排除ACI L3Out — 直连子网PcTag1故障

目录

简介

本文档介绍的场景是，来自直接连接的L3Out子网的流量在没有外部EPG下正确配置的情况下可能导致合同丢弃。

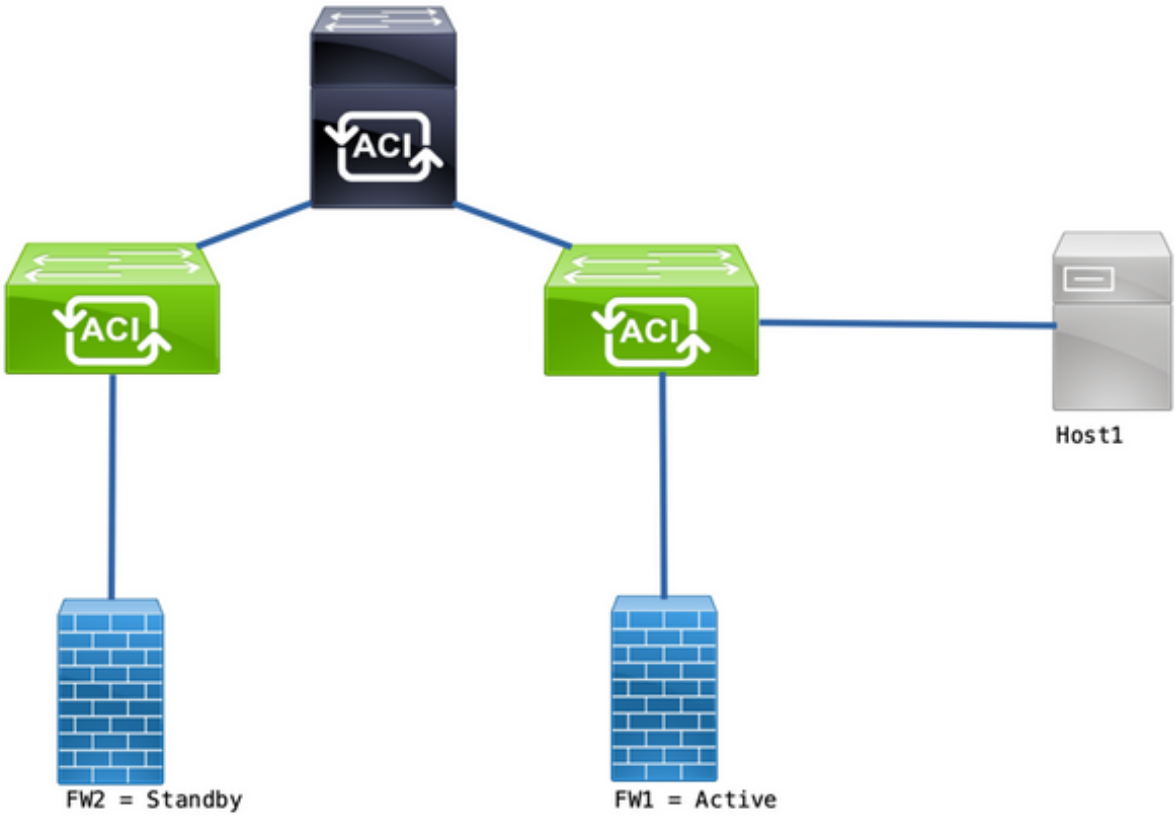
背景信息

ACI L3out白皮书中的“**0.0.0.0/0直连子网的例外”一节指出有关pcTag 1的以下行为：**

"...默认情况下，会为直接连接的子网分配pcTag 1，这是用于绕过合同的特殊pcTag。这是在拐角情况下隐式允许路由协议通信。但是……这会引发安全隐患。因此，可通过Cisco Bug ID CSCuz对此行为进行详细说明12913 ，还引入了应急配置："

场景

拓扑和配置



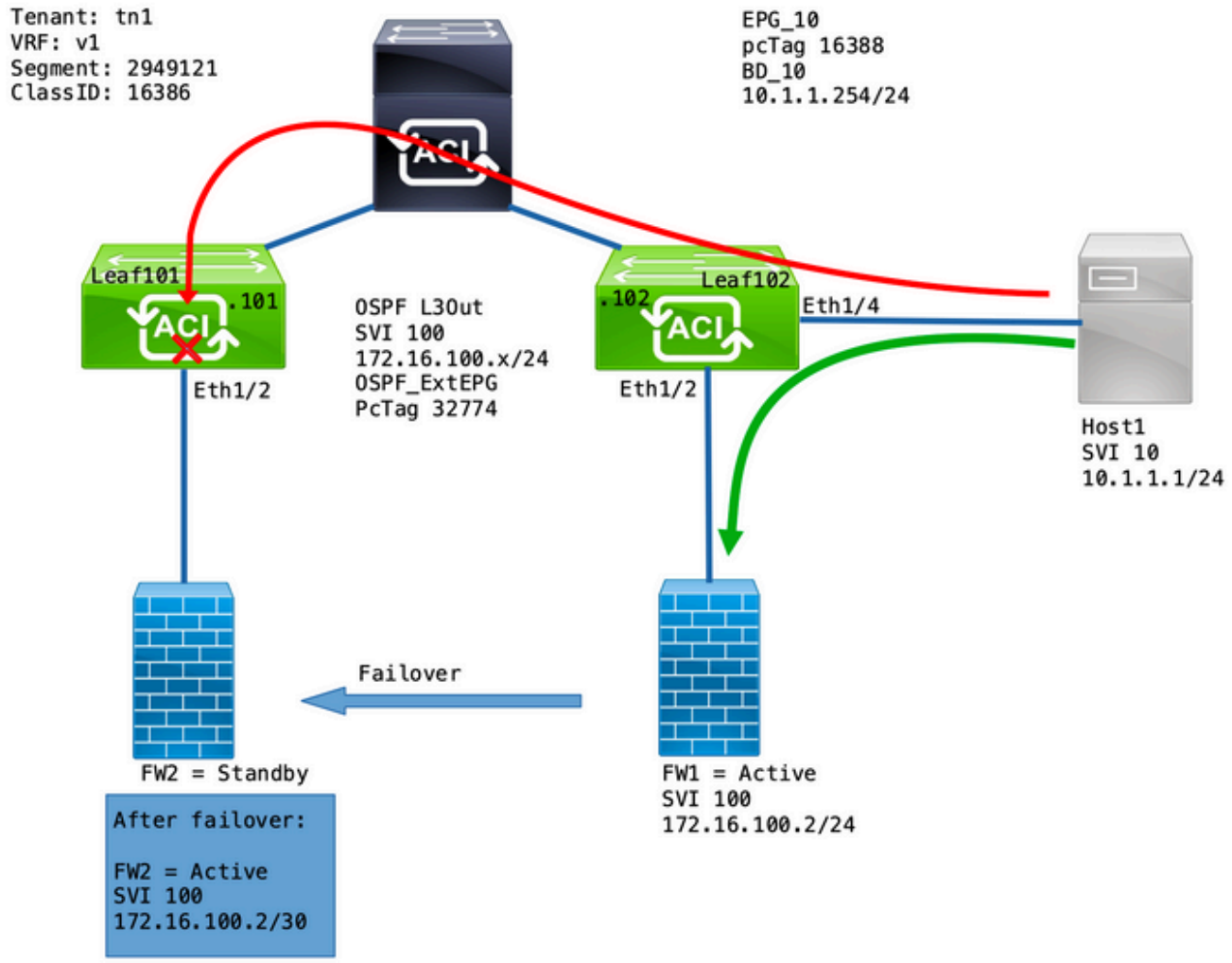
拓扑

- 防火墙(FW)配置了网络地址转换(NAT)。
- 发送到ACI交换矩阵的所有流量均来自与ACI形成OSPF邻接关系的FW的IP。
- 外部EPG有一个0.0.0.0/0网络，该网络配**置有外部EPG的外部子网**。
- 内部EPG和外部EPG之间已签订通信合同。

观察到的问题

使用FW1作为活动设备，流量可按预期工作。未观察到丢包。

在防火墙服务故障转移到FW2后，连接断开 — 10.1.1.1和172.16.100.2无法再通信。



问题深入探讨

Leaf101上的ELAM捕获允许我们验证从主机1到FW2的流量是否被丢弃。

使用以下ELAM选项：

```
leaf101# vsh_lc
module-1# debug platform internal roc elam asic 0
module-1(DBG-elam-insel6)# trigger reset
module-1(DBG-elam)# trigger init in-select 14 out-select 1
module-1(DBG-elam-insel14)# set inner ipv4 src_ip 10.1.1.1 dst_ip 172.16.100.2
module-1(DBG-elam-insel14)# start
module-1(DBG-elam-insel14)# status
```

在触发时，电子报告允许您查看查找结果：

```
<snip>
================================================================================================
================================================
Captured Packet
================================================================================================
================================================
<snip>
------------------------------------------------------------------------------------------------
```

```
-----------------------------------------------------
Inner L3 Header
-----------------------------------------------------------------------------------------------
-----------------------------------------------------
L3 Type : IPv4
DSCP : 0
Don't Fragment Bit : 0x0
TTL : 254
IP Protocol Number : ICMP
Destination IP                 : 172.16.100.2   <<<----
Source IP                      : 10.1.1.1   <<<----
<snip>
===============================================================================================
=====================================================
Contract Lookup ( FPC )
===============================================================================================
=====================================================

-----------------------------------------------------------------------------------------------
-----------------------------------------------------
Contract Lookup Key
-----------------------------------------------------------------------------------------------
-----------------------------------------------------
IP Protocol : ICMP( 0x1 )
L4 Src Port : 2048( 0x800 )
L4 Dst Port : 52579( 0xCD63 )
sclass (src pcTag)                      : 16388( 0x4004 )   <<<----
dclass (dst pcTag)                      : 16386( 0x4002 )   <<<----
<snip>

-----------------------------------------------------------------------------------------------
-----------------------------------------------------
Contract Result
-----------------------------------------------------------------------------------------------
-----------------------------------------------------
Contract Drop                           : yes   <<<----
Contract Logging : yes
Contract Applied : no
Contract Hit : yes
Contract Aclqos Stats Index : 81824
( show sys int aclqos zoning-rules | grep -B 9 "Idx: 81824" )
```

此报告显示流程为“已放弃合同”，同时显示以下详细信息：

- SCLASS为16388，即EPG_10的pcTag。
- DCLASS为16386，即VRF v1的pcTag。

接下来，验证VRF的分区规则：

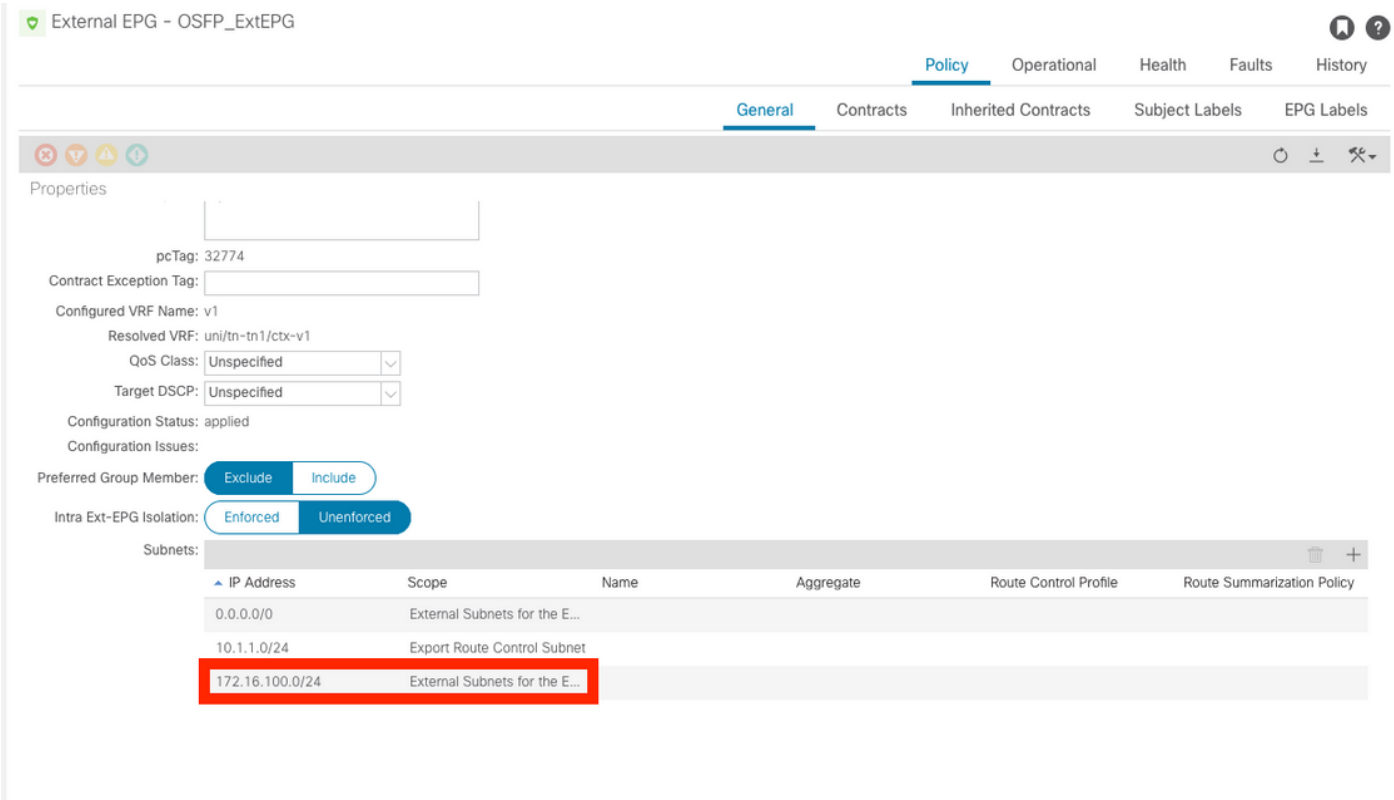
```
leaf102# show zoning-rule scope 2949121
+---------+--------+--------+----------+---------+---------+---------+-----------------+-------
---+----------------------+
| Rule ID | SrcEPG | DstEPG | FilterID |   Dir   |  operSt |  Scope  |       Name      |
Action  |       Priority       |
+---------+--------+--------+----------+---------+---------+---------+-----------------+-------
---+----------------------+
|   4131  |   0    |   15   | implicit | uni-dir | enabled | 2949121 |                 |
deny,log | any_vrf_any_deny(22) |
|   4130  |   0    |   0    | implarp  | uni-dir | enabled | 2949121 |                 |
permit  |  any_any_filter(17)  |
|   4129  |   0    |   0    | implicit | uni-dir | enabled | 2949121 |                 |
deny,log |   any_any_any(21)    |
|   4132  |   0    | 49155  | implicit | uni-dir | enabled | 2949121 |                 |
```

```
permit  |   any_dest_any(16)   |
|   4112  | 16386  | 16388  | default  | uni-dir | enabled | 2949121 | tn1:EPG-to-L3Out |
permit  |    src_dst_any(9)    |
|   4133  | 16388  |   15   | default  | uni-dir | enabled | 2949121 | tn1:EPG-to-L3Out |
permit  |    src_dst_any(9)    |
+---------+--------+--------+----------+---------+---------+---------+------------------+-------
---+----------------------+
```

存在从EPG_10(16388)到OSPF L3Out后的网络的通信合同(0.0.0.0/0 = 15)。 但是，来自172.16.100.2的流量在VRF v1的pcTag(16386)下标记。

解决方案

在OSPF Ext_EPG下添加L3Out的直连子网。



此添加有2个效果：

1. 来自直连子网的流量在OSPF_ExtEPG pcTag下标记(32774)
2. 添加规则以允许流入EPG_10和OSPF_ExtEPG和流出

```
leaf102# show zoning-rule scope 2949121
+---------+--------+--------+----------+----------------+---------+---------+-----------------
+----------+----------------------+ | Rule ID | SrcEPG | DstEPG | FilterID | Dir | operSt |
Scope | Name | Action | Priority | +---------+--------+--------+----------+----------------+----
-----+---------+-----------------+----------+----------------------+ | 4131 | 0 | 15 | implicit
| uni-dir | enabled | 2949121 | | deny,log | any_vrf_any_deny(22) | | 4130 | 0 | 0 | implarp |
uni-dir | enabled | 2949121 | | permit | any_any_filter(17) | | 4129 | 0 | 0 | implicit | uni-
dir | enabled | 2949121 | | deny,log | any_any_any(21) | | 4132 | 0 | 49155 | implicit | uni-dir
| enabled | 2949121 | | permit | any_dest_any(16) | | 4112 | 16386 | 16388 | default | uni-dir |
enabled | 2949121 | tn1:EPG-to-L3Out | permit | src_dst_any(9) | | 4133 | 16388 | 15 | default |
uni-dir | enabled | 2949121 | tn1:EPG-to-L3Out | permit | src_dst_any(9) | |   4134   | 16388  |
32774   | default  |     bi-dir      | enabled | 2949121 | tn1:EPG-to-L3Out |  permit  |
src_dst_any(9)     |  <<<----
|   4135   | 32774   | 16388   | default   | uni-dir-ignore | enabled | 2949121 | tn1:EPG-to-L3Out |
```

```
permit  |    src_dst_any(9)    |  <<<----
+---------+--------+--------+----------+---------------+---------+---------+-----------------
+----------+---------------------+
```

说明

当FW和主机连接到同一枝叶时（不添加L3Out子网），这样做的原因是直接连接的子网使用特殊的pcTag，即1，它会绕过所有合同。这是在拐角情况下隐式允许路由协议通信。

通过这些触发器，我们可以捕获从172.16.100.2到10.1.1.1的流量，而在枝叶102上：

```
leaf102# vsh_lc
module-1# debug platform internal roc elam asic 0
module-1(DBG-elam)# trigger reset
module-1(DBG-elam)# trigger init in-select 6 out-select 1
module-1(DBG-elam-insel6)# set outer ipv4 src_ip 172.16.100.2 dst_ip 10.1.1.1
module-1(DBG-elam-insel6)# start
module-1(DBG-elam-insel6)# status
 ELAM STATUS
===========
Asic 0 Slice 0 Status Triggered
```

此报告显示查找结果：

```
module-1(DBG-elam-insel6)# ereport
Python available. Continue ELAM decode with LC Pkg
 ELAM REPORT
================================================================================================================
========================================================
                                                                Captured Packet
================================================================================================================
========================================================

----------------------------------------------------------------------------------------------------------------
----------------------------------------------------
Outer L3 Header
----------------------------------------------------------------------------------------------------------------
----------------------------------------------------
L3 Type                       : IPv4
IP Version                    : 4
DSCP                          : 0
IP Packet Length              : 84 ( = IP header(28 bytes) + IP payload )
Don't Fragment Bit            : not set
TTL                           : 255
IP Protocol Number            : ICMP
IP CheckSum                   : 32320( 0x7E40 )
Destination IP                : 10.1.1.1      <<<----
Source IP                     : 172.16.100.2  <<<----

================================================================================================================
========================================================
                                                                  Contract Lookup ( FPC )
================================================================================================================
========================================================

----------------------------------------------------------------------------------------------------------------
```

```
-----------------------------------------------------
Contract Lookup Key
-------------------------------------------------------------------------------------------------
-----------------------------------------------------
IP Protocol                              : ICMP( 0x1 )
L4 Src Port                              : 0( 0x0 )
L4 Dst Port                              : 19821( 0x4D6D )
sclass (src pcTag)                       : 1( 0x1 )          <<<----
dclass (dst pcTag)                       : 16388( 0x4004 )   <<<----
src pcTag is from local table            : yes
derived from a local table on this node by the lookup of src IP or MAC
Unknown Unicast / Flood Packet           : no
If yes, Contract is not applied here because it is flooded

-------------------------------------------------------------------------------------------------
-----------------------------------------------------
Contract Result
-------------------------------------------------------------------------------------------------
-----------------------------------------------------
Contract Drop                            : no  <<<----
Contract Logging                         : no
Contract Applied                         : no  <<<----
Contract Hit                             : yes
Contract Aclqos Stats Index              : 81903
```

要验证退货流程，请执行以下操作：

```
module-1(DBG-elam-insel6)# trigger reset
module-1(DBG-elam)# trigger init in-select 6 out-select 1
module-1(DBG-elam-insel6)# set outer ipv4 src_ip 10.1.1.1 dst_ip 172.16.100.2
module-1(DBG-elam-insel6)# start
module-1(DBG-elam-insel6)# status
 ELAM STATUS
===========
Asic 0 Slice 0 Status Triggered
```

返回流的查找结果：

```
module-1(DBG-elam-insel6)# ereport
Python available. Continue ELAM decode with LC Pkg
 ELAM REPORT
=================================================================================================
=====================================================
                                                                    Captured Packet
=================================================================================================
=====================================================
-------------------------------------------------------------------------------------------------
-----------------------------------------------------
Outer L3 Header
-------------------------------------------------------------------------------------------------
-----------------------------------------------------
L3 Type                        : IPv4
IP Version                     : 4
DSCP                           : 0
IP Packet Length               : 84 ( = IP header(28 bytes) + IP payload )
Don't Fragment Bit             : not set
TTL                            : 255
IP Protocol Number             : ICMP
IP CheckSum                    : 32198( 0x7DC6 )
Destination IP                 : 172.16.100.2  <<<----
```

```
Source IP                     : 10.1.1.1      <<<----

================================================================================================================
================================================
                                                                        Contract Lookup ( FPC )
================================================================================================================
================================================

----------------------------------------------------------------------------------------------------------------
------------------------------------------------
Contract Lookup Key
----------------------------------------------------------------------------------------------------------------
------------------------------------------------
IP Protocol                           : ICMP( 0x1 )
L4 Src Port                           : 2048( 0x800 )
L4 Dst Port                           : 18134( 0x46D6 )
sclass (src pcTag)                    : 16388( 0x4004 ) <<<----
dclass (dst pcTag)                    : 1( 0x1 )        <<<----
src pcTag is from local table         : yes
derived from a local table on this node by the lookup of src IP or MAC
Unknown Unicast / Flood Packet        : no
If yes, Contract is not applied here because it is flooded

----------------------------------------------------------------------------------------------------------------
------------------------------------------------
Contract Result
----------------------------------------------------------------------------------------------------------------
------------------------------------------------
Contract Drop                         : no    <<<----
Contract Logging                      : no
Contract Applied                      : no    <<<----
Contract Hit                          : yes
Contract Aclqos Stats Index           : 81903
```

下表总结了第2代交换机的预期行为：

场景	方向性	合同丢弃	无合同丢弃
跨越同一枝叶 VRF策略实施：两者	X到L3Out		X
	L3Out到X		X
跨2个枝叶节点 VRF策略实施：入口	X到L3Out	X	
	L3Out到X		X
跨2个枝叶节点 VRF策略实施：出口	X到L3Out		X
	L3Out到X		X

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