EX硬體:ACI資料包轉發深入分析。

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簡介

本文檔介紹在應用中心基礎設施(ACI)中使用基於「EX」的ACI交換機的不同轉發方案。它將說明如 何驗證硬體是否已正確程式設計,以及我們正在將資料包轉發到相應終端組(EPG)中的正確目標終 端(EP)。

必要條件

需求

本文件沒有特定需求。

採用元件

本檔案中的資訊是根據以下硬體和軟體版本:

- ACI交換矩陣,包括使用EX硬體的兩個主幹交換機和兩個枝葉交換機
- 一台帶有兩個上行鏈路的ESXi主機,分別連線到每台枝葉交換機
- 充當路由器的Nexus 5000裝置。
- •用於初始設定的應用策略基礎設施控制器(APIC)

本文中的資訊是根據特定實驗室環境內的裝置所建立。文中使用到的所有裝置皆從已清除(預設)的組態來啟動。如果您的網路正在作用,請確保您已瞭解任何指令可能造成的影響。

案例

2個EP位於同一EPG/相同枝葉 --- 交換幀中

拓撲





s - static-arp



根據此拓撲,從EP1到EP2的流是L2流,應在源流量進入的任何枝葉上本地交換。 要檢查第2層 (L2)資料流,首先要檢查mac地址表,以確定交換機是否接收幀以及在何處收到幀:

leaf4#	show mac address-tabl	Le grep	fccc			
* 30	0050.56a5.fccc	dynamic	-	F	F	po3
leaf4#	show mac address-tabl	Le grep	6794			
* 30	0050.56a5.6794	dynamic	-	F	F	po4
若要檢	視封裝VLAN,您還可	「以檢查EI	P資料庫:			

leaf4# show endpoint mac 0050.56a5.fccc Legend: 0 - peer-attached H - vtep a - locally-aged S - static V - vpc-attached p - peer-aged L - local M - span B - bounce

_____+ ---+ VLAN/ Encap MAC Address MAC Info/ Interface Domain VLAN IP Address IP Info ---+ vlan-2268 0050.56a5.fccc LV 30 ро3 vlan-2268 192.168.20.2 LV Joey-Tenant:Joey-Internal po3 calo2-leaf4# show endpoint mac 0050.56a5.6794 Legend: 0 - peer-attached H - vtep a - locally-aged S - static V - vpc-attached p - peer-aged L - local M – span s - static-arp B - bounce ---+ MAC Address MAC Info/ VLAN/ Encap Interface IP Address IP Info VLAN Domain ---+ 30 vlan-2268 0050.56a5.6794 LV po4 vlan-2268 192.168.20.3 LV Joey-Tenant:Joey-Internal po4

我們知道FD_VLAN 30匹配,但我們可以始終在軟體中驗證對映:

leaf4# show vlan extended | grep 2268

30 enet CE vlan-2268

當然,我們可以檢查硬體,以確保VLAN 30對映到作為前面板封裝的VLAN 2268。

leaf4# vsh_lc

module-1# show system internal eltmc info vlan 30

vlan_id:	30	:::	hw_vlan_id:	22
vlan_type:	FD_VLAN	:::	bd_vlan:	28
access_encap_type:	802.1q	:::	access_encap:	2268
fabric_encap_type:	VXLAN	:::	fabric_encap:	11960
sclass:	32778	:::	scope:	11
untagged:	0			
acess_encap_hex:	0x8dc	:::	fabric_enc_hex:	0x2eb8
pd_vlan_ft_mask:	0x8			
fd_learn_disable:	0			
<pre>qos_class_id:</pre>	0	:::	<pre>qos_pap_id:</pre>	0
qq_met_ptr:	25	:::	<pre>ipmc_index:</pre>	0
ingressBdAclLabel:	0	:::	ingBdAclLblMask:	0
egressBdAclLabel:	0	:::	egrBdAclLblMask:	0
<pre>qos_map_idx:</pre>	0	:::	qos_map_pri:	0
<pre>qos_map_dscp:</pre>	0	:::	<pre>qos_map_tc:</pre>	0
<pre>vlan_ft_mask:</pre>	0xe30			
hw_bd_idx:	0	:::	hw_epg_idx:	11267
intf_count:	2	:::	<pre>glbl_scp_if_cnt:</pre>	2

<SNIPPED>

鑑於已經從軟體中學習了電子產品,我們還可以驗證硬體是否也對這些電子產品的二級資訊進行程

式設計。 在新硬體中,硬體抽象層(HAL)是硬體的軟體狀態。 HAL的工作是接受軟體程式設計請求 ,並將其推送到硬體上。

為了檢視有關終端的L2硬體資訊,我們可以檢視HAL中給定mac地址的L2表:

leaf4# vsh_lc module-1# show platform internal hal ep 12 mac 0050.56a5.fccc LEGEND: _____ BDId: BD Id BD Name: BD Name EP Type (Pl: Physical Vl: Virtual Xr: Remote т: EP Mac: Mac L2 Interface L2 IfName: L2 IfId: L2 IfName FD Id FDTd· FD Name· FD Name S Class S Class: Age Intvl: Age Interval P A: Packet Action (F: Forward, T: Trap to CPU, L: Log & Forward, D: Drop, N: None) S T: Static Ep S E: Secure EP Learn Disable B N D: L D: Bind Notify Disable E N D: Epg Notify Disable в Е: Bounce Enable I D L: IVxlan Dont Learn SPI: Source Policy Incomplete DPI: Dest Policy Incomplete SPA: Source Policy Applied DPA: Dest Policy Applied DSS: Dest Shared Service Is Local VUB: Vnid IL: Use Bd SO: SA Only L2 EP Count: 1 _____ _____ ВE ISDSDD V BD ΕP L2 L2 FD S Age PSSLNN BDPPPPSIUS BdId Name T Mac IfId Ifname FDId Name Class Intvl A T E D D D ELIIAASLBO _____ _____ BD-28 Pl 00:50:56:a5:fc:cc 16000002 Po3 1e FD-30 **800a** 29f F00010 1c 0 0 0 0 0 0 0 1 0 0 module-1# show platform internal hal ep 12 mac 0050.56a5.6794 _____ _____ ΒΕ ISDSDD V BD ΕP т.2 T.2 FD S Age PSSLNN B D P P P P S I U S BdId Name T Mac IfId Ifname FDId Name Class Intvl A T E D D D ELIIAASLBO

BD-28 Pl 00:50:56:a5:67:94 16000003 Po4 1e FD-30 800a 29f F 0 0 0 1 0

0 0 0 0 0 0 0 1 0 0

現在我們已經規劃了硬體,讓我們來執行ELAM並檢視資料包應該傳送到哪裡。

伊拉姆語

1c

module-1(DBG-TAH-elam-insel6)# report | grep ovec

sug_elam_out_sidebnd_no_spare_vec.ovector_idx: 0x9E

很好,因此Leaf4在Asic 0片1上收到該幀。在新硬體上使用ELAM時,出現了一個在故障排除時非 常重要的新的欄位:**ovector_idx**。 此索引是轉發幀/資料包時應使用的物理埠索引。 收到 ovector_idx後,我們可以使用此命令查詢它對映到的埠:

module-1(Legend:	DBG-TAH-elam-insel6)# show platform	internal hal 12 port gpd	
IfId: I P: Uc PC Cfg	Interface Id Is PC Mbr : UcPcCfg Idx	IfName: : IfId: Uc PC MbrId:	Interface Name Interface Id Uc Pc Mbr Id
As: Sl: Ss:	Asic Slice Slice SrcId	AP: Sp: Ovec:	Asic Port Slice Port Ovector (slice
L S: L3:	Local Slot Is L3	Reprogram:	
P: RP: IP: RS: DP: SP: RSP: UC: IM.	PifTable Rw PifTable If Profile Table Rw SrcId Table DPort Table SrcPortState Table RwSrcPortstate Table UCPcCfg UCPcMbr	Xla Idx: Ovx Idx: N L3: NI L3: Vif Tid: RwV Tid: Ing Lb1: Egr Lb1: Beprogram:	Xlate Idx OXlate Idx Num. of L3 Ifs Num. of Infra L3 Ifs Vif Tid RwVif Tid Ingress Acl Label Egress Acl Label
PROF ID: VS: Install RV: Num. of S	Lport Profile Id VifStateTable Rw VifTable andboxes: 1	HI:	LportProfile Hw
Sandbox_I Port Cou	D: 0, BMP: 0x0 nt: 8		
	Uc Uc	Reprogram	

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NI Vif	RwV	Ing		Egr		V	R	P	ROF	Η																			
IfId	Ifname		Ρ	Cfq	g	Mbr	ID	As	AP	Sl	Sp	Ss	0vec	S	Ρ	Ρ	Ρ	S	Ρ	Sp	Sp	С	М	ь	3	Idx	Idx	L3	
L3 Tid	Tid	Lbl		Lbl		S	V	I	D	Ι																			
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1a004000	Eth1/5		1	0		1d		0	d	0	С	18	18	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	80	0 00			0	1	0		0																				
1a005000	Eth1/6		1	0		b		0	е	0	d	1a	1a	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	80	0 00			0	1	0		0																				
1a006000	Eth1/7		0	26		5		0	f	0	е	1c	1c	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D-256 -	8(0 00			0	1	е		0																				
1a007000	Eth1/8		0	2e		7		0	10	0	f	1e	1e	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D-84 -	8(0 00			0	1	3()	0																				
1a01e000	Eth1/31	1	1	0		2d		0	37	1	е	1c	9c	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0			0	1	0		0																				
1a01f000	Eth1/32	2	1	0		3d		0	38	1	f	1e	9e	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0			0	1	0		0																				
1a030000	Eth1/49	9	0	2		1		0	49	1	20	38	b8	1	0	0	0	0	0	0	0	0	0	0	1	8	6	2	2
D-24d -	40	0 00			0	0	1		0																				
1a031000	Eth1/50	C	0	3		3		0	29	1	0	0	80	1	0	0	0	0	0	0	0	0	0	0	1	9	7	2	2
D-350 -	40	0 00			0	0	1		0																				
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leaf4#	show	port-channel	l summary	
Flags:	D -	Down	P - Up in po:	rt-channel (members)
	I -	Individual	H - Hot-stand	dby (LACP only)
	s -	Suspended	r - Module-re	emoved
	s -	Switched	R - Routed	
	U -	Up (port-cha	annel)	
	М –	Not in use.	Min-links not	t met
	F -	Configuratio	on failed	
Group	Port-	Туре	Protocol	Member Ports
	Channe	21		
1	Pol(SU	J) Eth	LACP	Eth1/5(P)
2	Po2 (SU	J) Eth	LACP	Eth1/6(P)
3	Po3 (SU	J) Eth	LACP	Eth1/31(P)
4	Po4 (SU	J) Eth	LACP	Eth1/32(P)
會,因	日此封付	包會從介面1	/32轉送到目的	的地主機。

不同EPG/相同枝葉中的2個EP — 路由資料包

拓撲



在本示例中,我們將跟蹤資料包從EP1到EP2的流量,其中資料包存在於同一個vPC枝葉對中。 兩 個EP使用不同的BD位於不同的EPG中。

首先要始終檢查EP資料庫,看我們是否學習了EP:

<pre>leaf4# show endpoint Legend:</pre>	ip 192.168.20.2			
0 - peer-attached V - vpc-attached s - static-arp	H - vtep p - peer-aged B - bounce	a - locall L - local	y-aged S - sta M - spa	atic an
+	·	·		
VLAN/		Encap	MAC Address	MAC Info/
Interface Domain		VLAN	IP Address	IP Info
+ 30		vlan-2268	0050.56a5.fccc 1	LV
po3		1 0000	100 100 00 0	
po3	rnal	v1an-2268	192.168.20.2	
calo2-leaf4# show end	point ip 192.168	.21.2		
Legend:	II stan		ward C at	
V - vpc-attached	n - veer-aged	a - locali	y-ayeu S-Sta M-sna	an
s - static-arp	B - bounce		11 590	
++	+	+		+
VLAN/		Encap	MAC Address	MAC Info/
Interface		<u>r</u>		

Domain	VLAN .	IP Address	IP Info
+	+		+++
8	vlan-2200	0050.56a5.0c11	LV
po4			
Joey-Tenant:Joey-Internal	vlan-2200	192.168.21.2	LV
po4			

由於我們已經學習了EP並瞭解了IP資訊,因此我們應當能夠檢視硬體中的EP學習資訊:

VirfName: Vrf Name T: Type (P1: Flysical, V1: Virtual, X: Remote) F F Type (P1: Flysical, V1: Virtual, X: Remote) F State Age Intv1: Age S Class: S Class Age Intv1: Age S Class: S Class Age Intv1: Age State EP S E: SE: Secure 2F L D: Dean Disable B N D: Bind Notify Disable B N D: Bind SF: Bource Enable I D L: TVxlan Dont Learn SPI: Source Policy Incomplete SPA: Source Policy Applied DSS: DPA: Dest Policy Applied DSS: Dest Source Policy Applied DSS: Dest Null Gae Bd SO: SA Only EP NH L3IfName: EP Next Hop Type (L2: L2 Entry L3: L3 Next Hop) BD Name: L2 NH ED Name EP Mac L3 IfName: L3 NH E1 Name: L2 IN Mame FD Name: L2 NH BP Count: L2 FD	<pre>leaf4# vsh_lc module-1# show play LEGEND:</pre>	tform internal	hal ep 13 all	L														
P1: Physical, V1: Virtual, Xr: Remote) Age Intv1: Age PD IP: Endpoint IP S Class: S Class: S T: Static Ep Source Folicy Incomplete B E: Source Folicy Incomplete SFA: Source Folicy Applied DSS: Dest Folicy Applied DSS: Source Source SA Cnly EF Mac L3 IfName: ES Mare L3 IfName: ES Mare FD Name: ES Mare FD Name: ET Kamae: L2 If Name ET Kamae: L2 If Name Fit Ame FD Name: L3 EP Count: L2 N S Age S S L N N B D P P P P S I U S L3 N B E I S BP Count: L2 N </th <th>VrfName:</th> <th>Vrf Name</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>т</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>Tvpe</th>	VrfName:	Vrf Name									т							Tvpe
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Action 5 Class Age 10.01.	S Clace.	S Class									A	20	Τn	+ 17	1.			A C A
ST: Static Ep S S E: Secure EP L D; Learn Disable EN D; Bind Notify Disable B E: Source Policy Incomplete DEI: Dest Policy Incomplete Source Policy Applied DEA: Dest Policy Applied DSS: Dest Shared Service L: Next Hop Type (L2: L2 Entry L3: L3 Next Hop) BD Name: L2 NH BD Name EP Mac: EP Mac L3 IfName: L3 IfName: L3 NH If Name EP Mac: EP Mac L3 IfName FD Name: L2 Entry FD Name IP: L3 NH IP L3 EP Count: 12	Interval	b crubb									11	gc	±11		± •			nge
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b: Learn Disable B N D: Bind Notify Disable B N D: Bind EN D: Epg Notify Disable B E: Bounce Enable SPI: Spin I D L: TVXlan Dont Learn SPI: Source Policy Incomplete SPA: SPA: Source Policy Applied Dest Policy Applied DSS: Dest Shared Service I: Is Local VUB: Vnid Use Ed Source Policy Incomplete DSS: Dest Next Hop IJ If Name EP NH LJIfName: EP NuB: Vnid Next Hop IJ If Name Mac L3 IfName: L2 NH EP Mac: EP Mac L3 IfName: L3 IfName: L2 IfName: L2 If Name FD Name: L2 Entry FD Name FP S Age S S I N N B D P P P S I US L3 N Vrf FD S Age S S I N N B D P P P S I US L3 N Vrf EP S Age S S I N N B D P P P S I US L3 N Vrf FD Class Intvl T E D D D E L I I A A S L B O	Secure FD	Deacie ip									D	. ப	•					
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L2	BD-7	00:50:56:a5:0c:11	-	Po4	L .		FD-	8			-											
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L3	_	00:00:00:00:00:00	-	_			_				0	.0.	0.	. 0								

HAL第3層(I3)表非常有用,因為它為我們提供了第3層獲知EP的VLAN/埠資訊。 我們知道目的地是 Po4,因此應該將封包從Po4中的任何連線埠轉送。

我們運行一個ELAM並檢視結果!

伊拉姆語

module-1(DBG-TAH-elam-insel6) # report | grep ovec sug_elam_out_sidebnd_no_spare_vec.ovector_idx: 0x9E

很好,所以我們觸發了資料包,我們發現「ovector_idx」是0x9E。ovector索引是應該將資料包轉 發出來的傳出物理介面索引。 讓我們看看哪個連線埠具有此索引:

module-1(DBG-TAH-elam-insel6)# show platform internal hal 12 port gpd Legend:

IfId:	Interface Id	IfName:	Interface Name
I P:	Is PC Mbr	IfId:	Interface Id
Uc PC Cfg:	UcPcCfg Idx	Uc PC MbrId:	Uc Pc Mbr Id
As:	Asic	AP:	Asic Port
Sl:	Slice	Sp:	Slice Port
Ss:	Slice SrcId	Ovec:	Ovector (slice
srcid)			
L S:	Local Slot	Reprogram:	

L3: Is L3 Xla Idx: Xlate Idx P: PifTable RP: Rw PifTable Ovx Idx: OXlate Idx IP: If Profile Table N L3: Num. of L3 Ifs RS: Rw SrcId Table NI L3: Num. of Infra L3 Ifs DP: DPort Table Vif Tid: Vif Tid SP: SrcPortState Table RwVif Tid RwV Tid: RSP: RwSrcPortstate Table Ing Lbl: Ingress Acl Label UC: UCPcCfg Egress Acl Label Egr Lbl: UM: UCPcMbr Reprogram: PROF ID: Lport Profile Id VS: VifStateTable HI: LportProfile Hw Install RV: Rw VifTable Num. of Sandboxes: 1 Sandbox_ID: 0, BMP: 0x0 Port Count: 8 _____ _____ Reprogram UC UC Rep I PC Pc L | RIRD R UUX | L Xla Ovx N NI Vif RwV Ing Egr | V R | PROF H IfId Ifname P Cfg MbrID As AP Sl Sp Ss Ovec S | P P P S P Sp Sp C M L | 3 Idx Idx L3 L3 Tid Tid Lbl Lbl | SV | ID I _____ _____ 1a004000 Eth1/5 1 0 1d 0 d 0 c 18 18 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 - - 800 0 0 1 0 0 1a005000 Eth1/6 10 b 0 e 0 d 1a 1a 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 - - 800 0 0 1 0 0 1a006000 Eth1/7 0 26 5 0 f 0 e 1c 1c 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 D-256 - 800 0 0 1 с 0 1a007000 Eth1/8 0 2f 7 0 10 0 f 1e 1e 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 D-199 - 800 0 0 1 2e 0 1a01e000 Eth1/31 1 0 2d 0 37 1 e 1c 9c 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 - - 0 0 0 1 0 0 1a01f000 Eth1/32 1 0 3d 0 38 1 f 1e 9e 1 0 0 0 0 0 0 0 0 0 00 0 0 0 - - 0 0 01 0 0 1a030000 Eth1/49 0 2 1 0 49 1 20 38 b8 1 0 0 0 0 0 0 0 0 0 16422 0 0 0 0 0 3 3 0 0 0 1 D-24d - 400 0 0 0 1 0 0 29 1 0 0 80 1 0 0 0 0 0 0 0 0 0 1 5 3 2 2 1a031000 Eth1/50 D-350 - 400 0 0 似乎應該從埠1/32傳送它,對嗎? leaf4# 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-Туре Protocol Member Ports Channel _____
 Pol(SU)
 Eth
 LACP
 Eth1/5(P)

 Po2(SU)
 Eth
 LACP
 Eth1/6(P)

 Po3(SU)
 Eth
 LACP
 Eth1/31(P)
 1 2 3

不同EPG/不同枝葉中的2個EP — 路由資料包

拓撲

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在本示例中,我們將跟蹤資料包從EP1到EP2的資料包流,其中EP1存在於EX vPC對上,EP2存在 於遠端第1代vPC枝葉對上。 兩個EP使用不同的BD位於不同的EPG中。

再來,我們看看環保部門從哪裡學到:

<pre>leaf4# show endpoint</pre>	ip 192.168.20.2				
Legend:					
0 - peer-attached	H - vtep	a - local	ly-aged S -	static	
V - vpc-attached	p - peer-aged	L - local	М –	span	
s - static-arp	B - bounce				
+		+	+	++	
+					
VLAN/		Encap	MAC Address	MAC Info/	
Interface					
Domain		VLAN	IP Address	IP Info	
+		+	+	++	
+					
30		vlan-2268	0050.56a5.fcc	c LV	
роЗ					
Joey-Tenant:Joey-Int	ernal	vlan-2268	192.168.20.	2 LV	
роЗ					
calo2-leaf4# show er	dpoint ip 192.168	8.1.100			
Legend:					
0 - peer-attached	H - vtep	a - local	ly-aged S -	static	
V - vpc-attached	p – peer-aged	L - local	М –	span	
s - static-arp	B - bounce				
		1	1		

VLAN/		Encap	þ	MAC Address	5	MAC Ir	nfo/		
Interface		57T 7 NI		TD Adrogg		TD Tof	-		
+		· IAU	+		+-		+-		
+	.								
Joey-Tenant:Joe tunnel2	ey-Internal			192.168.1	1.100				
現在,讓我們顯	澰證硬體已程式	設計:							
<pre>leaf4# vsh_lc module-1# show LEGEND:</pre>	platform inter	nal hal ep 13	all						
	Wrf Name					Ψ.			Tune
(Pl: Physical,	Vl: Virtual, X	r: Remote)				1.			TYPC
EP IP:	Endpoint I	P							
S Class: Interval	S Class					Age	e Intvl:		Age
S T:	Static Ep					SE	5:		
Secure EP	,	-							
L D: Notify Disable	Learn Disa	ole				ВГ	1 D:		Bind
E N D:	Epg Notify	Disable				ВE	C:		
Bounce Enable									
I D L:	IVxlan Don	t Learn				SPI	:		
Source Policy	Incomplete	Theomelete				CDZ			
Source Policy	Dest Polic	y Incompiete				SPF	7:		
DPA:	Dest Polic	y Applied				DSS	5:		Dest
Shared Service									
IL:	Is Local					VUE	3:		Vnid
USE BA	SA Only					FD	NH L3TEN:	ame•	FP
Next Hop L3 If	Name					ш		anic.	
NHT:	Next Hop T	ype (L2: L2 Er	ntry L3: L3	Next Hop)		BD	Name:		L2 NH
BD Name									
EP Mac:	EP Mac					Г3	IfName:		L3 NH
L2 IfName:	L2 If Name					FD	Name:		L2
Entry FD Name									
IP:	L3 NH IP								
L3 EP Count:	12								
								====	
					ΒE	ISI	DSDD	V	EP-NH
N									
Vrf	EP	тр	S T C	Age SS	LNNE	BDPI	PPSI	υS	L3
Name '	r ip	23	Clas	s Intvl T E	DDDB	ELII	IAASL	во	
IfName T	Name M	ac	IfName	Ifname	e 1	Name	IP		
								====	
common*rewall	Pl 10.6.112.1		1	0 1 0	0 0 0 0) 1 1 (0001	0 0	_
L3 -	00:00:00:00:00	:00 -	-	-	0.0	.0.0			
common*rewall	Pl 10.6.114.1		1	0 1 0	0 0 0 0	0110	0 0 0 1	0 0	-
L3 -	00:00:00:00:00	:00 -	-	-	0.0	.0.0		0 0	
common*rewall :	PI IU.6.114.129	•00 -	- 1	v 10 _) T T (0001	υ 0	-
common*efault	Pl 100.100.101.	1	1	0 1 0	0 0 0 0) 1 1 (0001	0 0	_
L3 -	00:00:00:00:00	:00 -	-	-	0.0	.0.0			

Joey-	-T*ternal	Pl	192.168.1.1			1	0		1	0	0	0	0 0) 1	1	0	0	0	0	1	0	0	-
L3	-	00	:00:00:00:00:00	-	-			-				0	.0.	0.	0								
Joey-	T*ternal	Xr	192.168.1.100			8013	128	3	0	0	0	1	0 0	0 (0	0	0	0	0	0	1	0	-
L3	-	00	:0c:0c:0c:0c:0c	Tunnel2	Tur	nnel2		-				0	.0.	0.	0								
Joey-	T*ernal2	Pl	192.168.3.1			1	0		1	0	0	0	0 0) 1	1	0	0	0	0	1	0	0	-
L3	-	00	:00:00:00:00:00	-	-			-				0	.0.	0.	0								
Joey-	-T*ternal	Pl	192.168.20.1			1	0		1	0	0	0	0 0) 1	1	0	0	0	0	1	0	0	-
L3	-	00	:00:00:00:00:00	-	-			-				0	.0.	0.	0								
T						000-	•		Δ	^	^	^	<u>م</u>	<u>م</u>	•	^	~	~	~	4	~	~	
Joey-	•T*ternal	ЪТ	192.168.20.2			000a	U		U	U	U	U	0 0	, ,	U	U	0	0	U	T.	U	0	-
Joey- L2	BD-28	00 PT	192.168.20.2):50:56:a5:fc:cc	-	Po	800a 3	U	FD-	-30	ט כ	U	- -	0 0	, ,	U	0	0	0	0	Ŧ	0	0	-
Joey- L2 Joey-	BD-28 T*ternal	Р1 00 Р1	192.168.20.2 150:56:a5:fc:cc 192.168.21.1	-	Po	300a 1	0	FD-	-30 1	0 0	0	- 0	0 0) 1	1	0	0	0	0	1	0	0	-
Joey- L2 L3	- T*ternal BD-28 -T*ternal	P1 00 P1 00	192.168.20.2 9:50:56:a5:fc:cc 192.168.21.1 9:00:00:00:00:00	-	P03	1	0	FD-	-30 1	0 0	0	0 0	00) 1 .0.	1 0	0	0	0	0	1	0	0	-
Joey- L2 L3 Joey-	BD-28 •T*ternal • •T*ternal	P1 00 P1 00 P1	192.168.20.2 150:56:a5:fc:cc 192.168.21.1 0:00:00:00:00:00 192.168.21.2	-	P03 -	800a 1 800c	0	FD-	-30 1 0	0 0	0	0 0 0	00) 1 .0.) 0	1 0 0	0	0 0	0 0	0	1 1	0	0	-
Joey- L2 Joey- L3 Joey- L2	BD-28 T*ternal - T*ternal BD-7	P1 00 P1 00 P1 00	192.168.20.2 50:56:a5:fc:cc 192.168.21.1 0:00:00:00:00:00 192.168.21.2 0:50:56:a5:0c:11	-	Po 3	800a 1 800c	0	FD- FD-	-30 1 0 -8	0 0	0	0 0 0 0	0 (0.00)) 1 .0.) 0	1 0 0	0 0	0 0	0 0	0	1 1	0	0	-
Joey- L2 Joey- L3 Joey- L2 Joey-	BD-28 T*ternal - T*ternal BD-7 T*ternal	P1 00 P1 00 P1 00 P1	192.168.20.2 50:56:a5:fc:cc 192.168.21.1 0:00:00:00:00:00 192.168.21.2 0:50:56:a5:0c:11 2001:0:0:100::1	-	Po 3	800a 1 800c 1	0 0 0	FD- FD-	-30 1 0 -8 1	0 0 0	0 0 0	0 0 0 0 0) 1 .0.) 0	1 0 0 1	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	-
Joey- L3 Joey- L2 Joey- L3	BD-28 T*ternal - T*ternal BD-7 T*ternal -	P1 00 P1 00 P1 00 P1 00 00	192.168.20.2 50:56:a5:fc:cc 192.168.21.1 0:00:00:00:00:00 192.168.21.2 0:50:56:a5:0c:11 2001:0:0:100::1 0:00:00:00:00:00	- - -	Po 3 - Po4	800a 1 800c 1	0 0 0	FD - FD-	-30 1 0 -8 1	0 0 0	0 0 0	0 0 0 - 0) 1 .0.) 0) 1 .0.	1 0 0 1 0	0 0 0	0 0 0	0 0 0	0 0 0	1 1 1	0 0 0	0 0 0	-

硬體認為EP存在於通道2上。通道2的目的地是什麼?

module-1# show system	internal eltmc	info :	interface tunnel2	
IfInfo:				
interface:	Tunnel2	:::	ifindex:	402718722
iod:	66	:::	state:	up
Mod:	0	:::	Port:	0
Tunnel Index:	0	:::	Tunnel Dst ip:	0xc0a87843
Tunnel Encap:	ivxlan	:::	Tunnel VPC Peer:	0
Tunnel Dst ip str:	192.168.120.67	:::	Tunnel ept:	0x1
[SDK Info]:				
tunnl_name:	-			0.40040555
vrf_id:	2	:::	<pre>it_index:</pre>	0x18010002
hwencapidx:	0	:::	encaptype:	1
<pre>mac_proxy:</pre>	0	:::	v4_proxy:	0
v6_proxy:	0	:::	ip_addr_type:	0
ipv4_address:	0xc0a87843			
[CDR INFO].				
IDI THEOI:	C C			
re if index.	00			
pc_11_1ndex:	0			
	0			
sv_11:	0			
int wlong	0			
	0			
mod port status	0-241620002			
$mod_poil_status:$	0x41020003			
	0			
v4_tb1_10;		0		
unnumbered.	n			
trunk id.	0			
tunnel mod.	0			
tunnel nort.	0			
ten in:	0xc0a87843			
in if mode.	0xc0a07843			
adk wrf id.	0 2			
SUK_VII_IU:	9366		inmtu id.	0
ic for fabric.	00066	•••	Thurn Ta:	0
IS_TEX_TADITC:	0			

由於目標位於vPC之外,因此該目標IP應該是遠端枝葉的vPC虛擬IP。 讓我們檢查遠端枝葉並檢視

1

Local TEP IP	:	192.168.160.95
Peer TEP IP	:	192.168.160.93
vPC configured	:	Yes
VPC VIP	:	192.168.120.67
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

非常好,因此它從遠端vPC對獲取了目標EP。 我們來看看ELAM看到什麼並驗證我們是否正確轉發 資料包:

伊拉姆語

現在,對於EX硬體上的遠端目標,有2個ELAM值在排除資料包流故障時非常重要。 與之前類似的 ovector_idx和encap_idx:

module-1(DBG-TAH-elam-insel6)# report | grep ovec sug_elam_out_sidebnd_no_spare_vec.ovector_idx: 0xB8 module-1(DBG-TAH-elam-insel6)# report | grep encap sug_lurw_vec.encap_l2_idx: 0x0 sug_lurw_vec.encap_pcid: 0x0 sug_lurw_vec.encap_idx: 0x6 sug_lurw_vec.encap_vld: 0x1

在EX硬體上,我們確實能夠驅動應轉發資料包的目的埠。以前,我們通常只檢查封裝idx並驗證目標idx是否是正確的隧道。在此我們可以驗證哪些埠對映到8B:

module-1(D	BG-TAH-elam-insel6)#	show platform	internal 1	nal 12 port	gpd		
IfId:	Interface Id			IfName	:	Interface Name	
I P:	Is PC Mbr			IfId:		Interface Id	
Uc PC Cfg:	UcPcCfg Idx			Uc PC	MbrId:	Uc Pc Mbr Id	
As:	Asic			AP:		Asic Port	
Sl:	Slice			Sp:		Slice Port	
Ss:	Slice SrcId			Ovec:		Ovector (slice	
srcid)							
L S:	Local Slot			Reprog	ram:		
L3:	Is L3						
P:	PifTable			Xla Id	x:	Xlate Idx	
RP:	Rw PifTable			Ovx Id	x:	OXlate Idx	
IP:	If Profile Table			N L3:		Num. of L3 Ifs	
RS:	Rw SrcId Table			NI L3:		Num. of Infra	L3 Ifs
DP:	DPort Table			Vif Ti	d:	Vif Tid	

RwV Tid: RwVif Tid SP: SrcPortState Table Ing Lbl: RSP: RwSrcPortstate Table Ingress Acl Label UC: UCPcCfg Egr Lbl: Egress Acl Label UM: UCPcMbr Reprogram: PROF ID: Lport Profile Id VS: VifStateTable HT: LportProfile Hw Install RV: Rw VifTable Num. of Sandboxes: 1 Sandbox_ID: 0, BMP: 0x0 Port Count: 8 -----UC UC Reprogram | Rep | I PC Pc L | RIRD R U U X | L Xla Ovx N NI Vif RwV Ing Egr | V R | PROF H IfId Ifname P Cfg MbrID As AP Sl Sp Ss Ovec S | P P P S P Sp Sp C M L | 3 Idx Idx L3 L3 Tid Tid Lbl Lbl | SV | ID I -----1a004000 Eth1/5 1 0 1d 0 d 0 c 18 18 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 - - 800 0 0 1 0 0 1a005000 Eth1/6 10 b 0 e 0 d 1a 1a 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 - - 800 0 0 1 0 0 1a006000 Eth1/7 026 5 0 f 0 e 1c 1c 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 D-256 - 800 0 0 1 c 0 0 10 0 f 1e 1e 1 1a007000 Eth1/8 0 2f 7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 D-199 - 800 0 0 1 2e 0 0 0 0 0 0 0 0 0 0 0 0 0 1a01e000 Eth1/31 1 0 2d 0 37 1 e 1c 9c 1 0 0 - - 0 0 01 0 0 1a01f000 Eth1/32 1 0 3d 0 38 1 f 1e 9e 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 - - 0 0 01 0 0 1a030000 Eth1/49 02 1 0 49 1 20 38 b8 1 0 0 0 0 0 0 0 0 0 0 16422 D-24d - 400 0 0 0 1 0 1a031000 Eth1/50 03 3 0 29 1 0 0 80 1 0 0 0 0 0 0 0 0 0 1 5 3 2 2 D-350 - 400 0 0 0 1 0

Switch認為它應該將其轉發到介面Eth1/49上的主幹。但我們如何驗證封裝是否正確?

我們首先需要檢視有關隧道的硬體資訊。 可通過運行以下HAL命令執行此操作:

module-1(I	BG-TAH-elam-insel6) # show platform internal hal tunnel	rtep pi	
Non-Sandbo	x Mode		
LEGEND:			
Tun Ifid:	Tunnel Ifid	IfName:	Tunnel If Name
Lid:	Logical Id	ET:	Encap Type V:
Vxlan I: I	Vxlan N: NVGRE		
VrfId:	Vrf Id	Vrf Name: V	rf Name
IP:	Tunnel's IP		
Hw Enc:	Hw Encap Idx	IVP:	Is VPC Peer
IL:	Is Local	P4:	Proxy for v4
P6:	Proxy for V6	PM:	Proxy for Mac
II:	Is Ingress Only	IC:	Is Copy Service
C OBd:	Copy Service Outer Bd	U D:	Use DF
NBT:	Next Base Type E: ECMP N: Next-Hop	NB Id:	Next Base Id
NH cnt:	Next Hop Count	VrfId:	Vrf Id
Vrf Name:	Vrf Name	IP:	IP Address
Mac:	Mac	L3 IfId:	L3 IfId
L3IfName:	L3 If Name	L2 IfId:	L2 IfId

L2IfName: L2 If Name Num. of Sandboxes: 1 Sandbox_ID: 0, BMP: 0x0 Remote Tep Count: 15 _____ _____ ======= Т ΝΝ HW VIPPPIIC UBB E Vrf NH Vrf L3 L3 L2 L2 T Lid VrfId Name Enc PL46MICOBdDTId TfTd IP Ifname Cnt | VrfId Name IP Mac IfId IfName IfId IfName _____ _____ ====== overlay-1 **18010002 Tunnel2** I 3005 2 **192.168.120.67**0 0000001 0E2 overlay-1 0.0.0.0 0d:0d:0d:0d:0d:00 1a030001 Eth1/49.1 1a030000 Eth1/4 2 2 9 overlay-1 0.0.0.0 0d:0d:0d:0d:00 1a031002 Eth1/50.2 1a031000 Eth1/5 2 0 此輸出提供我們關心的幾個值:

lfld — 分配給通道的介面ID

IP — 目的地的IP。 這應該與ELTMC相符。

L3 IfId — 交換器可用來轉送到適當目的地的第3層介面。

得知lfld後,我們可以驗證在群組中取得的封包是否與通道目的地相符:

module-1(DBG-TAH-elam-insel9)# show platform internal hal tunnel rtep apd Non-Sandbox Mode LEGEND: _____ Interface Id IP address ifTd: TP: HwVrfId: Hardware Vrf Id Source Tep Index SrcTepIdx: DstInfoIdx: Destination info index BDXlate: Egress BDXlate RwEncapIdx: Rw Encap Index ECMPIdx: ECMP Index Num: Number of hops ECMPMbrIdx: ECMP member Index Rw Dmax Index L2 Index: L2 Index RwDmacIdx: Num. of Sandboxes: 1 Sandbox_ID: 0, BMP: 0x0 Remote Tep Count: 15 _____ _____ ifId ΙP HwVrfId BDXlate SrcTepIdx DstInfoIdx RwEncapIdx ECMPIdx ECMPMbrIdx Num L2Index RwDmacIdx _____

18010002 192.168.120.67 2
 1
 3a9a
 3005
 6 0
 0
 2

 1a030000 0
 <---- RwEncapIdx is 6!</td>
 Same as the "encap_idx" in the ELAM Report.

1a031000 1

此隧道的RwEncapIdx(重寫封裝索引)為6,這是在elam中顯示的內容。

1 EP ---> L3輸出 --- 路由流

拓撲





在本示例中,我們將跟蹤資料包的流量,該資料包從EP1傳送ICMP到運行OSPF的N5K上的環回。 N5K通過同一對EX交換機上的L3Out連線。

由於我們已經在本文檔開頭驗證了本地EP程式設計,因此假定在硬體中正確學習了EP,然後繼續 路由驗證。

首先檢查OSPF狀態和路由表:

<pre>leaf6# show ip</pre>	ospf neighbors vrf j	r:sb			
OSPF Process	ID default VRF jr:sb				
Total number	of neighbors: 2				
Neighbor ID	Pri State	Up Time A	Address	Interfac	ce
27.27.27.1	1 FULL/BDR	00:22:39 1	L0.10.27.1	Vlan28	< Leaf5
27.27.27.3	1 FULL/DROTHER	00:22:37 1	L0.10.27.3	Vlan28	< N5K

leaf6# show ip route vrf jr:sb 100.100.100.100
IP Route Table for VRF "jr:sb"
'*' denotes best ucast next-hop
'**' denotes best mcast next-hop

'[x/y]' denotes [preference/metric] '%<string>' in via output denotes VRF <string>

100.100.100.100/32, ubest/mbest: 1/0

*via 10.10.27.3, vlan28, [110/5], 00:16:58, ospf-default, intra

因此,我們知道路由表在10.10.27.3上將下一跳顯示為5K。這算是良好的開端,但我們如何驗證哪 些硬體有呢?

首先檢查硬體中的鄰接表,確保ARP解析為10.10.27.3,並且已使用正確的介面進行程式設計:

leaf6# vsh_lc module-1# show forwarding adjacency

IPv4 adjacency information, adjacency count 20

MAC地址與5K:			
10.10.27.3	8c60.4f02.88fc	Vlan28	port-channel5
10.10.27.1	0022.bdf8.19ff	Vlan28	Tunnel3
next-hop	rewrite info	interface	phy i/f

ACI-5548-B# show interface vlan 3117

Vlan3117 is up, line protocol is up Hardware is EtherSVI, address is 8c60.4f02.88fc Internet Address is 10.10.27.3/29 MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec

在EX平台上,有一個分配給VRF的「hw_vrf_idx」。在我們驗證硬體程式設計時,將引用此索引。 讓我們找到索引:

module-1# show system	internal eltmc	info	vrf jr:sb	
VRF-TABLE: jr:sb				
vrf_type:	tenant	:::	context_id:	6
overlay_index:	0	:::	vnid:	2129921
scope:	5	:::	sclass:	16386
v4_table_id:	0x5	:::	v6_table_id:	0x80000005
intf_count:	5	:::	intrn_vlan_id:	0
VRF Intf:	Vlan11	:::	<pre>src_plcy_incomp:</pre>	0
vnid_hex:	0x208001	:::	ingress_policy:	0x1
<pre>vrf_intf_list:</pre>	Vlan28,Vlan16,V	/lan9,	Vlan11,loopback2,	
hw_vrf_idx:	4612	:::	nb_egr_outer_bd:	0
sb_egr_outer_bd:	0			
<pre>vrf_bd_list:</pre>	28,16,11,9,			
<pre>sb_egr_outer_bd:</pre>	0	:::	sdk_vrf_id:	5
[SDK Info]:				
vrf_name:	jr:sb			
vrf_id:	5	:::	hw_vrf_idx:	4612
vrf_vnid:	2129921	:::	is_infra:	0
tornbinfrahwbd:	0	:::	torsbinfrahwbd:	0
ingressBdAclLabel:	0	:::	ingBdAclLblMask:	0
egressBdAclLabel:	0	:::	egrBdAclLblMask:	0
sg_label:	5	:::	sclass:	16386
<pre>sp_incomplete:</pre>	1	:::	sclassprio:	3
[SDB INFO]:				
v4 table				
vrf type:	1			
vrf id:	5			

TTTO F	÷.a.,	
VLL	Ta:	

vnid: 2129921 internal infra vlan: 0 external router mac:00:22:bd:f8:19:ff v6 table vrf type: 1 1 5 vrf id: vnid: 2129921 0 internal infra vlan: external router mac:00:22:bd:f8:19:ff :::: 在檢測到鄰接關係後,HAL應該對路由進行程式設計。 我們可以使用以下命令檢查這一點: module-1# show platform internal hal 13 routes | head _____ LEGEND: _____ _____ LID: Logical ID RID: Route ID PID: Physical ID NB-ID:Next-Base ID TBI: Trie Base Index HIT IDX: Next-Hop HitIndex CLP : Class Priority SC:Sup-CopySSR:Src Sup-RedirectDSR:Dst Sup-RedirectTDD:TTL DisableNB:NextBaseTypeSDC:Src Direct ConnectTRO:Trie Offget' DPI: Dst Policy Inc DR : Default Route LE :Learn Enable SPI: Src Policy Inc [E:Ecmp/A:Adj] RT : Route Type ILL : Is Link Local ISS: Is Shared Services FWD: Forwarding HR : Host Routes EP :Ext Prefixes DLR: Default Lpm Route CLSS: Class Id RDEL: Route in Deletion BNE: Bind Notify Enable SNE: Sclass Notify Enable BE : Bounce Enable IDL : Ivxlan SA : Src Only DoNotLearn DL : Dest Local AI : Age Interval SF : Static Flag SH : Src Hit DH: Dest Hit module-1# show platform internal hal 13 routes _____ LEGEND: _____ _____ LID: Logical ID PID: Physical ID NB-ID:Next-Base ID RID: Route ID HIT IDX: Next-Hop HitIndexCLP: Class PriorityTBI: Trie Base Index|SC: Sup-CopySSR: Src Sup-RedirectDSR: Dst Sup-Redirect TDD :TTL Disable NB: NextBaseType SDC : Src Direct Connect TRO: Trie Offset DPI: Dst Policy Inc DR : Default Route LE :Learn Enable SPI: Src Policy Inc ILL : Is Link Local [E:Ecmp/A:Adj] ISS: Is Shared Services RT : Route Type FWD: Forwarding HR : Host Routes EP :Ext Prefixes DLR: Default Lpm Route CLSS: Class Id RDEL: Route in Deletion BNE: Bind Notify Enable SNE: Sclass Notify Enable BE : Bounce Enable IDL : Ivxlan DoNotLearn DL : Dest Local SA : Src Only AI : Age Interval SF : Static Flag SH : Src Hit DH: Dest Hit _____ _____ | LID |<------ Trie ----->|<Dleft Trie>| VRF | RT| RID | LID | Type| PID | FPID/| HIT Prefix/Len N NB-ID | NB Hw | PID | FPID/| TBI |TRO|Ifindex|CLSS|CLP| AI |SH|DH| Flags | |-----|-----|----| TID | IDX

						-	-	_		<		
- DLEFT	>				-							
 N NB-ID	NB Hw	1 1	I	I						PID	FPID/	/ HIT
	1	1 1	I	I				'	1 1		TID	IDX
В	Idx									Ι.		
 - TCAM	>		I	I.						<		
			I	1					1 1	PID	TCAM	HIT
N NB-ID	NB Hw									I		
 B 	Idx							 				104
Sandbox_ID	. 0 Asic	Bitmap: ()x0									
 module-1# s	how platfo	rm interr	nal hal 1	 3 routes	 egre	p 100.	100.100	.100				
4612		000 -1 100	100.100	.100.100/	32 U	C e	4	4a04	TRIE	10	5/ ()
5010 A 山山台山田/日	7567 +	802e 186 十 m/o + F 民家	ba 1/2 次=□ /	1 610日;r:::::	0 0 6.VDC	6/1 h.u.	0 ±	3 * 1 71	0 0 543543:	0 sp 	ı,dpı ν 1⊢ /	眼边店
此割 古 定け 田 エ C A M 由	ᇼᅣᅳᇖᆄ᠄ ᄵᄃᄢᄆ璛ᄤ	出び化阏	頁武。 4 「監惑下」	012定jf:S _ 主 .		แกมพ ⁻	_vrr_iax。	。忝」	쬈起	下一別	3, 我们	〕形仗
HICANT	DY IND 收售	豆IUX」 次	いっている。	-衣.								
nodule-1# s	how platfo	rm interr	nal hal l	3 nexthop	s							
Non-Sandbox	Mode			-								
LEGEND:												
NHOP ID	: Nhop	Identifie	er (Hex)		CON	S	: 1	H/W S/W	inf	o Cons	istency	Y
YPE	: Nexth	op Type			ACT:	N	: 1	Nexthop	Act	ion	()	
/rf .2 INTE	: L3 Vr	f of the terface i	Nhop Index (He	Y)	L3 BDT	INTF D Or B	WURF ·	L3 inte Bridge	rface Doma	e inde in Id	x (Hex)) rite
/rfid (Hex)	• 12 11		index (ne	A)	DDI	D OI I		Dridge	Doma	111 10	OI ICCWI	LICC
INFR	: ACI I	nfra vali	ld		PVR	F	:	Preserv	e VRI	F		
LRN	: Learn	Enabled			VRF	R	:	VRF Rew	rite	1		
PID TLID	: Physic : Tile	cal ID Id withir	ı FP		FPI. HIT	D IDX	:	FP OI t Locatio	nis i n of	this	p Nhop (I	Hex)
												,
Mac Entry:	m					T b	F	1		(
LY P RN	: Type • Learn Ti	nfo		TN.I.F.	:	Desti	nation	lated I Local	nio	(Hex)		
MLD	: Unused			VNB	:	Vnid	use BD	locar				
OFL	: Default	Entry		VLD	:	МасКе	y Valid					
FT	: FID Typ	е		FV	:	FID V	alid					
FID	: FID val	ue (Hex)		Mac	:	L2 MA	C Addre	SS				
LZ LIADRIC	INIO: • Source (Class			CLP		• 50	urce Cl	255	Priori	tv	
EPG	: EndPoin	t Group			BNE		: Bi	nd Noti	fica	tion E	nabled	
SNE	: Source .	Address N	Jotificat	ion Enabl	ed CNE		: So	urce cl	ass I	Notifi	cation	
Enabled												
DL	: iVxlan	DL			SPI		: So	urce Po	licy	Incom	plete	
JPI IP Address	: Dest Po. • IP addr	licy Inco	omplete									
11001 CDD	. II adul	~~~										
Sandbox_ID:	0 Asic B	itmap: 0>	c0									
Summary inf	o for 31 L	3 Nexthor	o objects -		7 7		m '				3.6	Der bi
C	'I' A _	T.7 Tfal	B Baric Info	 ТР	V		т -				Mac	Entry-
NHOP O	Y C	L3	L2	Or NV	L R		L НІТ Т		L	MVD	V	
Мас Кеу	·	С	ВSС	S D								
ID N	РТ	INTF	INTF R	wVRF F R	R F	FP	I IDX Y	INTF	R D	L N F	L F F	FID
L	NNND	P P										

module-1# show platform internal hal 13 nexthops | grep 802e 7567 N I F 5 901001c 1600004 1c 0 0 0 0 2e 9 0 802e 0 22 0 0 0 0 0 1 1 1 1214 8c:60:4f:02:88:fc 0 0 2c0d 0 0 0 0 0 10.10.27.3 這裡,我們選擇「NB硬體IDX」並將其對映到「HIT IDX」。這將向我們顯示與下一跳MAC/IP對應

的條目。這相當於檢視第1代ACI枝葉交換機上Broadcom中的「I3 defip show」和「I3 egress show」。

我們可以看到,該表包含正確的資訊:

L2 INTF:0x16000004 —> Port-channel 5的ifIndex

命中IDX: Hal I3路由中Nb硬體IDX驅動的索引

MAC:8c:60:4f:02:88:fc ---> 5K上下一跳SVI的MAC

EPG: L3 EPG的SCLASS

IP 位址:10.10.27.3 ---> 5K上SVI的下一跳IP

伊拉姆語

1 EP —>遠端EP或SVI — 主幹驗證

拓撲



邏輯

在本示例中,我們將跟蹤從EP1發往遠端BD交換虛擬介面(SVI)的資料包流。本示例的目的是驗證主 幹轉發,以確保將該資料包傳送到正確的枝葉。 讓我們假設封包已傳送到輸入枝葉上的主幹代理。

在骨幹上,我們首先驗證目的地IP的Council of Oracles Protocol(COOP),因為封包已傳送到骨幹 代理進行查詢:

calo1-spine1# show coop internal info ip-db | grep -A 10 192.168.20.1
IP address : 192.168.20.1
Vrf : 2129921
Flags : 0
EP vrf vnid : 2129921
EP IP : 192.168.20.1
Publisher Id : 10.0.224.88
Record timestamp : 11 04 2016 16:41:16 422062712
Publish timestamp : 11 04 2016 16:41:16 424633605
Seq No: 0
Remote publish timestamp: 01 01 1970 00:00:00 0
URIB Tunnel Info
Num tunnels : 1
Tunnel address : 10.0.224.88 <---- REMOTE LEAF</pre>

Tunnel ref count : 1 讓我們驗證哪個枝葉具有該TEP地址:

 spine1# acidiag fnvread | grep 10.0.224.88

 105
 1
 calo1-leaf5
 FD020160TPS
 10.0.224.88/32
 leaf

 active
 0

由於我們知道資料包進入模組2上的骨幹(埠6),因此我們可以連線到模組2並檢視埠佈局。

spine1# vsh Cisco iNX-OS Debug Shell This shell should only be used for internal commands and exists for legacy reasons. User should use ibash infrastructure as this will be deprecated. calo1-spine1# attach module 2 Attaching to module 2 ... To exit type 'exit', to abort type '\$.' No directory, logging in with HOME=/ Bad terminal type: "xterm-256color". Will assume vt100. Cisco iNX-OS Debug Shell This shell should only be used for internal commands and exists for legacy reasons. User should use ibash infrastructure as this will be deprecated. Loading parse tree (LC). Please be patient... module-2#

module-2# show platform internal hal 12 port gpd

Legend: _____ IfId: Interface Id IfName: Interface Name Is PC Mbr IfId: Interface Id I P: Uc PC Cfg: UcPcCfg Idx Uc PC MbrId: Uc Pc Mbr Id Asic Asic Port AP: As: Sl: Slice Sp: Slice Port Ss: Slice SrcId Ovec: Ovector (slice | srcid) Reprogram: L S: Local Slot L3: Is L3 P: PifTable Xla Idx: Xlate Idx RP: Rw PifTable Ovx Idx: OXlate Idx IP: If Profile Table N L3: Num. of L3 Ifs Rw SrcId Table NI L3: Num. of Infra L3 Ifs RS: DPort Table DP: Vif Tid: Vif Tid RwVif Tid SP: SrcPortState Table RwV Tid: RSP: RwSrcPortstate Table Ing Lbl: Ingress Acl Label UC: UCPcCfg Egr Lbl: Egress Acl Label UM: UCPcMbr Reprogram: PROF ID: Lport Profile Id VS: VifStateTable HI: LportProfile Hw Install RV: Rw VifTable Num. of Sandboxes: 1 Sandbox_ID: 0, BMP: 0x0 Port Count: 7 _____ _____ UC UC Reprogram Rep I PC Pc L | RIRD R UUX | L Xla Ovx N

NI Vif	-	RwV		Ing	I	Egr		VI	R	PI	ROF	Η																			
IfId		Ifnar	ne		Ρ	Cfg	J	Mbr	ID	As	AP	Sl	Sp	Ss	Ovec	S	Ρ	Ρ	Ρ	S	Ρ	Sp	Sp	С	Μ	L	3	B Id	x Idx	L3	
L3 Tic	1	Tid		Lbl	1	_bl		S V	V	I1	C	I																			
	===			====:	==:	====			===	===:	====		===:	===:						==	==			===		===:	===		=====	===:	==
====== 1f5	:==:	spInE	==== 3ndl	====: Mgmt	=== 0	==== 9de	=== 2	===== 1a	===	===: 0	==== 0	==== 0	=== 0	0	0	0	0	0	0	0	0	0	0	0	0	0	() ()	0	0	0
D-2d4	D	-3e1	0	0			0	0	1		0																				
1a0800	000	Eth2/	1/1		0	9a		1c		0	11	0	10	20	20	1	0	0	0	0	0	0	0	0	0	0	-	b	b	1	1
D-f3	D	-61	100	0 C			0	0	1		0																				
1a0810	000	Eth2,	2		0	9b		22		0	d	0	С	18	18	1	0	0	0	0	0	0	0	0	0	0	-	С	С	1	1
D-1ee	D	-30b	100	0 C			0	0	1		0																				
1a0840	000	Eth2/	/5		0	9e		1e		0	3d	1	14	28	a8	1	0	0	0	0	0	0	0	0	0	0	-	. 1	1	1	1
D-19a	D	-2ee	100	0 C			0	0	1		0																				
1a0850	000	Eth2/	6		0	9f		24		0	39	1	10	20	a0	1	0	0	0	0	0	0	0	0	0	0	-	e	е	1	1
D-87	D	-184	100	0 C			0	0	1		0																				
1a0860	000	Eth2/	7		0	a0		26		0	35	1	С	18	98	1	0	0	0	0	0	0	0	0	0	0	-	. d	d	1	1
D-1d0	D	-357	100	0 C			0	0	1		0																				
1a0880	000	Eth2/	/9		0	a2		20		1	d	0	С	18	18	1	0	0	0	0	0	0	0	0	0	0	(0 (0	0	0
D-3ea	D	-1a9	100	0 C			0	0	1		0																				

Ethernet 2/6是連線到枝葉6的介面位於ASIC 0 SLICE 1上

現在我們知道哪個ASIC運行我們的ELAM。 ASIC 0.

Asic 0 Slice 0 Status Triggered <---- Packet triggered from FM Asic 0 Slice 1 Status Triggered <---- Packet triggered from Front Panel 通過ELAM可以找到向量索引:

Front Panel ELAM drove sug_elam_out_sidebnd_no_spare_vec.ovector_idx: 0xB8 現在,如何將0xb8對映到埠?由於我們知道資料包應該傳送到交換矩陣模組(FM)進行查詢,因此我 們可以檢視內部埠對映以查詢目的FM:

module-2# show platform internal hal 12 internal-port pi Num. of Sandboxes: 1 Legend: _____ IfId: Interface Id IfName: Interface Name As: Asic AP: Asic Port Sl: Slice SP: Slice Port Slice SrcId Ovec: Ovector Ss: Lb Mbrid: LB MbrId UcPcCfgId: Uc Pc CfgId

Sandbox_ID: 0, BMP: 0x0
Internal Port Count: 32

========		====	====	====	====	====	=====	======	
								UcPc	Lb
IfId	IfName	As	AP	Sl	SP	Ss	Ovec	CfgId	MbrId
=========									
7d	-	0	21	0	20	38	38	0	4
7e	-	0	29	1	0	0	80	0	8
7£	-	1	21	0	20	38	38	0	С
80	-	1	29	1	0	0	80	0	10
81	-	2	21	0	20	38	38	0	14
82	-	2	29	1	0	0	80	0	18
83	-	3	21	0	20	38	38	0	1c
84	-	3	29	1	0	0	80	0	20
95	-	0	19	0	18	30	30	0	3
96	-	0 4	19 1	12	20 3	38 1	o8 (07	
97	-	1	19	0	18	30	30	0	b
98	-	1	49	1	20	38	b8	0	f
99	-	2	19	0	18	30	30	0	13
9a	-	2	49	1	20	38	b8	0	17
9b	-	3	19	0	18	30	30	0	1b
9c	-	3	49	1	20	38	b8	0	1f
ad	-	0	25	0	24	40	40	0	1
ae	-	0	41	1	18	30	b0	0	6
af	-	1	25	0	24	40	40	0	9
b0	-	1	41	1	18	30	b0	0	е
b1	-	2	25	0	24	40	40	0	11
b2	-	2	41	1	18	30	b0	0	16
b3	-	3	25	0	24	40	40	0	19
b4	-	3	41	1	18	30	b0	0	1e
dd	-	0	15	0	14	28	28	0	2
de	-	0	4d	1	24	40	с0	0	5
df	-	1	15	0	14	28	28	0	a
e0	-	1	4d	1	24	40	с0	0	d
e1	-	2	15	0	14	28	28	0	12
e2	-	2	4d	1	24	40	с0	0	15
e3	-	3	15	0	14	28	28	0	1a
e4	-	3	4d	1	24	40	с0	0	1d
			_	~ · · ·	``	/			

使用ASIC0/Ovc B8時,我們得到Mbrld 0x7,Slice並不重要。

此MbrId是USD上對映到FM上的介面的介面。 請記住,此MbrId以十六進位制表示,必須轉換為十 進位制。

通過檢視USD介面並檢查埠7,我們可以找到哪個FM:

module-2# show platform internal usd port info | grep -A 3 "Int 7"(if the interface has multiple digits, will be "Int##" with no space)

Port 73.0 (Int 7) : Admin UP Link UP Remote slot22.asic0

slice:1 slice port:32 lcl srcid:56 gbl srcid:184
asic mrl:0xd07c010, mac mrl:0x12c84010, mac:16, chan:0
speed 106G serdes: 0x328 0x329 0x32a 0x32b

「slot」以0為基礎,而FM編號以1為基礎,因此我們需要將1新增到此處列出的數字中。 這意味著 資料包應傳送到FM 23。

合成IP

與Alpine一樣,有一個合成IP用作外部IP地址,用於確定COOP查詢的雜湊。 若要尋找此內容,您 需要對內部DST IP運行此命令和grep: module-2(DBG-TAH-elam-insel7)# show forwarding route synthetic vrf all | grep 192.168.20.1 SYNTH-88 1.203.211.185/32 0x208001 192.168.20.1 這表明1.203.211.185是我們的合成IP。基於此,我們還可以將FM鏈路上的「外部DST IP」設定為此。我們應該在FM上觸發:

光纖模組ELAM

module-23(DBG-TAH-elam-insel7)# trigger reset module-23(DBG-TAH-elam)# trigger init in-select 13 out-select 0 module-23(DBG-TAH-elam-insel13)# set outer ipv4 dst_ip 1.203.211.185 <---- DST IP IS THE SYNTHETIC IP module-23(DBG-TAH-elam-insel13)# set inner ipv4 src_ip 10.100.17.11 dst_ip 192.168.20.1 module-23(DBG-TAH-elam-insel13)# start stat module-23(DBG-TAH-elam-insel13)# stat ELAM STATUS _____ Asic 0 Slice 0 Status Armed Asic 0 Slice 1 Status Armed Asic 0 Slice 2 Status Armed Asic 0 Slice 3 Status Armed Asic 0 Slice 4 Status Armed Asic 0 Slice 5 Status Armed module-23(DBG-TAH-elam-insel13)# stat ELAM STATUS ============ Asic 0 Slice 0 Status Armed Asic 0 Slice 1 Status Armed Asic 0 Slice 2 Status Triggered <---- Triggered on SLICE 2 Asic 0 Slice 3 Status Armed Asic 0 Slice 4 Status Armed Asic 0 Slice 5 Status Armed 顯然,請轉儲完整的報告,但讓我們看一下我們觸發的此資料包的ovector_idx:

lac_elam_out_sidebnd_no_spare_vec.ovector_idx:0x20 <以下-----令中使用的向量索引

我們如何確定哪個介面具有此向量? 在FM上運行以下命令:

**錯誤<u>CSCvf42796</u> ,附加所有FM命令,並加上「|不更多」。 否則,某些表條目可能不會顯示在 最終輸出中。

module-23(DBG-TAH-elam-insel13)# s	how platform	internal had	l 12 port gpd	no-more
Legend:					
IfId:	Interface Id			IfName:	Interface Name
I P:	Is PC Mbr			IfId:	Interface Id
Uc PC Cfg:	UcPcCfg Idx			Uc PC MbrId:	Uc Pc Mbr Id
As:	Asic			AP:	Asic Port
Sl:	Slice			Sp:	Slice Port
Ss:	Slice SrcId			Ovec:	Ovector (slice
srcid)					
L S:	Local Slot			Reprogram:	
L3:	Is L3				
P:	PifTable			Xla Idx:	Xlate Idx
RP:	Rw PifTable			Ovx Idx:	OXlate Idx

If Profile Table TP: N L3: Num. of L3 Ifs RS: Rw SrcId Table Num. of Infra L3 Ifs NI L3: DP: DPort Table Vif Tid: Vif Tid SP: SrcPortState Table RwV Tid: RwVif Tid RSP: RwSrcPortstate Table Ing Lbl: Ingress Acl Label UC: UCPcCfg Egr Lbl: Egress Acl Label UM: UCPcMbr Reprogram: PROF ID: Lport Profile Id VS: VifStateTable LportProfile Hw HT: Install RV: Rw VifTable Num. of Sandboxes: 1 Sandbox_ID: 1, BMP: 0x1 Port Count: 8 _____ _____ UC UC Reprogram | Rep | I PC Pc L | RIRD R UUX | L Xla Ovx N NI Vif RwV Ing Egr | V R | PROF H IfId Ifname P Cfg MbrID As AP Sl Sp Ss Ovec S | P P P S P Sp Sp C M L | 3 Idx Idx L3 L3 Tid Tid Lbl | S V | ID I _____ -----fc0-lc1:0-0 1 0 3 ae 0 fc0-lc1:0-1 1 0 4 0 3d 2 c 18 98 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 af 0 0 0 0 0 0 fc0-lc1:1-0 1 0 13 0 d 0 c 18 18 0 0 0 0 0 0 0 0 0 0 0 0 0 0 b01 0 0 0 0 0 0 _ fc0-lc1:1-1 1 0 14 0 39 2 8 10 90 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 b1 0 0 0 0 0 0 fc0-lc1:2-0 1 0 23 0 5d 3 14 28 e8 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 b2 0 0 0 0 _ 0 0 fc0-lc1:2-1 1 0 24 0 21 1 8 10 50 1 0 0 0 0 0 0 0 0 0 0 0 b3 0 0 0 0 0 0 0 _ 0 0 fc0-lc1:3-0 1 0 33 0 51 3 8 10 d0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 h4 0 0 0 0 0 0 該向量對映到ASIC 0/SLICE 0上的LC1(插槽2中的線卡,因為它基於0)。我們從最初在LC上運行 的ELAM中得知,我們在此片上觸發: module-2# debug platform internal tah elam asic 0 module-2(DBG-TAH-elam)# trigger reset module-2(DBG-TAH-elam) # trigger init in-select 13 out-select 0 module-2(DBG-TAH-elam-insel13) # set inner ipv4 src_ip 10.100.17.11 dst_ip 192.168.20.1 module-2(DBG-TAH-elam-insel13)# start stat module-2(DBG-TAH-elam-insel13)# stat

ELAM STATUS

Asic 0 Slice 0 Status Armed

Asic 0 Slice 1 Status Armed

module-2(DBG-TAH-elam-insel13)# stat
ELAM STATUS
=========

Asic 0 Slice 0 Status Triggered <---- Packet triggered from FM

Asic 0 Slice 1 Status Triggered <---- Packet triggered from Front Panel

此ELAM上的向量是sug_elam_out_sidebnd_no_spare_vec.ovector_idx:0x98(我們通過「hal I2埠

														==																		
=======	=====		===	===	====			===	===	===:	===	==																				
					Uc		Uc													Re	epr	rogi	ram									
Rep																																
				Ι	PC		Pc								L			R	Ι	R	D		R	U	U	Х		L	Xla	0vx	Ν	
NI Vif	RwV	I	ng	H	Egr		VI	R	PI	ROF	Η																					
IfId	Ifnar	ne		Ρ	Cfq	J	Mbr]	ID	As	AP	Sl	. Sp	Ss	Ovec	S		Ρ	Ρ	Ρ	S	Ρ	Sp	Sp	С	М	L		3	Idx	Idx	L3	
L3 Tid	Tid	L	b1	Ι	ld		S V	J	II	D	Ι																					
=======	=====		===	===	====			===	===	===:	===	====		=====	===	==	==	===	===			===	====		===		-==	:==	====		===	==
=========	=====		===	===		==		===	===	===:	===	===																				
1f5	SpInH	BndMg	mt	0	9de	9	1a		0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
D-2d4 D	-3e1	0	0			0	0	1		0																						
1a080000	Eth2,	/1		0	9a		1c		0	11	0	10	20	20	1		0	0	0	0	0	0	0	0	0	0		1	b	b	1	1
D-f3 D	-61	100	0			0	0	1		0																						
1a081000	Eth2,	/2		0	9b		22		0	d	0	С	18	18	1		0	0	0	0	0	0	0	0	0	0		1	С	С	1	1
D-lee D	-30b	100	0			0	0	1		0																						
1a084000	Eth2,	/5		0	9e		1e		0	3d	1	14	28	a8	1		0	0	0	0	0	0	0	0	0	0		1	1	1	1	1
D-19a D	-2ee	100	0			0	0	1		0																						
1a085000	Eth2,	/6		0	9f		24		0	39	1	10	20	a0	1		0	0	0	0	0	0	0	0	0	0		1	е	е	1	1
D-87 D	-184	100	0			0	0	1		0																						
1a086000	Eth2,	/7		0	a0		26	(3!	51	С	18 9	98	1	0	0	0	0	0	0	C) (0 C	0		1	d		d	1 1	L :	D-
1d0 D-3	57 10	0 00			0	0	1		0																							
1a088000	Eth2,	/9		0	a2		20		1	d	0	С	18	18	1		0	0	0	0	0	0	0	0	0	0		0	0	0	0	0
D-3ea D	-1a9	100	0			0	0	1		0																						
Ethernet	t 2/7長	≧連紡	到	肘	裝葉	5自	内介	面	0																							

額外方案:獲取不在「hal internal-port pi」輸出中的Ovector

拓撲



邏輯

在某些情況下,我們會在「**show platform internal hal2 internal-port pi」表中捕獲沒有Ovector的**資料包。 在下面的場景中,我們實際上捕獲的是從FM傳回的資料包,因此我們需要檢視不同的表格 ,以檢視資料包選擇的前面板埠。

請注意,上面的拓撲是學習傳輸流量的完全不同的環境(無代理路由)。 模組是N9K-X9732C-EX。

@module-1(DBG-elam-insel13)# report | grep ovector sug_elam_out_sidebnd_no_spare_vec.ovector_idx: 0xA0 <<<<<<<< onthe interval of the interv the "hal internal-port pi" command

@module-1# show platform internal hal 12 internal-port pi No sandboxes exist Num. of Sandboxes: 1 Legend: _____ IfId: Interface Id IfName: Interface Name Asic AP: Asic Port As: Slice Port Slice SP: Sl: Slice SrcId Ovec: Ovector Ss: Lb Mbrid: LB MbrId UcPcCfgId: Uc Pc CfgId

Sandbox_ID: 0, BMP: 0x0

Internal Port Count: 24

			===	==	===	===	===	=====		=====	===
								1	UcPc	Lb	
IfId	IfName	As	s A	Ρ	Sl	SP	Ss	Ovec	CfgId	Mbrl	Id
======				==	===		====		=====	=====	
7d	-	0	2	1	0	20	38	38	0	4	
7e	-	0	2	9	1	0	0	80	0	8	
7£	-	1	2	1	0	20	38	38	0	С	
80	-	1	2	9	1	0	0	80	0	10	
81	-	2	2	1	0	20	38	38	0	14	
82	-	2	2	9	1	0	0	80	0	18	
83	-	3	2	1	0	20	38	38	0	1c	
84	-	3	2	9	1	0	0	80	0	20	
ad	-	0	2	5	0	24	40	40	0	1	
ae	-	0	4	1	1	18	30	b0	0	6	
af	-	1	2	5	0	24	40	40	0	9	
b0	-	1	4	1	1	18	30	b0	0	е	
b1	-	2	2	5	0	24	40	40	0	11	
b2	-	2	4	1	1	18	30	b0	0	16	
b3	-	3	2	5	0	24	40	40	0	19	
b4	-	3	4	1	1	18	30	b0	0	1e	
dd	-	0	1	5	0	14	28	28	0	2	
de	-	0	4	d	1	24	40	с0	0	5	
df	-	1	1	5	0	14	28	28	0	a	
e0	-	1	4	d	1	24	40	с0	0	d	
e1	-	2	1	5	0	14	28	28	0	12	
e2	-	2	4	d	1	24	40	с0	0	15	
e3	-	3	1	5	0	14	28	28	0	1a	
e4	_	3	4	d	1	24	40	с0	0	1d	<<<<
entrv	that matches 0xA0										

@module-1# show platform internal hal 12 port gpd Legend: _____ <snip>

Sandbox_ID: 0, BMP: 0x0 Port Count: 6

_____ _____ | Reprogram UC UC Rep

L | RIRD R UUX | L Xla Ovx N NI

I PC Pc Vif RwV Ing Egr | V R | PROF H

IfIc	1	Ifname		P Cfg	Mbi	CID	As	AP	Sl	Sp	Ss	0vec	S	Ρ	Ρ	Ρ	S	Ρ	Sp	Sp	С	Μ	L	3	Idx	Idx	L3
L3 1	Fid 	Tid 	Lbl	Lbl 			II) 	I 																		
====					====																						
1f5		SpInBndl	Mgmt	0 9de	1a		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0 I	D-2d4	D-3e1	0	0	0	0	1		0																		
1a00	00000	Eth1/1		0 1b	1c		0	11	0	10	20	20	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1
1 I	D-13b	D-33b	500	0	1	0	3		0																		
1a01	lc000	Eth1/29		0 37	1e		3	3d	1	14	28	a8	1	0	0	0	0	0	0	0	0	0	0	1	8	8	1
1 I	D-3f2	D-7a	100	0	0	0	2		0																		
1a01	1d000	Eth1/30		0 38	20		3	39	1	10	20	a0	1	0	0	0	0	0	0	0	0	0	0	1	5	5	1
1 I	D-36e	D-362	100	0	0	0	2		0																		
1a01	le000	Eth1/31		0 39	22		3	35	1	С	18	98	1	0	0	0	0	0	0	0	0	0	0	1	9	9	1
1 I	0-273	D-8	100	0	0	0	2		0																		
1a01	1£000	Eth1/32		0 3a	24		3	31	1	8	10	90	1	0	0	0	0	0	0	0	0	0	0	1	a	a	1
1 I	D-154	D-5d	100	0	0	0	2		0																		

1/30是連線到枝葉102的phy介面,由拓撲、ASIC 3、片1驗證