardware: 100/1000/10000/auto Ethernet, address: 0081.c4b1.2521 (bia
0081.c4b1.2521) MTU 9000 bytes, BW 0 Kbit, DLY 1 usec reliability 255/255, txload 1/255, rxload
1/255 Encapsulation ARPA, medium is broadcast Port mode is trunk full-duplex, 10 Gb/s FEC
(forward-error-correction) : disable-fec Beacon is turned off Auto-Negotiation is turned on
Input flow-control is off, output flow-control is off Auto-mdix is turned off Switchport monitor
is off EtherType is 0x8100 EEE (efficient-ethernet) : n/a Last link flapped 00:08:15 Last
clearing of "show interface" counters never 9 interface resets 30 seconds input rate 0 bits/sec,
0 packets/sec 30 seconds output rate 0 bits/sec, 0 packets/sec Load-Interval #2: 5 minute (300
seconds) input rate 0 bps, 0 pps; output rate 0 bps, 0 pps
```

Show interface output提供介面e1/33的更多詳細資訊。我們可以看到E1/33在notconnect狀態下關閉。

建議的操作：

請確保連線埠正確連線且組態正確。

2. 由LACP暫停

```
FAB3-L1# show port-channel extended Flags: D - Down P - Up in port-channel (members) I -
Individual H - Hot-standby (LACP only) s - Suspended r - Module-removed S - Switched R - Routed
U - Up (port-channel) M - Not in use. Min-links not met F - Configuration failed -----
----- Group Port- BundleGrp Protocol
Member Ports Channel -----
-- 3 Po3(SD) 101-102 LACP Eth1/33(s)
```

輸出顯示Eth1/33處於掛起狀態。接下來，我們檢視show interface Eth1/33以瞭解更多詳細資訊。

```
FAB3-L1# show int e1/33 Ethernet1/33 is down (suspended-due-to-no-lACP-pdus) admin state is up,
Dedicated Interface Belongs to po3 Hardware: 100/1000/10000/auto Ethernet, address:
0081.c4b1.2521 (bia 0081.c4b1.2521) MTU 9000 bytes, BW 0 Kbit, DLY 1 usec reliability 255/255,
txload 1/255, rxload 1/255 Encapsulation ARPA, medium is broadcast Port mode is trunk full-
duplex, 10 Gb/s FEC (forward-error-correction) : disable-fec Beacon is turned off Auto-
Negotiation is turned on Input flow-control is off, output flow-control is off Auto-mdix is
turned off Switchport monitor is off EtherType is 0x8100 EEE (efficient-ethernet) : n/a Last
link flapped 00:00:13 Last clearing of "show interface" counters never 12 interface resets 30
seconds input rate 0 bits/sec, 0 packets/sec 30 seconds output rate 1640 bits/sec, 0 packets/sec
Show interface表示連線埠已暫停，因為沒有LACP PDU。我們可以進一步檢視LACP計數器，並確定是否正在傳送和接收LACP PDU。
```

```
FAB3-L1# show lacp counters interface port-channel 3 LACPDU's Marker Marker Response LACPDU's Port
Sent Recv Sent Recv Sent Recv Pkts Err -----
----- port-channel3 Ethernet1/33 314 264 0 0 0 0 0 FAB3-L1# FAB3-L1# FAB3-L1# show lacp
counters interface port-channel 3 LACPDU's Marker Marker Response LACPDU's Port Sent Recv Sent
Recv Sent Recv Pkts Err -----
----- port-channel3 Ethernet1/33 315 264 0 0 0 0 0
```

輸出顯示，計數器僅遞增傳送的LACPDU，Recv計數器保持不變。這表示我們沒有收到來自遠端的LACP PDU。

我們還可以檢視LACP協商引數、計數器等。對於特定介面，請使用「show lacp interface e1/33」

。

```
FAB3-L1# show lacp interface e1/33 Interface Ethernet1/33 is suspended Channel group is 3 port
channel is Po3 PDUs sent: 317 PDUs rcvd: 264 received Markers sent: 0 Markers rcvd: 0 Marker
response sent: 0 Marker response rcvd: 0 Unknown packets rcvd: 0 Illegal packets rcvd: 0 Lag Id:
[ [(7f9b, 00-23-04-ee-be-65, 82ae, 8000, 121), (0, 0-0-0-0-0-0, 0, 0, 0)] ] Operational as
aggregated link since Mon Aug 22 09:29:53 2022 Local Port: Eth1/33 MAC Address= 00-81-c4-b1-25-
4f System Identifier=0x8000,00-81-c4-b1-25-4f Port Identifier=0x8000,0x121 Operational key=33454
LACP_Activity=active LACP_Timeout=Long Timeout (30s) Synchronization=NOT_IN_SYNC
Collecting=false Distributing=false Partner information refresh timeout=Long Timeout (90s) Actor
Admin State=(Ac-1:To-0:Ag-1:Sy-0:Co-0:Di-0:De-1:Ex-0) Actor Oper State=Ac-1:To-0:Ag-1:Sy-0:Co-
0:Di-0:De-1:Ex-0 Neighbor: 0x0 MAC Address= 0-0-0-0-0-0 System Identifier=0x0,0x0 Port
Identifier=0x0,0x0 Operational key=0 LACP_Activity=unknown LACP_Timeout=Long Timeout (30s)
Synchronization=NOT_IN_SYNC Collecting=false Distributing=false Partner Admin State=(Ac-0:To-
0:Ag-0:Sy-0:Co-0:Di-0:De-0:Ex-0) Partner Oper State=(Ac-0:To-0:Ag-0:Sy-0:Co-0:Di-0:De-0:Ex-0)
Aggregate or Individual(True=1)= 2
```

此外，還可以在枝葉上為LACP資料包捕獲資料包，您可以使用特定過濾器過濾出有問題的介面。

```
tcpdump -vvvi kpm_inb ether proto 0x8809
```

建議的操作：

確保在遠端端正確配置了LACP，並且裝置在正確的介面上傳送了LACP PDU。

3.由vPC暫停

```
FAB3-L1# show vpc brief Legend: (*) - local vPC is down, forwarding via vPC peer-link vPC domain
id : 101 Peer status : peer adjacency formed ok vPC keep-alive status : Disabled Configuration
consistency status : success Per-vlan consistency status : success Type-2 consistency status :
success vPC role : primary Number of vPCs configured : 1 Peer Gateway : Disabled Dual-active
excluded VLANs : - Graceful Consistency Check : Enabled Auto-recovery status : Enabled (timeout
= 240 seconds) Operational Layer3 Peer : Disabled vPC Peer-link status -----
----- id Port Status Active vlans -- ---- -----
----- 1 up - vPC status -----
----- id Port Status Consistency Reason Active vlans -- ---- -----
- ----- 686 Po3 down* failed vpc port channel mis-config due to vpc
links in the 2 switches connected to different partners
```

此輸出顯示vPC埠通道因vPC配置錯誤而關閉。現在來進一步瞭解埠通道狀態。

```
FAB3-L1# show port-channel summary Flags: D - Down P - Up in port-channel (members) I -
Individual H - Hot-standby (LACP only) s - Suspended r - Module-removed S - Switched R - Routed
U - Up (port-channel) M - Not in use. Min-links not met F - Configuration failed -----
----- Group Port- Type Protocol
Member Ports Channel -----
---- 3 Po3(SD) Eth LACP Eth1/33(D)
```

這裡Eth1/33處於Down狀態，我們進一步檢視「show interface e1/33」以瞭解更多詳細資訊。

```
FAB3-L1# show int e1/33 Ethernet1/33 is down (suspend-by-vpc) admin state is up, Dedicated
Interface Belongs to po3 Hardware: 100/1000/10000/auto Ethernet, address: 0081.c4b1.2521 (bia
0081.c4b1.2521) MTU 9000 bytes, BW 0 Kbit, DLY 1 usec reliability 255/255, txload 1/255, rxload
1/255 Encapsulation ARPA, medium is broadcast Port mode is trunk full-duplex, 10 Gb/s FEC
(forward-error-correction) : disable-fec Beacon is turned off Auto-Negotiation is turned on
Input flow-control is off, output flow-control is off Auto-mdix is turned off Switchport monitor
is off EtherType is 0x8100
```

vPC使用LAG ID確定vPC對等體是否連線到同一主機，如果LAG ID不匹配，則介面由vPC掛起。

「Show vpc brief」顯示vPC對等體上的埠通道中的物理鏈路未連線到同一遠端裝置。

可以使用「show vpc consistency-parameters interface port-channel 3」檢查LAG ID比較。

```
FAB3-L1# show vpc consistency-parameters interface port-channel 3 Type 1 : vPC will be suspended in case of mismatch Name Type Local Value Peer Value -----  
----- lag-id 1 [(7f9b, [(7f9b, 0-23-4-ee-be-65, 82ae, 0-23-4-ee-be-68, 82ae, 0, 0), (8000, 0, 0), (8000, 0-a6-ca-75-6f-c1, 0-a6-ca-75-6f-c1, 8000, 0, 0)] 8000, 0, 0)] mode 1 active active Speed 1 10 Gb/s 10 Gb/s Duplex 1 full full Port Mode 1 trunk trunk Native Vlan 1 0 0 MTU 1 9000 9000 vPC card type 1 Empty Empty Allowed VLANs - 86 86 Local suspended VLANs - - -
```

如果LAG-ID埠不匹配，將掛起。

建議的操作：

確保port-channel中的物理鏈路連線到同一遠端裝置。

4. LACP暫停個人

LACP將埠設定為掛起狀態（如果它沒有從對等方接收LACP PDU）。這可能會導致某些伺服器無法啟動，因為它們需要LACP來邏輯啟動埠。您可以通過禁用LACP掛起個人將行為調整為單獨使用。為此，請在vPC策略組中建立一個埠通道策略，並在將LACP活動模式設定為後，刪除Suspend Individual Port。現在，vPC中的埠保持活動狀態，並繼續傳送LACP資料包。

```
FAB3-L1# show port-channel extended Flags: D - Down P - Up in port-channel (members) I - Individual H - Hot-standby (LACP only) s - Suspended r - Module-removed b - BFD Session Wait S - Switched R - Routed U - Up (port-channel) M - Not in use. Min-links not met F - Configuration failed ----- Group Port-BundleGrp Protocol Member Ports Channel -----  
----- 1 Pol(SD) 101-102 LACP Eth1/33(I)
```

輸出顯示，即使刪除LACP Suspend-Individual標誌後，我們沒有在Eth1/33上接收LACP PDU，埠作為單個埠處於UP狀態。請注意，我們仍然通過此配置從ACI枝葉傳送LACP PDU，一旦收到LACP PDU，埠將返回到捆綁模式。

其他錯誤

更多並非特定於vPC但仍適用於vPC介面的介面錯誤。有關詳細資訊，請參閱連結。

1. mcp-loop-err-disable

<https://www.cisco.com/c/dam/en/us/solutions/collateral/data-center-virtualization/application-centric-infrastructure/aci-guide-using-mcp-mis-cabling-protocol.pdf>

2. bpduguard-err-disable

https://www.cisco.com/c/en/us/td/docs/switches/datacenter/aci/aci_virtual_edge/configuration/1-x/b_Virtual_Edge_Config_Guide_1_2_1/b_Virtual_Edge_Config_Guide_1_2_1_chapter_0101.pdf

關於此翻譯

思科已使用電腦和人工技術翻譯本文件，讓全世界的使用者能夠以自己的語言理解支援內容。請注意，即使是最佳機器翻譯，也不如專業譯者翻譯的內容準確。Cisco Systems, Inc. 對這些翻譯的準確度概不負責，並建議一律查看原始英文文件（提供連結）。