使用ASAv配置和验证第2层服务图配置

目录

简介

本文档介绍如何在思科以应用为中心的基础设施(ACI)中配置和验证第2层服务图配置。

先决条件

要求

Cisco 建议您了解以下主题：

- 了解第3层服务图在ACI中如何工作
- 了解如何在ACI中配置终端策略组、桥接域和合同
- 了解如何将（自适应安全设备虚拟）ASAv配置为透明防火墙

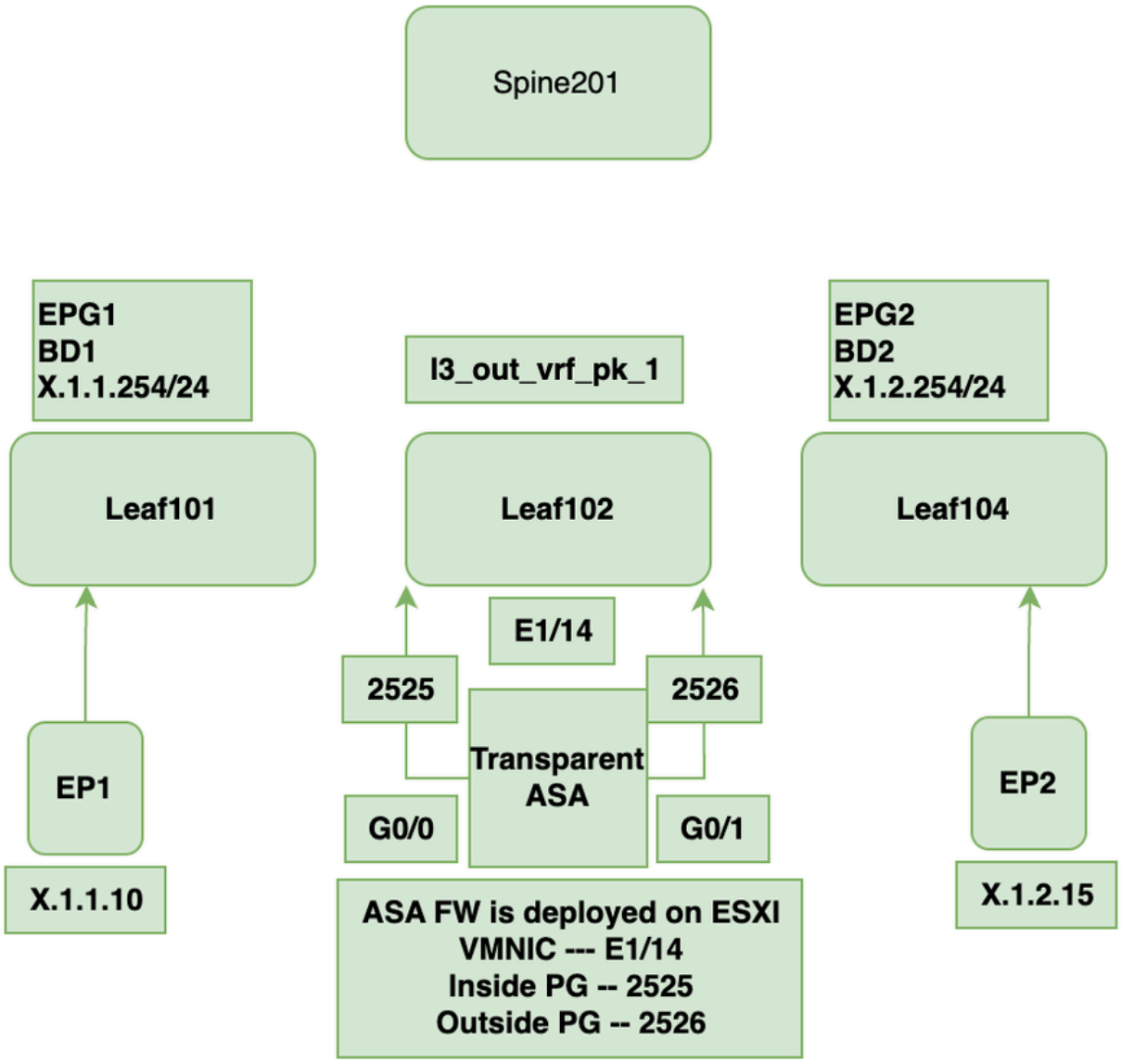
使用的组件

本文档中的信息基于以下软件和硬件版本：

- APIC版本:6.0(3g)
- 枝叶硬件：N9K-C93180YC-FX
- 枝叶软件：n9000-16.0(3g)
- 枝叶节点101、102、103
- 在ESXi服务器上部署的ASAv

本文档中的信息都是基于特定实验室环境中的设备编写的。本文档中使用的所有设备最初均采用原始（默认）配置。如果您的网络处于活动状态，请确保您了解所有命令的潜在影响。

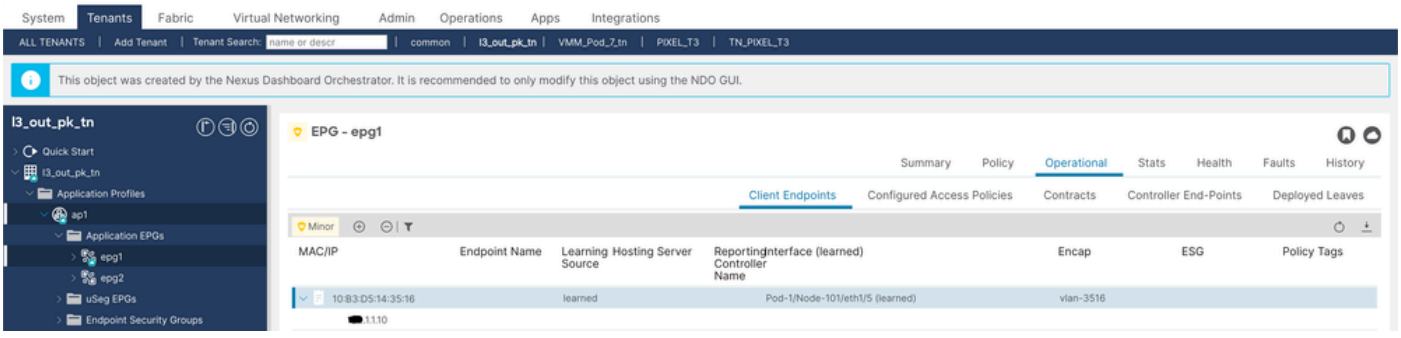
拓扑



拓扑

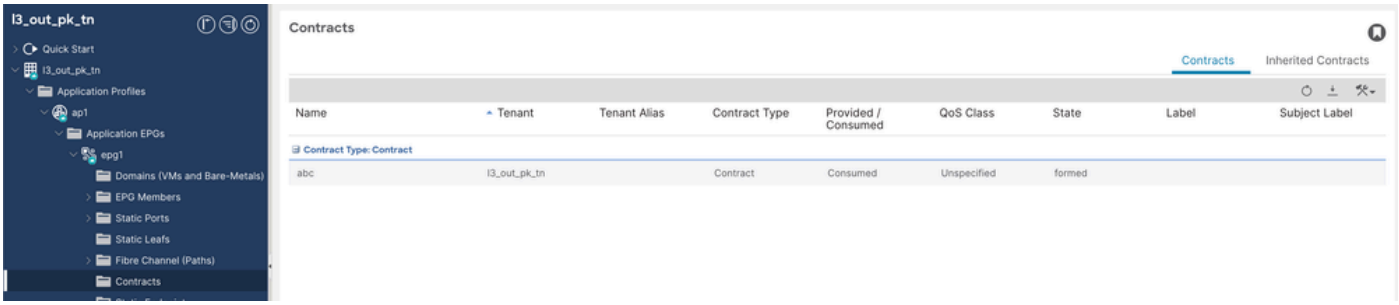
本文档中未显示EPG1和EPG2配置，必须在手前对其进行配置，且必须学习终端。

1.验证EPG1已获ş知的网络终端X.1.1.10（节点101）。



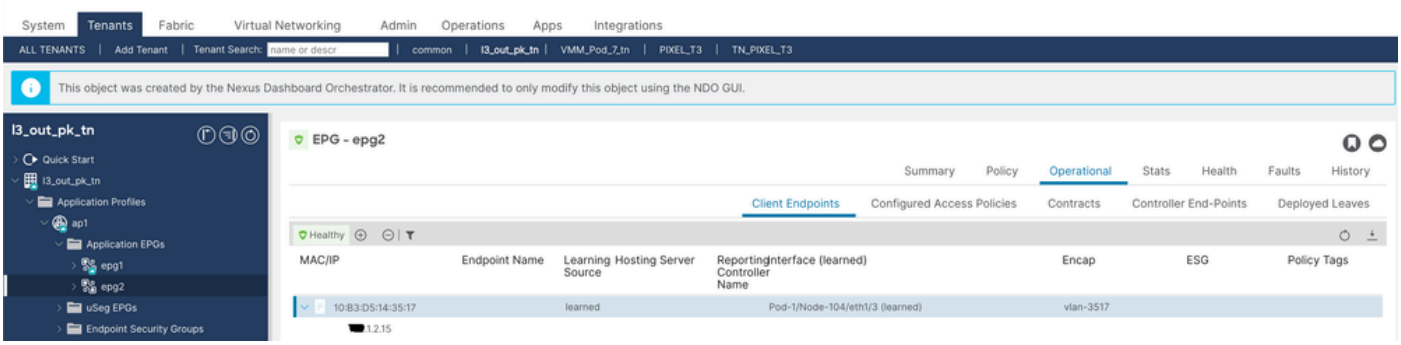
客户端终端

2.合同abc由EPG1使用。



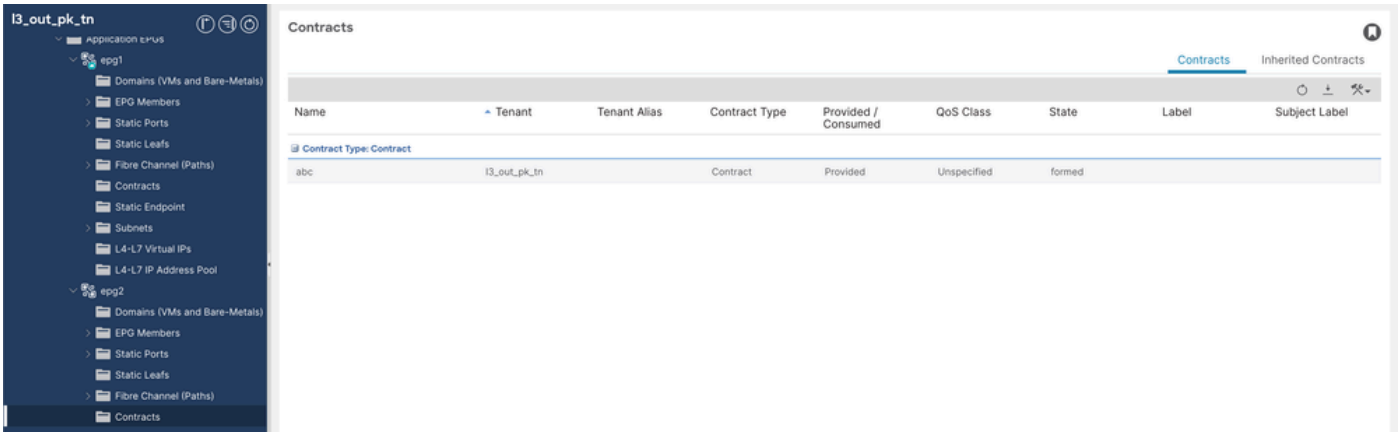
已使用合同

3.验证EPG2具有终端X.1.2.15已获取（节点104）。



客户端终端

4.合同abc由EPG2提供。



提供的合同

为什么ACI中需要L2服务图？

- 在思科ACI中，第4-7层服务设备可插入第3层(L3)、第2层(L2)或第1层(L1)。
- 第3层服务插入：外部设备(例如防火墙、入侵防御系统(IPS))根据IP地址制定路由决策并转发流量。

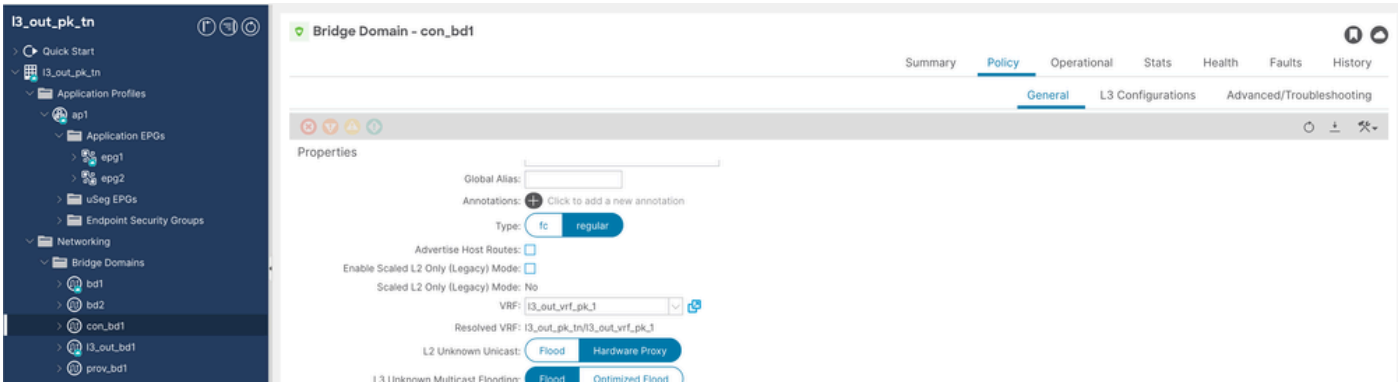
- 第2层服务插入：根据MAC地址转发流量，无需路由参与。这对于透明防火墙或IPS设备非常有用。
- 在ACI中插入L2服务设备（例如IPS或透明防火墙）时，使用基于策略的路由(PBR)。
- L3和L2 PBR的流量转发机制保持不变。
- 主要区别：
    - L3 PBR:流量被重定向到IP地址（设备参与路由）。
    - L2 PBR:流量被重定向到MAC地址（设备在第2层运行）。
- 在第2层PBR中，MAC地址被静态绑定到枝叶接口，以确保正确的流量转发。

有关主用/备用或主用/主用L1/L2 PBR使用案例的详细信息，请参阅PBR白皮书。

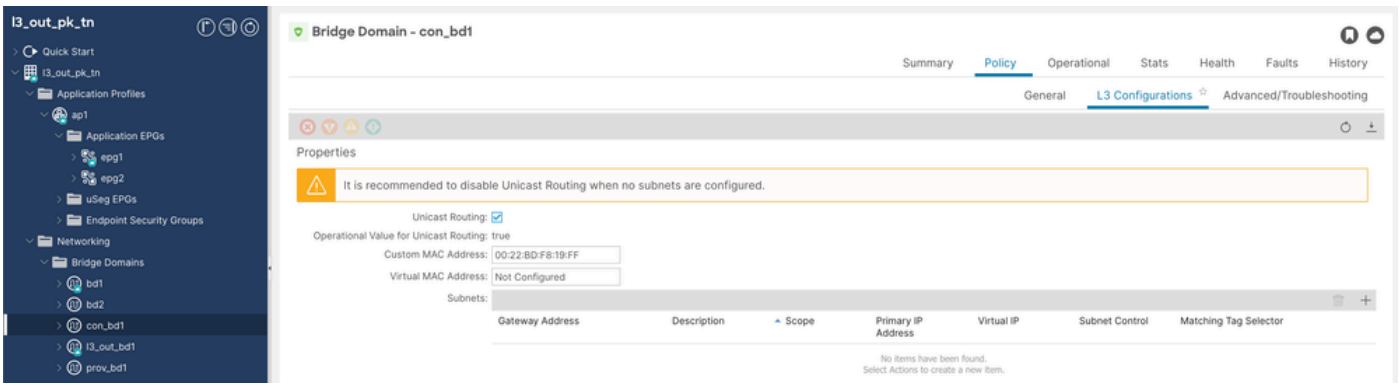
L2服务图的配置

步骤1.将使用者bd配置为con-bd1。

必须启用单播路由，L2未知单播必须设置为硬件代理，并且con和prov网桥域(BD)不需要子网。

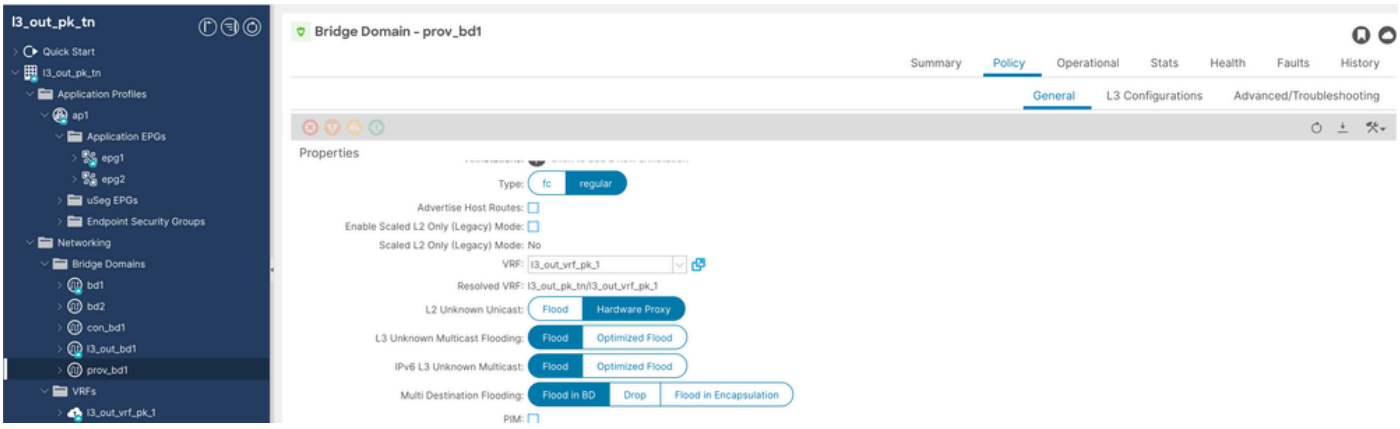


Cons BD配置

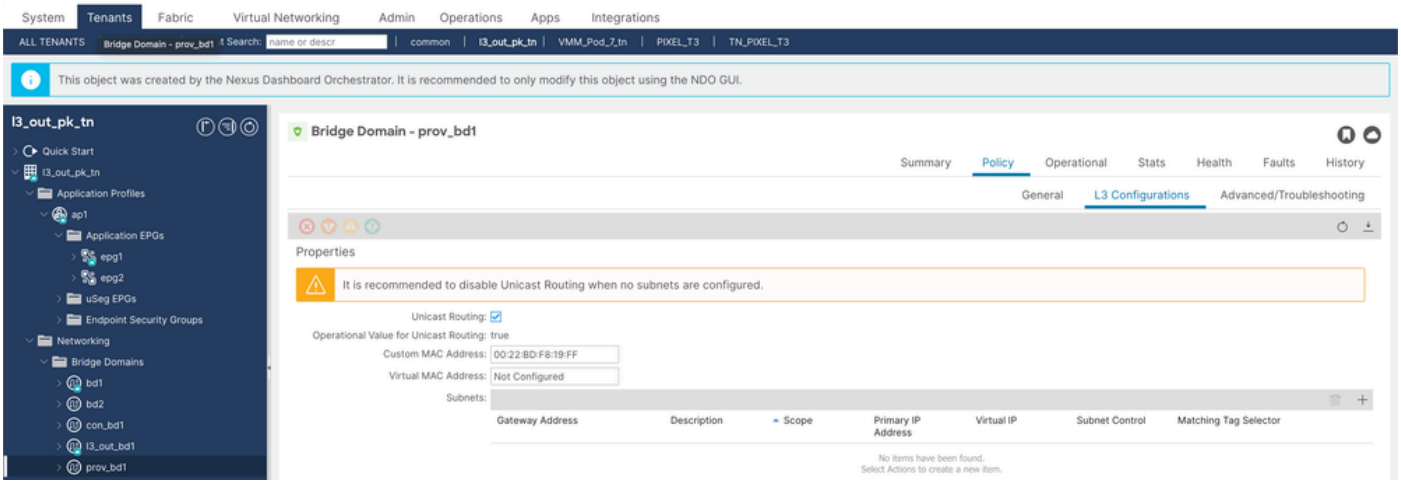


Cons BD配置2

步骤2.配置名为prov-bd1的提供商bd。



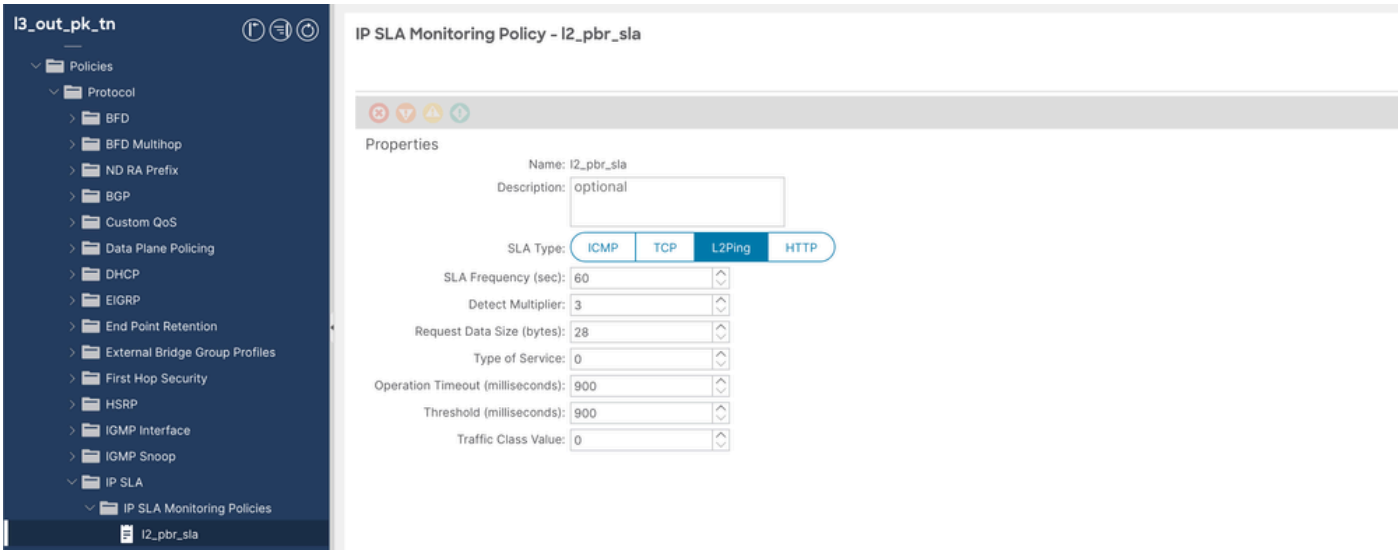
Prov BD配置



Prov BD配置2

步骤3.使用SLA类型L2Ping配置IP服务级别协议(SLA)策略。

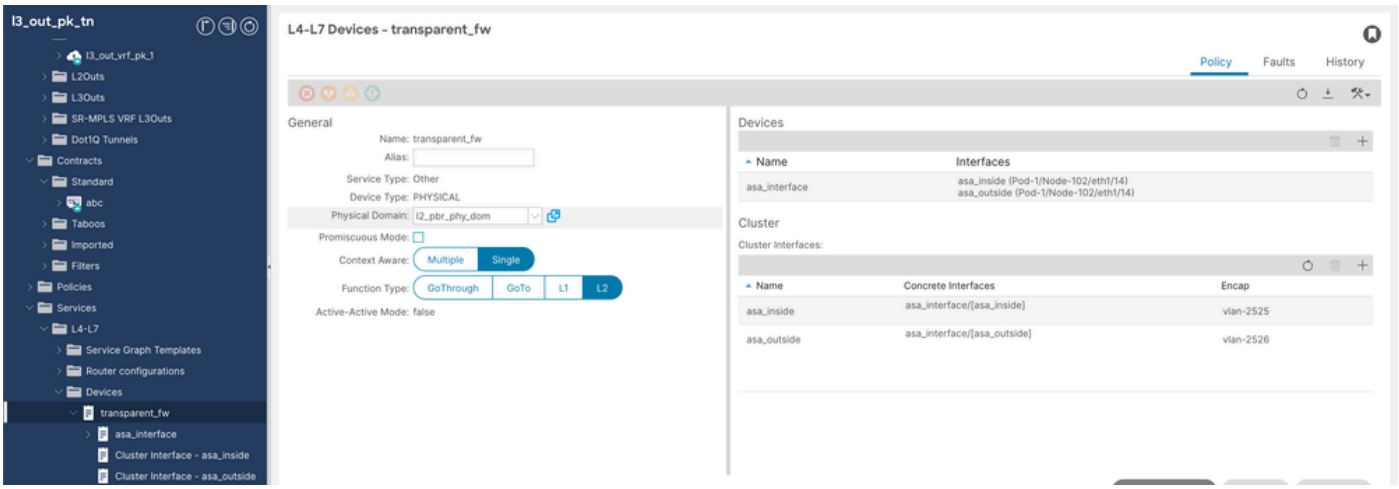
依次导航到租户(Tenant)>策略(Policies)>协议(Protocol)> IP SLA(IP SLA)> IP SLA监控策略(IP SLA Monitoring Policies)，然后右键点击并创建策略(create policy)。



IP SLA策略

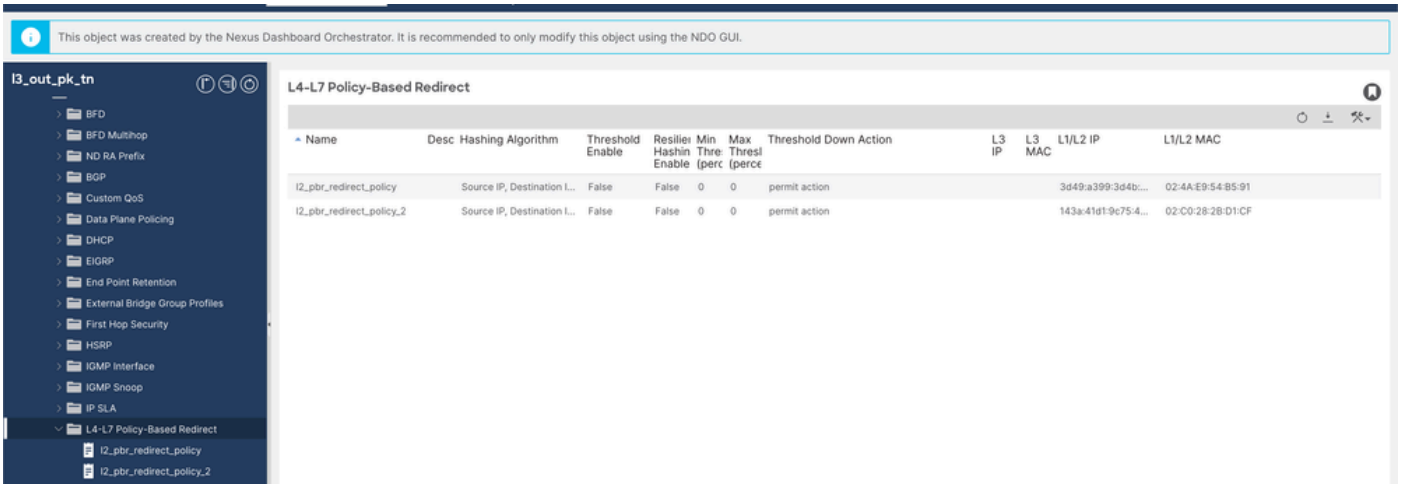
步骤4.配置第4/7层设备。

导航到租户>服务>设备，然后右键单击并创建L4-L7设备。



L4-L7设备

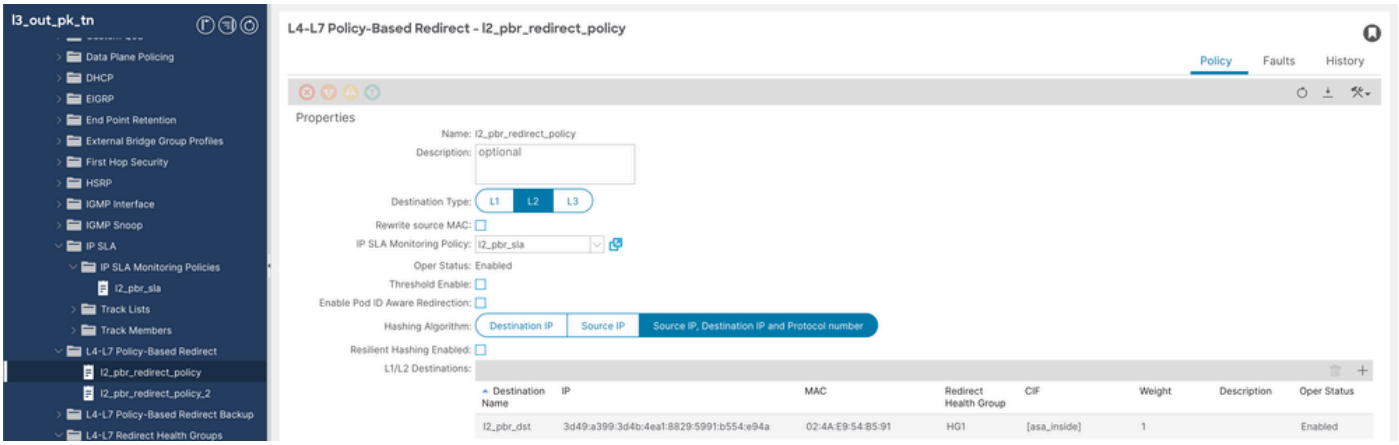
步骤5.验证基于策略的重定向概述（您可以在配置5a和5b后检查这一点）。



L4-L7重定向策略

第5.1步：为自适应安全设备(ASA)内部接口配置基于L4-L7策略的重定向策略（无需指定MAC或IP，由APIC自身填充）。

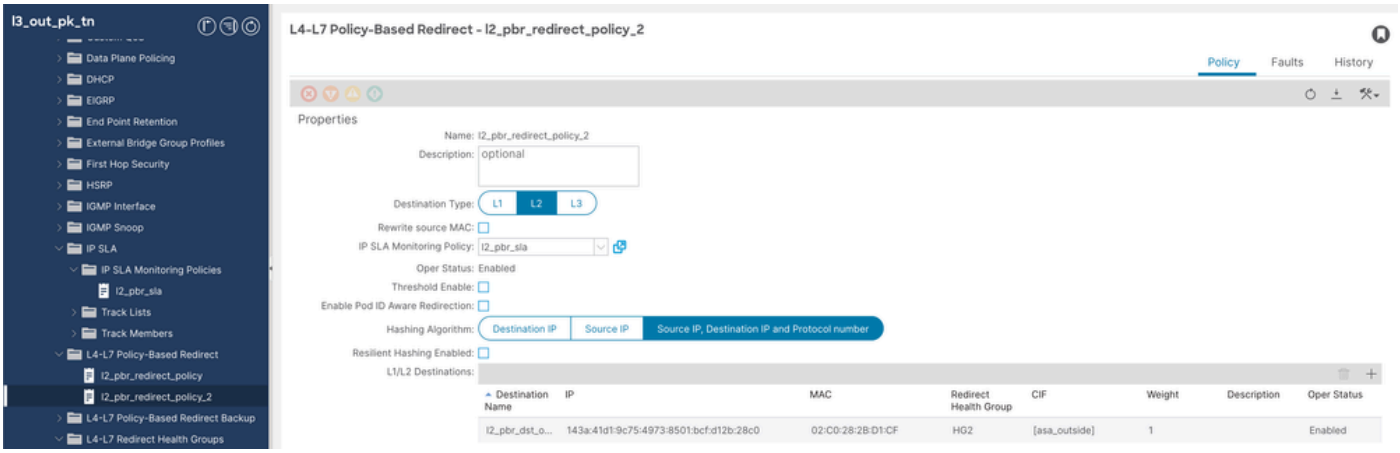
导航到Tenant > Policies > Protocol > L4-L7 Policy based redirect，然后右键单击并创建策略。



L4-L7重定向策略配置

第5.2步：为ASA外部接口配置基于L4-L7策略的重定向策略（无需指定MAC或IP，由APIC自身填充）。

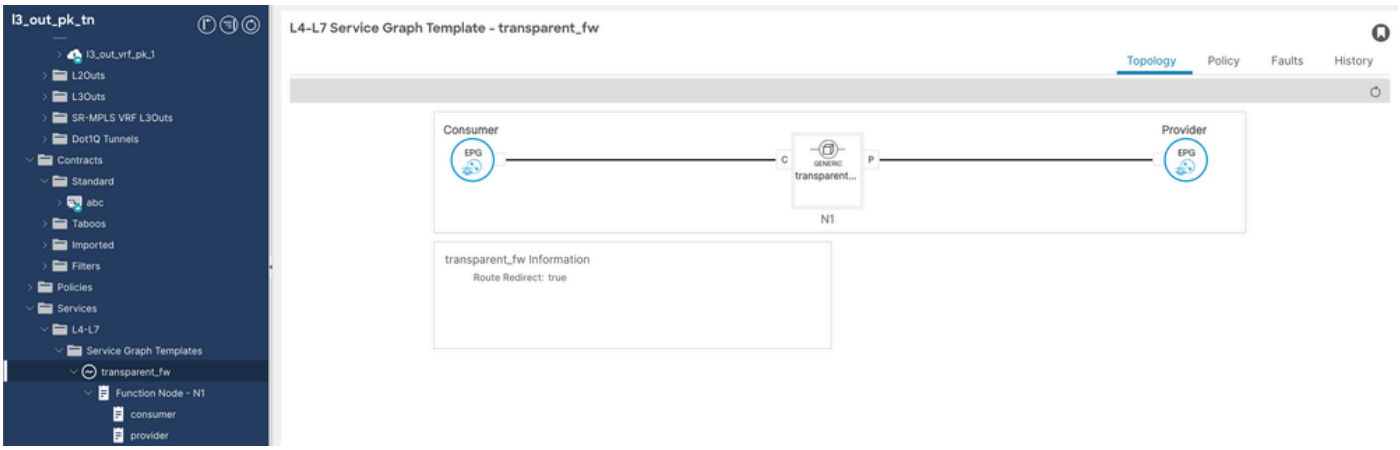
导航到Tenant > Policies > Protocol > L4-L7 Policy based redirect，然后右键单击并创建策略。



L4-L7重定向策略配置2

步骤6.配置Service graph模板。

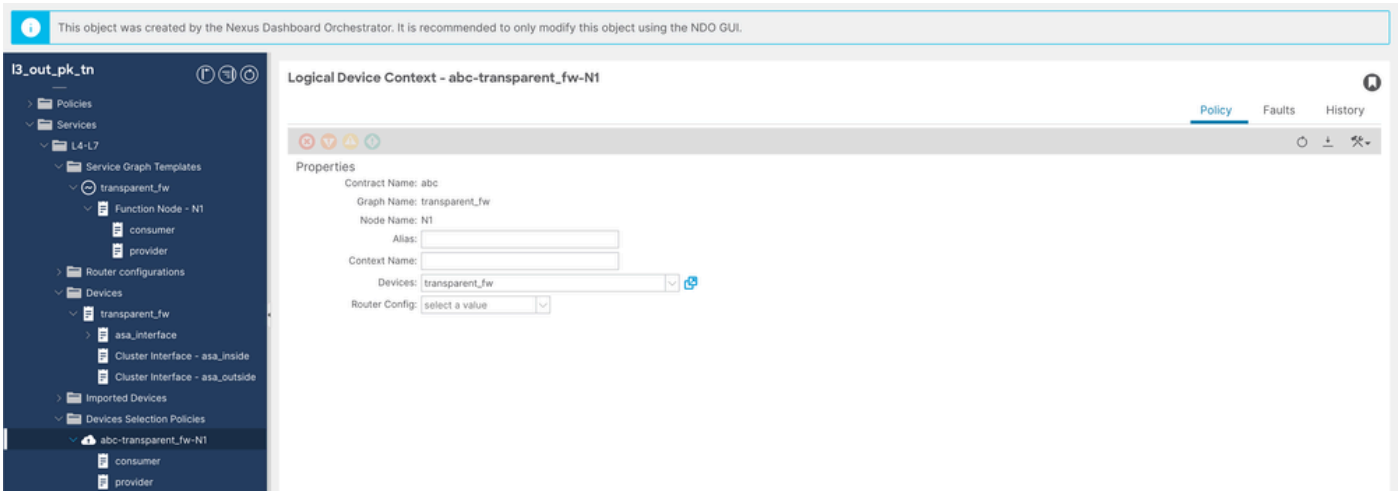
导航到Tenant > Services > Service Graph Template，然后右键单击并创建L4-L7服务图模板。



服务图配置

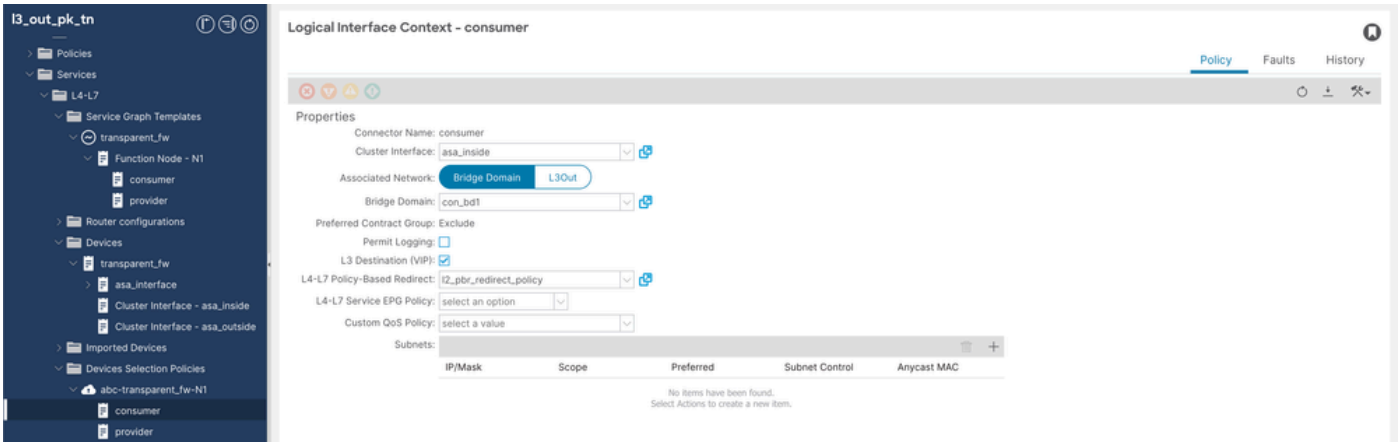
步骤7.配置设备选择策略。

导航到租户>服务>设备选择策略，然后右键单击并创建设备选择策略。



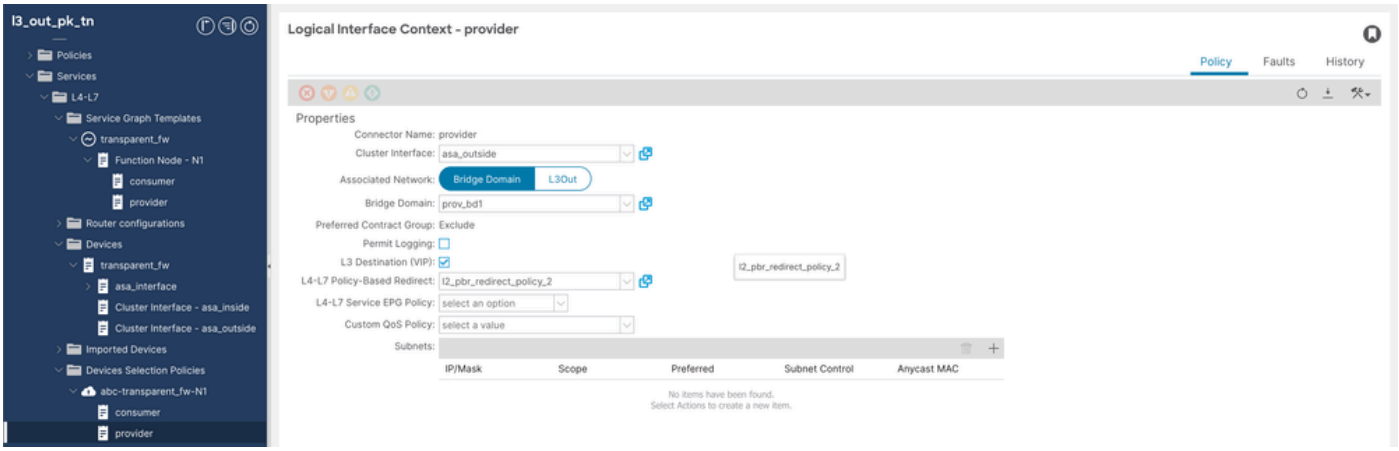
服务图配置2

++消费者逻辑接口环境

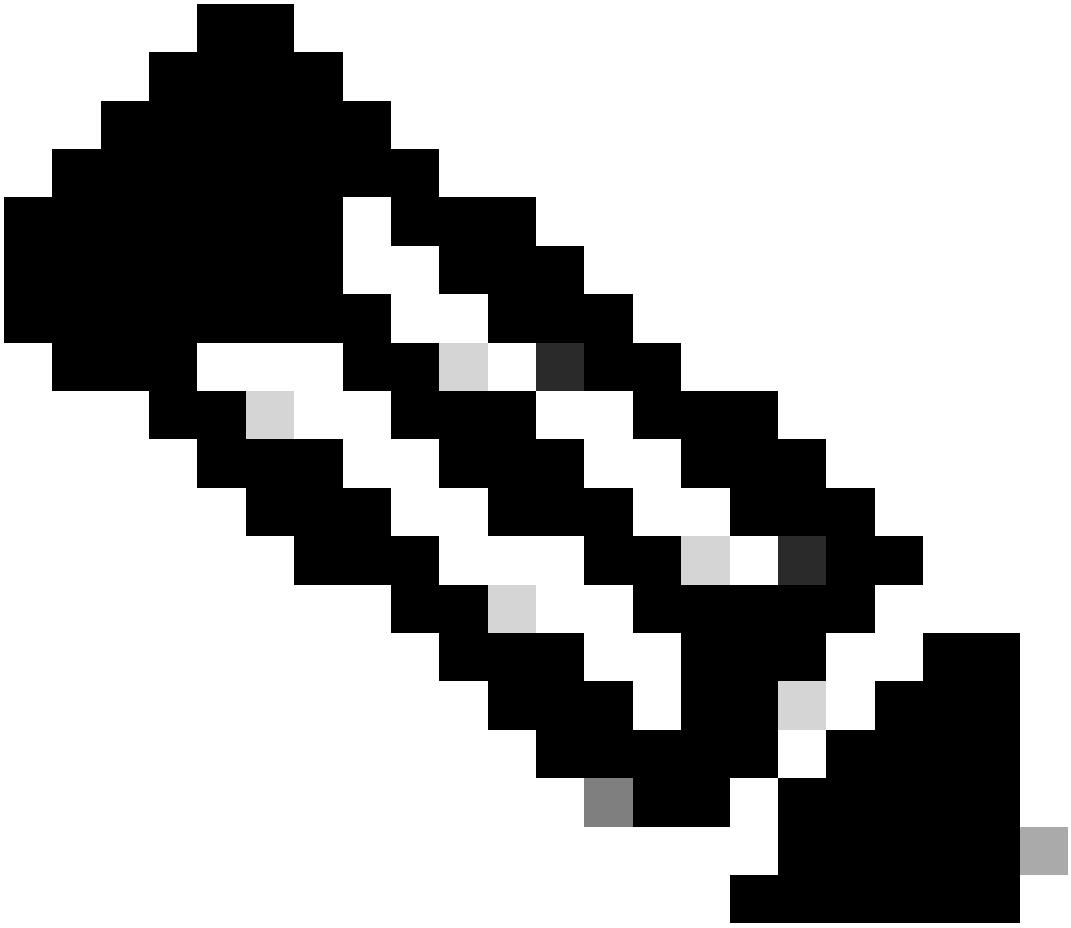


设备选择策略使用者配置

++提供程序逻辑接口上下文



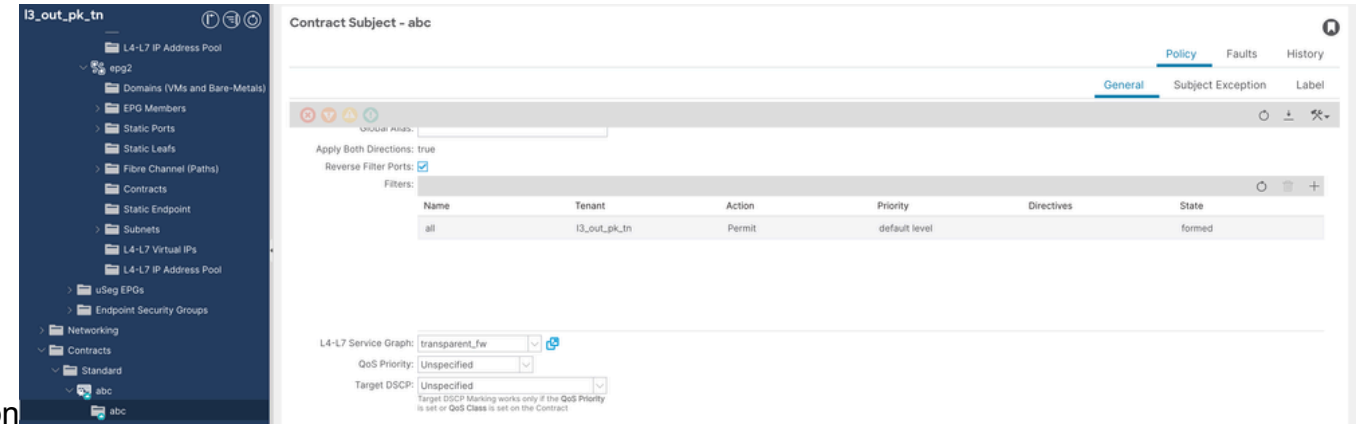
设备选择策略提供程序配置



注意：如果打算使用Apply Service Graph Option，则会自动创建设备选择策略。

步骤8.应用PBR以合同abc主题。

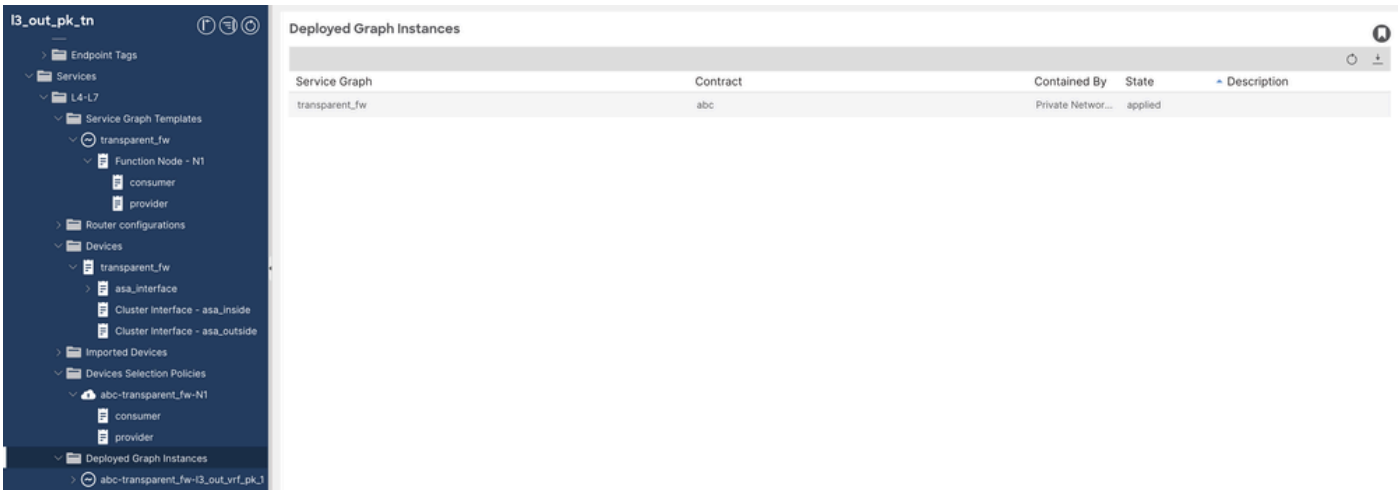
导航到租户>合同>合同主题> L4-L7服务图> transparent_fw。



Con

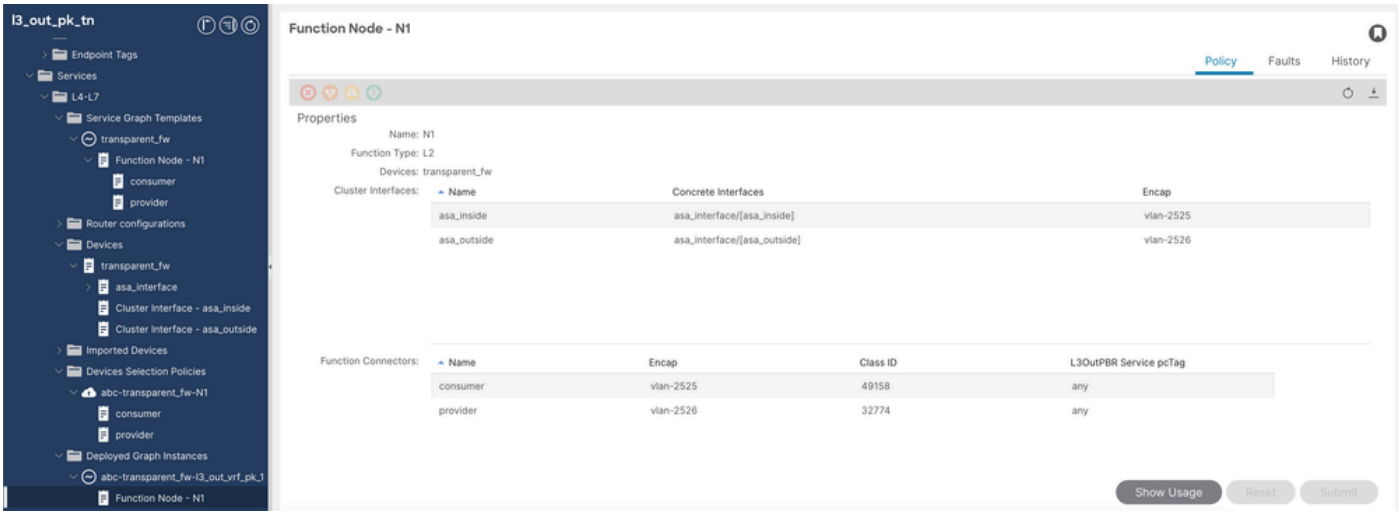
合同配置

步骤9.如果成功部署，则在“已部署的实例”图形下验证（查找状态）。



服务图验证

++验证集群接口、封装VLAN和功能连接器类ID。



服务图验证2

验证ASA上的L2 PBR流量

从源终端到目标终端的安全外壳(SSH)，您可以在ASA上的连接表条目中看到。

ASA验证

检验枝叶上的L2 PBR

1.枝叶节点102上的VLAN编程。

<#root>

```
PBR vlan 2525 and 2526 will get programmed on leaf node 102 and mac addresses will be statically tied t

bgl-aci07-apic100#
```

fabric 102 show endpoint

```
------------------------------------------------------------------
Node 102 (bgl-aci07-leaf2)
------------------------------------------------------------------
Legend:
S - static           s - arp              L - local            O - peer-attached
V - vpc-attached     a - local-aged       p - peer-aged        M - span
B - bounce           H - vtep             R - peer-attached-rl D - bounce-to-proxy
E - shared-service   m - svc-mgr
+----------------------------------+---------------+-----------------+--------------+-------------+
      VLAN/                            Encap           MAC Address       MAC Info/       Interface
      Domain                           VLAN            IP Address        IP Info
+----------------------------------+---------------+-----------------+--------------+-------------+
28/l3_out_pk_tn:l3_out_vrf_pk_1           vlan-2525    024a.e954.b591 LS                    eth1/14
1/l3_out_pk_tn:l3_out_vrf_pk_1            vlan-2526    02c0.282b.d1cf LS                    eth1/14
```

2.重定向消费者(101)和提供商(104)节点上的策略和分区规则。

<#root>

```
++ Redirect policy on consumer node

bgl-aci07-apic100#
```

fabric 101 show service redir info

```
------------------------------------------------------------------
Node 101 (bgl-aci07-leaf1)
------------------------------------------------------------------
================================================================================================================
LEGEND
TL: Threshold(Low)  |  TH: Threshold(High) |  HP: HashProfile  |  HG: HealthGrp  | BAC: Backup-Dest |
================================================================================================================
List of Dest Groups
GrpID Name            destination                                                 HG-name
===== ====            ===========                                                 ==============
7     destgrp-7       dest-[3d49:a399:3d4b:4ea1:8829:5991:b554:e94a]-[vxlan-2228224] l3_out_pk_tn::HG1
8     destgrp-8       dest-[143a:41d1:9c75:4973:8501:bcf:d12b:28c0]-[vxlan-2228224]  l3_out_pk_tn::HG2

List of destinations
Name                                                        bdVnid          vMac                vrf
====                                                        ======          ====                ===
dest-[3d49:a399:3d4b:4ea1:8829:5991:b554:e94a]-[vxlan-2228224] vxlan-16744328  02:4A:E9:54:B5:91    l3_
dest-[143a:41d1:9c75:4973:8501:bcf:d12b:28c0]-[vxlan-2228224]  vxlan-16056296  02:C0:28:2B:D1:CF    l3_

List of Health Groups
HG-Name                                 HG-OperSt  HG-Dest
=======                                 =========  =======
l3_out_pk_tn::HG1                       enabled    dest-[3d49:a399:3d4b:4ea1:8829:5991:b554:e94a]-[v
l3_out_pk_tn::HG2                       enabled    dest-[143a:41d1:9c75:4973:8501:bcf:d12b:28c0]-[vx

List of Backup Destinations
```

```
Name                                                                primaryDestName
====                                                                ==============
List of AclRules
AclRuleVnid     DestGroup       OperSt   OperStQual
===========     =========       ======   ==========

++ Zoning rule on consumer Node

bgl-aci07-apic100#
```

fabric 101 show zoning-rule | grep redir

```
|   4228  | 32771  | 49157  | default  |     bi-dir     | enabled | 2228224  |
|   4231  | 49157  | 32771  | default  | uni-dir-ignore | enabled | 2228224  |
|   4230  | 32771  |   15   | default  |    uni-dir     | enabled | 2228224  |
|   4229  | 16386  | 32771  | default  |    uni-dir     | enabled | 2228224  |
```

<#root>

```
++ Redirect Policy on Provider Node
bgl-aci07-apic100#
```

fabric 104 show service redir info

```
--------------------------------------------------------------------
Node 104 (bgl-aci07-leaf4)
--------------------------------------------------------------------
================================================================================================================
LEGEND
TL: Threshold(Low)  |  TH: Threshold(High) |  HP: HashProfile  |  HG: HealthGrp  | BAC: Backup-Dest |
================================================================================================================
List of Dest Groups
GrpID Name            destination                                                    HG-name
===== ====            ===========                                                    ==============
3     destgrp-3       dest-[3d49:a399:3d4b:4ea1:8829:5991:b554:e94a]-[vxlan-2228224] l3_out_pk_tn::HG1
4     destgrp-4       dest-[143a:41d1:9c75:4973:8501:bcf:d12b:28c0]-[vxlan-2228224]  l3_out_pk_tn::HG2

List of destinations
Name                                                                bdVnid          vMac                vrf
====                                                                ======          ====                ===
dest-[3d49:a399:3d4b:4ea1:8829:5991:b554:e94a]-[vxlan-2228224] vxlan-16744328  02:4A:E9:54:B5:91    l3_
dest-[143a:41d1:9c75:4973:8501:bcf:d12b:28c0]-[vxlan-2228224]  vxlan-16056296  02:C0:28:2B:D1:CF    l3_

List of Health Groups
HG-Name                                 HG-OperSt  HG-Dest
=======                                 =========  =======
l3_out_pk_tn::HG1                       enabled    dest-[3d49:a399:3d4b:4ea1:8829:5991:b554:e94a]-[v
l3_out_pk_tn::HG2                       enabled    dest-[143a:41d1:9c75:4973:8501:bcf:d12b:28c0]-[vx
List of Backup Destinations
Name                                                                primaryDestName
====                                                                ==============

++ Zoning rule on provider node
bgl-aci07-apic100#
```

fabric 104 show zoning-rule | grep redir

```
|   4220  | 32771  | 49157  | default  |     bi-dir     | enabled | 2228224  |
|   4221  | 49157  | 32771  | default  | uni-dir-ignore | enabled | 2228224  |
```

L2Ping失败时出现的故障

如果PBR设备上的L2ping失败，您会发现PBR仍处于部署状态，并且故障F4203、F2833和F2911引发，说明跟踪/运行状况组已关闭。

捕获L2 Ping

您可以使用tcpdump在tahoe接口上捕获L2Ping，以便了解它们是否正确发送和接收。如果只看到CPU传输已发送但未接收，则预期出现前面提到的故障，您必须进一步排除ASA上丢弃这些故障的原因（请参阅ASA配置部分）。

<#root>

Capturing L2Pings using tcpdump on PBR Node 102

bgl-aci07-leaf2#

tcpdump -i tahoe0 -w /data/techsupport/l2_pbr1.pcap

tcpdump: listening on tahoe0, link-type EN10MB (Ethernet), capture size 262144 bytes
^C4858 packets captured
4875 packets received by filter
0 packets dropped by kernel

In order to deocde the tcpdump

cat /data/techsupport/l2_pbr1.pcap | knet_parser.py --decode tahoe --pcap | less

** Search for mac 00ab.8752.3100

++ CPU transmit packets
Frame 505
Time: 2024-10-29T05:55:28.707136+00:00
Header: ieth

CPU Transmit

sup_tx:1, ttl_bypass:0, opcode:0x0, bd:0x207, outer_bd:0x0, dl:0, span:0, traceroute:0, tclass:5
src_idx:0x0, src_chip:0x0, src_port:0x0, src_is_tunnel:0, src_is_peer:0
dst_idx:0x0, dst_chip:0x0, dst_port:0x0, dst_is_tunnel:0
Len: 72
Eth:

00ab.8752.3100 > 024a.e954.b591

, len/

ethertype:0x721

Frame 506
Time: 2024-10-29T05:55:28.707297+00:00
Header: ieth CPU Transmit
sup_tx:1, ttl_bypass:0, opcode:0x0, bd:0x208, outer_bd:0x0, dl:0, span:0, traceroute:0, tclass:5
src_idx:0x0, src_chip:0x0, src_port:0x0, src_is_tunnel:0, src_is_peer:0
dst_idx:0x0, dst_chip:0x0, dst_port:0x0, dst_is_tunnel:0
Len: 72
Eth:

00ab.8752.3100 > 02c0.282b.d1cf

, len/

ethertype:0x721

++CPU recived packets

Frame 509
Time: 2024-10-10T20:16:37.580855+00:00
Header: ieth_extn

CPU Receive

sup_qnum:0x33, sup_code:0x4d, istack:

ISTACK_SUP_CODE_PBR_TRACK_REFRESH

(0x4d)
Header: ieth
sup_tx:0, ttl_bypass:0, opcode:0x0, bd:0x209, outer_bd:0x2, dl:0, span:0, traceroute:0, tclass:0
src_idx:0x32, src_chip:0x0, src_port:0x6, src_is_tunnel:0, src_is_peer:0
dst_idx:0x1, dst_chip:0x0, dst_port:0x3d, dst_is_tunnel:0
Len: 76
Eth:

00ab.8752.3100 > 024a.e954.b591

, len/ethertype:0x8100(802.1q)
802.1q:

vlan:2526

, cos:0, len/

ethertype:0x721

Frame 510
Time: 2024-10-10T20:16:37.580891+00:00
Header: ieth_extn

CPU Receive

sup_qnum:0x33, sup_code:0x4d, istack:

ISTACK_SUP_CODE_PBR_TRACK_REFRESH(0x4d)

Header: ieth
sup_tx:0, ttl_bypass:0, opcode:0x0, bd:0x20a, outer_bd:0x2, dl:0, span:0, traceroute:0, tclass:0
src_idx:0x32, src_chip:0x0, src_port:0x6, src_is_tunnel:0, src_is_peer:0
dst_idx:0x1, dst_chip:0x0, dst_port:0x3d, dst_is_tunnel:0
Len: 76

Eth:

00ab.8752.3100 > 02c0.282b.d1cf

, len/ethertype:0x8100(802.1q)
802.1q:

vlan:2525

, cos:0, len/

ethertype:0x721

从Src到Dst终端的流量

<#root>

```
++ Endpoint X.1.1.10 want to send traffic to X.1.2.15
++ If destination is not learned on consumer/source leaf, PBR will be performed on destination leaf
++ For this case we are assuming endpoint X.1.2.15 is learned on Leaf 101 so PBR/Redirection will be pe

bgl-aci07-apic100#
```

fabric 101 show endpoint

```
--------------------------------------------------------------------
Node 101 (bgl-aci07-leaf1)
--------------------------------------------------------------------
Legend:
S - static           s - arp              L - local            O - peer-attached
V - vpc-attached     a - local-aged       p - peer-aged        M - span
B - bounce           H - vtep             R - peer-attached-rl D - bounce-to-proxy
E - shared-service   m - svc-mgr
+----------------------------------+--------------+-----------------+-------------+-------------+
      VLAN/                           Encap           MAC Address       MAC Info/       Interface
      Domain                          VLAN            IP Address        IP Info
+----------------------------------+--------------+-----------------+-------------+-------------+
l3_out_pk_tn:l3_out_vrf_pk_1                              X.1.2.15                      tunnel6 ===> t
17                                    vlan-3516    10b3.d514.3516 L                     eth1/5 ===>
l3_out_pk_tn:l3_out_vrf_pk_1          vlan-3516        X.1.1.10 L                       eth1/5

++ EPM entry to get the PC TAG
bgl-aci07-apic100#
```

fabric 101 show system internal epm endpoint ip X.1.1.10

```
--------------------------------------------------------------------
Node 101 (bgl-aci07-leaf1)
--------------------------------------------------------------------
MAC : 10b3.d514.3516 ::: Num IPs : 1
IP# 0 : X.1.1.10 ::: IP# 0 flags :  ::: l3-sw-hit: No
Vlan id : 17 ::: Vlan vnid : 11792 ::: VRF name : l3_out_pk_tn:l3_out_vrf_pk_1
BD vnid : 16744307 ::: VRF vnid : 2228224
Phy If : 0x1a004000 ::: Tunnel If : 0
Interface : Ethernet1/5
Flags : 0x80005c04 ::: sclass :
```

32771

```
 ::: Ref count : 5 ==> sclass
EP Create Timestamp : 10/11/2024 09:15:44.430334
EP Update Timestamp : 10/29/2024 10:45:35.458416
EP Flags : local|IP|MAC|host-tracked|sclass|timer|

bgl-aci07-apic100#
```

fabric 101 show system internal epm endpoint ip X.1.2.15

```
------------------------------------------------------------
Node 101 (bgl-aci07-leaf1)
------------------------------------------------------------
MAC : 0000.0000.0000 ::: Num IPs : 1
IP# 0 : X.1.2.15 ::: IP# 0 flags :  ::: l3-sw-hit: No
Vlan id : 0 ::: Vlan vnid : 0 ::: VRF name : l3_out_pk_tn:l3_out_vrf_pk_1
BD vnid : 0 ::: VRF vnid : 2228224
Phy If : 0 ::: Tunnel If : 0x18010006
Interface : Tunnel6
Flags : 0x80004400 ::: sclass :
```

49157

```
 ::: Ref count : 3 ==> sclass
EP Create Timestamp : 10/29/2024 10:38:34.949150
EP Update Timestamp : 10/29/2024 10:45:55.571786
EP Flags : IP|sclass|timer|

++ Traffic will be redirected based on redir(destgrp-7)
bgl-aci07-apic100#
```

fabric 101 show zoning-rule src-epg 32771 dst-epg 49157

```
------------------------------------------------------------
Node 101 (bgl-aci07-leaf1)
------------------------------------------------------------
+---------+--------+--------+----------+--------+---------+---------+------+------------------+--------
| Rule ID | SrcEPG | DstEPG | FilterID |  Dir   |  operSt |  Scope  | Name |      Action      |    Prio
+---------+--------+--------+----------+--------+---------+---------+------+------------------+--------
|   4228  | 32771  | 49157  | default  | bi-dir | enabled | 2228224 |      | redir(destgrp-7) | src_dst_
+---------+--------+--------+----------+--------+---------+---------+------+------------------+--------

++ Based on redirect policy traffic will be redirected to mac
```

02:4A:E9:54:B5:91

```
bgl-aci07-apic100#
```

fabric 101 show service redir info

```
------------------------------------------------------------
Node 101 (bgl-aci07-leaf1)
------------------------------------------------------------
========================================================================================================
LEGEND
TL: Threshold(Low)  |  TH: Threshold(High) |  HP: HashProfile  |  HG: HealthGrp  | BAC: Backup-Dest |  T
========================================================================================================
List of Dest Groups
GrpID Name            destination                                                HG-name
===== ====            ===========                                                ==============
7     destgrp-7       dest-[3d49:a399:3d4b:4ea1:8829:5991:b554:e94a]-[vxlan-2228224] l3_out_pk_tn::HG1
List of destinations
```

```
Name                                                                bdVnid          vMac                vrf
====                                                                ======          ====                ===
dest-[3d49:a399:3d4b:4ea1:8829:5991:b554:e94a]-[vxlan-2228224] vxlan-16744328
```

02:4A:E9:54:B5:91

```
    l3_out_pk_tn:l3_out_vrf_pk_1 enabled    no-oper-dest    l3_out_pk_tn::HG
1

++ PBR mac addresses are never learnt remotely as IP/MAC learning is disabled for PBR BD
++ PBR mac addresses are statically binded to interfaces where L4/L7 device is connected and reported t
++ Traffic will be forwarded to SPINE PROXY
++ Spine has an COOP entry for 02:4A:E9:54:B5:91

bgl-aci07-apic100#
```

fabric 201 show coop internal info repo ep key 16744328 02:4A:E9:54:B5:91

```
------------------------------------------------------------------
Node 201 (bgl-aci07-spine1)
------------------------------------------------------------------
Repo Hdr Checksum : 49503
Repo Hdr record timestamp : 10 29 2024 10:15:07 658496921
Repo Hdr last pub timestamp : 10 29 2024 10:15:07 661679296
Repo Hdr last dampen timestamp : 01 01 1970 00:00:00 0
Repo Hdr dampen penalty : 0
Repo Hdr flags : IN_OBJ ACTIVE
EP bd vnid : 16744328
EP mac :
```

02:4A:E9:54:B5:91

```
 <<<<========== ASA MAC
flags : 0x480
repo flags : 0x102
Vrf vnid : 2228224
PcTag : 0x100c006
EVPN Seq no : 0
Remote publish timestamp: 01 01 1970 00:00:00 0
Snapshot timestamp: 10 29 2024 10:15:07 658496921
Tunnel nh : 10.0.144.66
MAC Tunnel  : 10.0.144.66
IPv4 Tunnel : 10.0.144.66
IPv6 Tunnel : 10.0.144.66
ETEP Tunnel : 0.0.0.0
num of active ipv4 addresses : 0
num of anycast ipv4 addresses : 0
num of ipv4 addresses : 0
num of active ipv6 addresses : 0
num of anycast ipv6 addresses : 0
num of ipv6 addresses : 0
Primary Path:
Current published TEP :
```

10.0.144.66

```
Backup Path:
BackupTunnel nh : 0.0.0.0
Current Backup (publisher_id): 0.0.0.0
Anycast_flags : 0
Current citizen (publisher_id): 10.0.144.66
Previous citizen : 10.0.144.66
```

```
Prev to Previous citizen : 10.0.144.66
Synthetic Flags : 0x5
Synthetic Vrf : 411
Synthetic IP : X.X.83.223
Tunnel EP entry: 0x7f20900167a8
Backup Tunnel EP entry: (nil)
TX Status: COOP_TX_DONE\
Damp penalty: 0
Damp status: NORMAL
Exp status: 0
Exp timestamp: 01 01 1970 00:00:00 0
Hash: 3209430840 owner: 10.0.144.65

++ Spine will forward this to PBR Leaf Node 102 based on COOP entry
++ PBR Leaf Node will forward this to ASA FW on interface E1/14
++ ASA FW will forward the traffic based on mac address table and send it back to PBR Leaf Node 102
++ PBR Leaf Node will look for Dst IP in the traffic and route it to Leaf 104 if remote endpoint entry
++ Leaf 104 will get this traffic forwarded to actual EP X.1.2.15 (Leaf4 does not learn the client IP a
```

ASA 配置

步骤1.接口配置。

<#root>

ASA(config)#

show running-config interface

```
!
interface GigabitEthernet0/0
 bridge-group 1
 nameif inside
 security-level 100
!
interface GigabitEthernet0/1
 bridge-group 1
 nameif outside
 security-level 0
!
interface BVI1
ip address 192.168.100.1 255.255.255.0 ==> In case BVI IP is not defined ASA will not switch the packet
!
```

步骤2.必须禁用MAC学习。

<#root>

ASA(config)#

show run mac-learn

```
mac-learn inside disable
mac-learn outside disable
```

PBR:

步骤3.PBR Mac的静态MAC地址表。

<#root>

```
The mac statically binded to inside interface is the PBR mac generated by provider and vice versa
ASA(config)#
```

show run mac-address-table

```
mac-address-table static outside 024a.e954.b591
mac-address-table static inside 02c0.282b.d1cf
```

步骤4.配置访问控制列表(ACL)以通过L2ping。

<#root>

```
ASA(config)#
```

show access-list

```
access-list L2_PBR ethertype permit 721

ASA(config)# show run access-group
access-group L2_PBR in interface inside
access-group L2_PBR in interface outside
```

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