

L4-L7与传输交换矩阵对等路由 — 配置漫游

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简介

本文档介绍具有路由对等的L4-L7服务图的配置演练，其中消费者和提供商都位于以应用为中心的基础设施(ACI)交换矩阵外部。

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先决条件

要求

Cisco 建议您了解以下主题：

- 静态VLAN池，用于外部设备和ACI交换矩阵之间的封装VLAN。
- 外部物理域和路由域，将外部设备的位置（枝叶节点/路径）与VLAN池连接在一起
- 第3层到外部网络的连接(L3Out)

本文档未涵盖前面的交换矩阵访问和L3Out配置步骤，并且假定这些步骤已经完成。

使用的组件

本文档中的信息基于以下软件版本：

- 思科应用策略基础设施控制器（思科APIC）— 1.2(1m)
- 自适应安全设备(ASA)设备包 — 1.2.4.8
- ASA 5585 - 9.5(1)
- Nexus 3064 - 6.0(2)U3(7)

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。如果您使用的是真实网络，请确保您已经了解所有命令的潜在影响。

背景信息

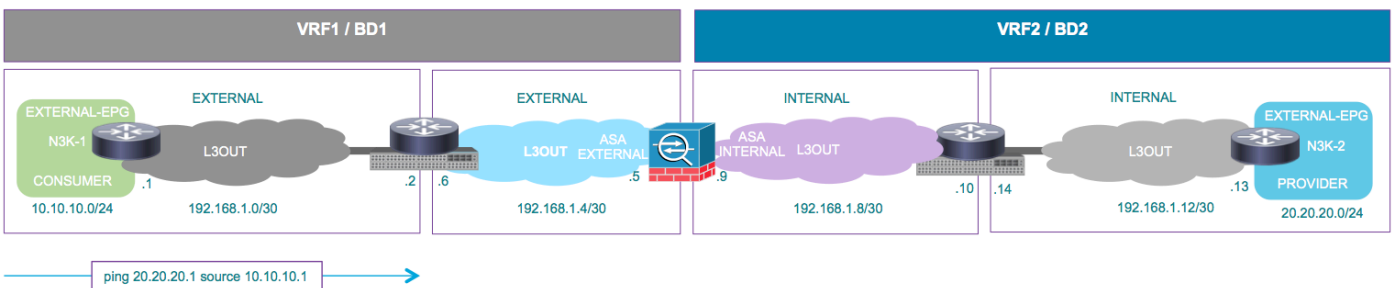
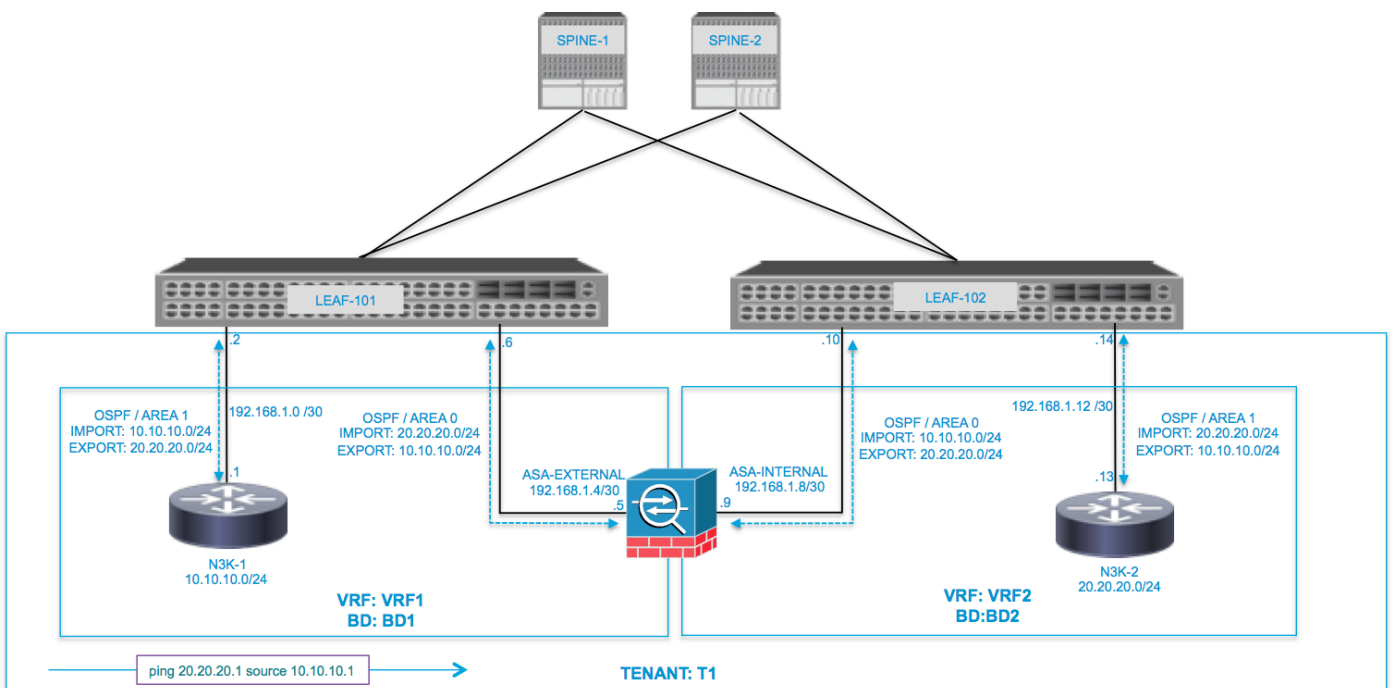
路由对等功能使负载均衡器或防火墙等服务设备能够通过ACI交换矩阵向外部网络通告其可达性。

此处介绍的使用案例是作为双臂服务图部署在两个L3Out或外部终端组(EPG)之间的物理防火墙。服务图与枝叶101(N3K-1)上的外部EPG和枝叶102(N3K-2)上的外部EPG之间的合同关联。ACI交换矩阵为路由器(N3K-1和N3K-2)提供中转服务，并使用路由对等(以开放最短路径优先(OSPF)作为路由协议)在防火墙和ACI交换矩阵之间交换路由。

配置

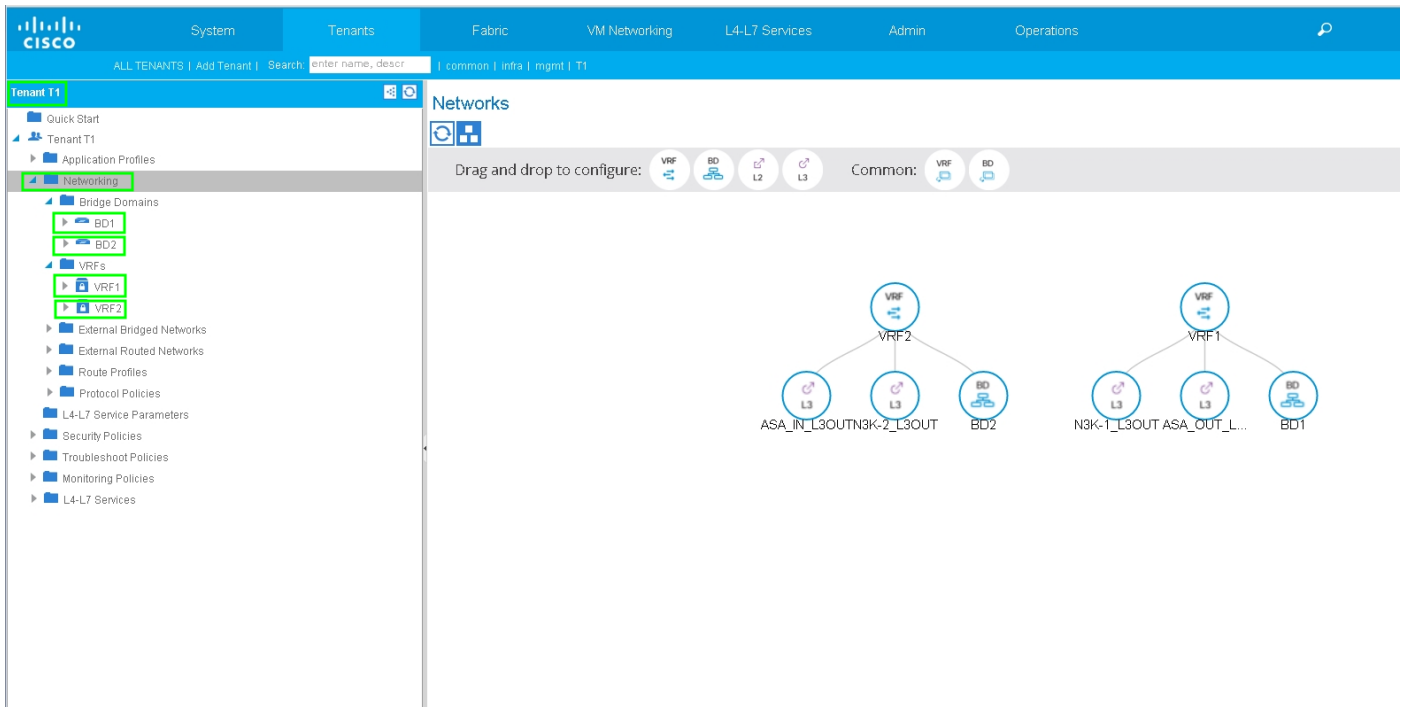
网络图

下图显示路由对等如何端到端工作：

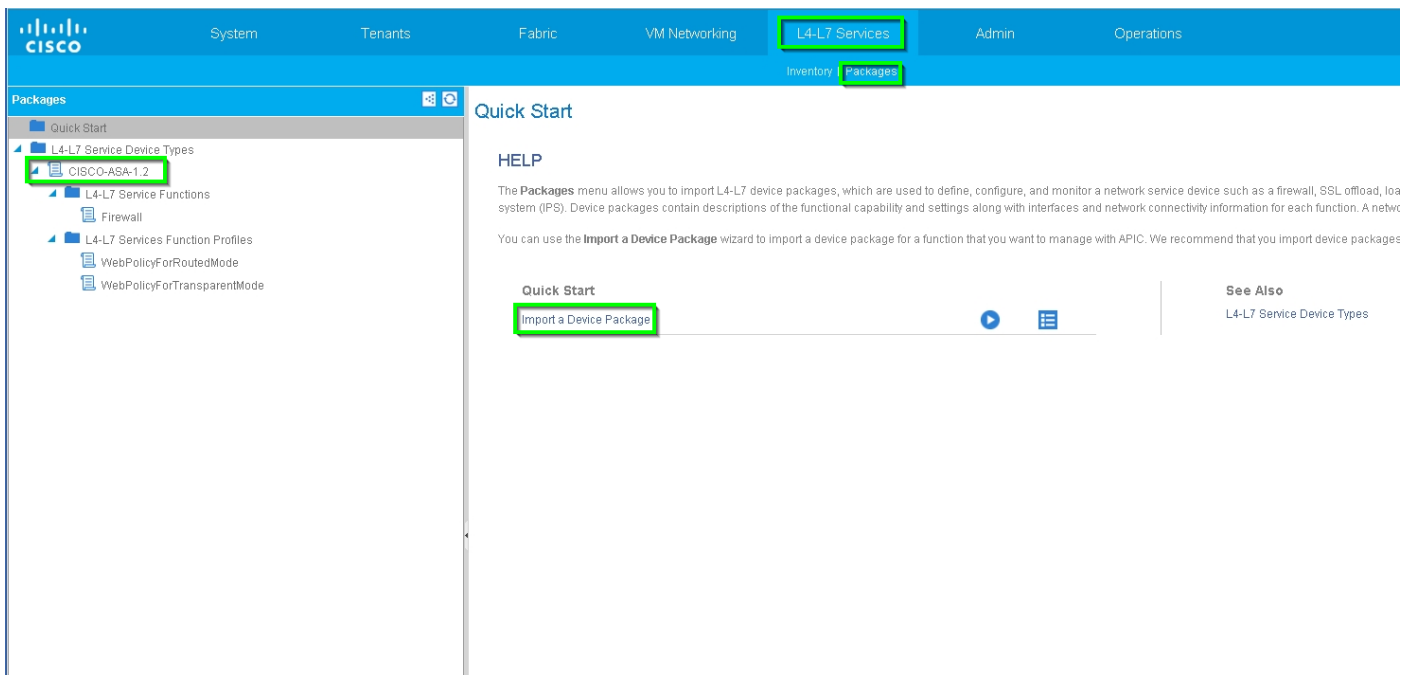


配置

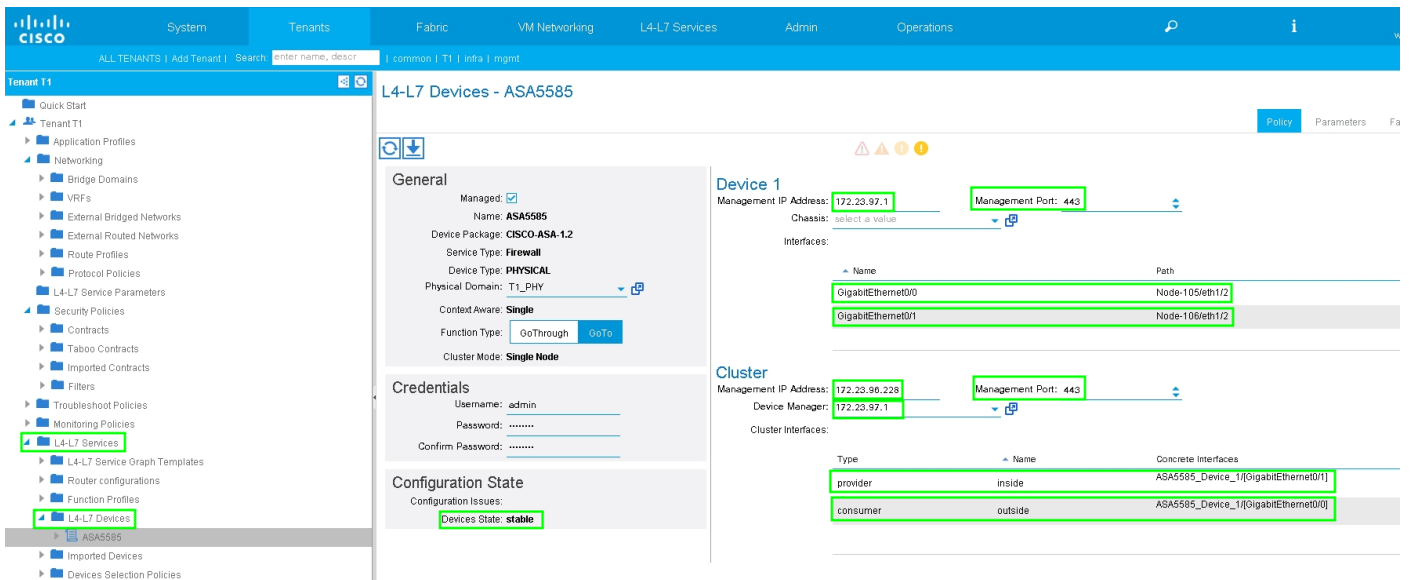
步骤1.配置虚拟路由和转发1(VRF1)、VRF2、网桥域1(BD1)和BD2。将BD1关联到VRF1，将BD2关联到VRF2，如图所示：



步骤2.在L4-L7设备下上传ASA设备包，如图所示：

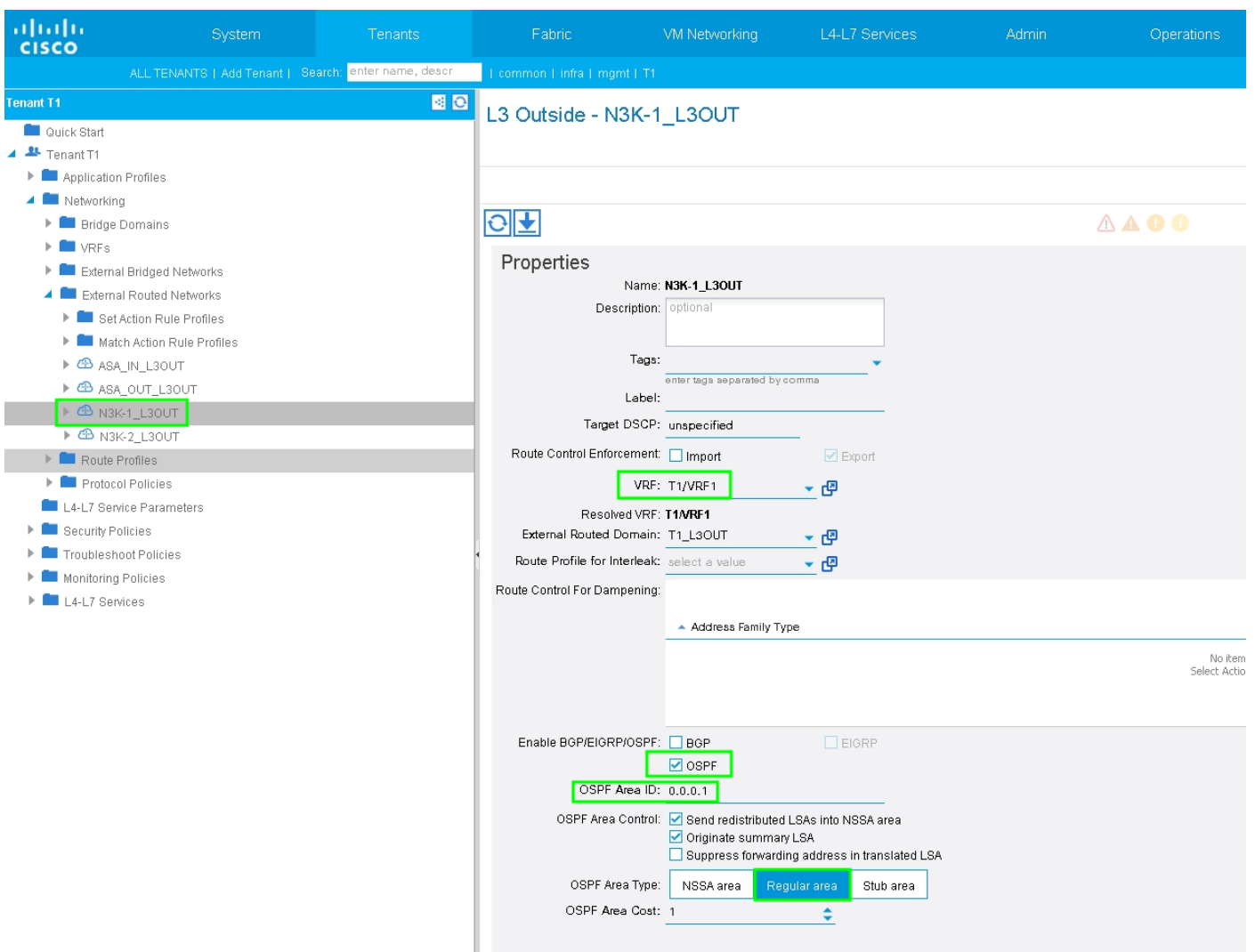


为物理ASA 5585 (路由) 配置L4-L7设备，如图所示：

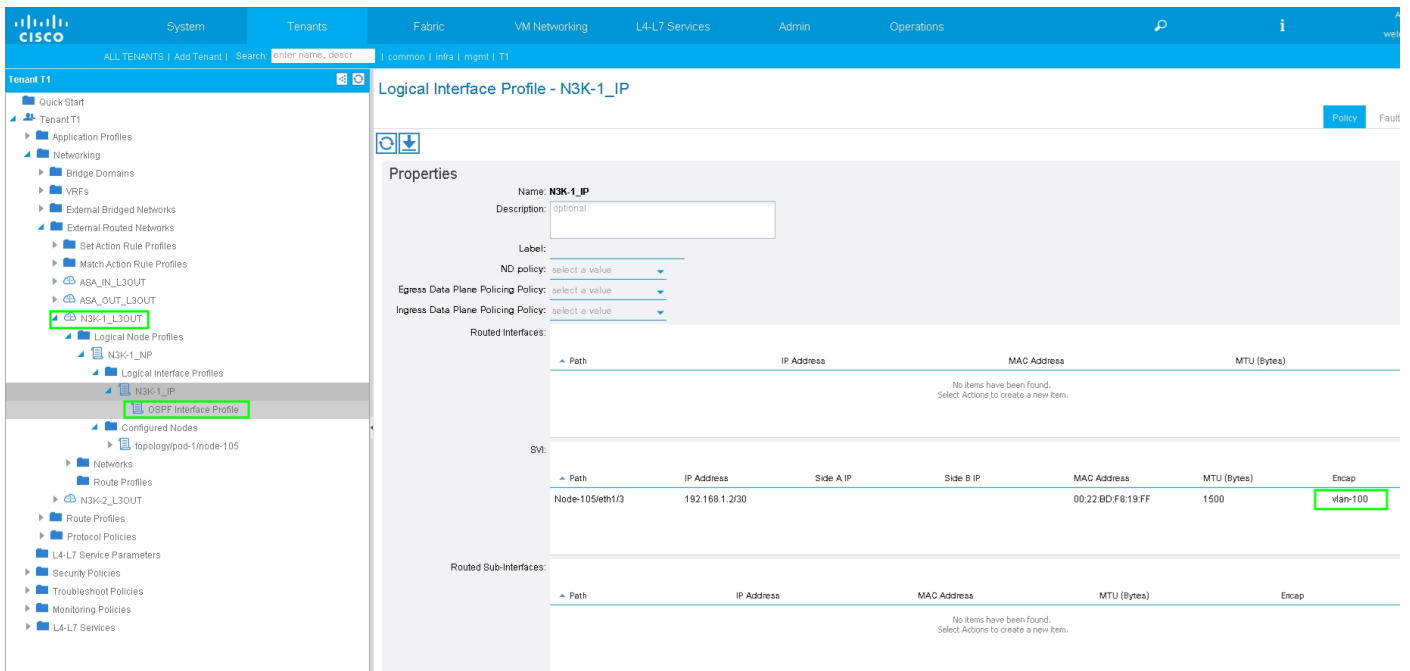


步骤3.为N3K-1配置L3Out并与BD1和VRF1关联。

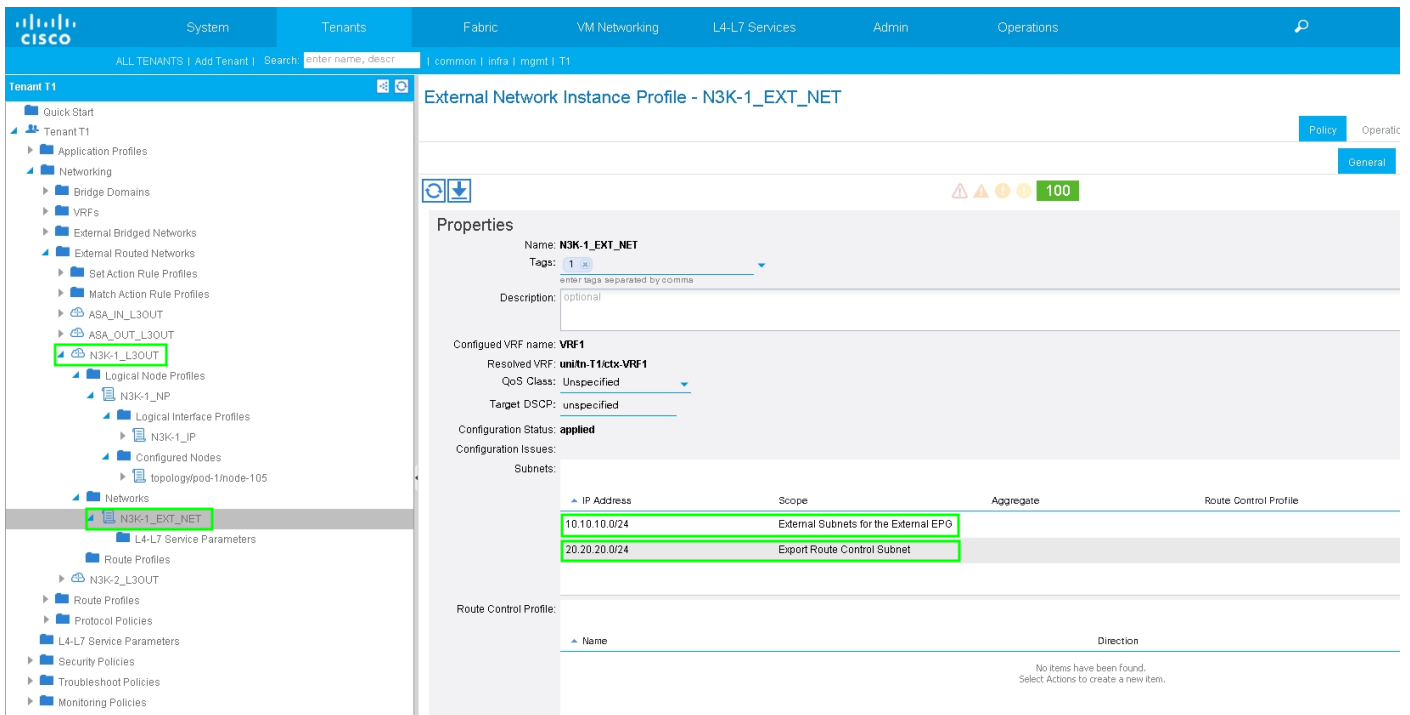
外部路由网络用于指定ACI交换矩阵中用于路由对等的路由配置，如图所示：



注意：所有用于路由对等的L3Out接口都需要相应地配置为带VLAN封装的交换机虚拟接口 (SVI)。



为N3K-1 L3Out外部EPG配置子网上的导入/导出路由控制，如图所示：



为ASA外部接口配置L3Out并与BD1和VRF1关联，如图所示：

L3 Outside - ASA_OUT_L3OUT

Properties

Name: **ASA_OUT_L3OUT**

Description: optional

Tags:

Label:

Target DSCP: unspecified

Route Control Enforcement: Import Export

VRF: **T1/VRF1**

Resolved VRF: **T1/VRF1**

External Routed Domain: T1_L3OUT

Route Profile for Interleaf: select a value

Route Control For Dampening:

Address Family Type:

Route Dampening Policy: No items have been found. Select Actions to create a new item.

Enable BGP/EIGRP/OSPF: BGP OSPF EIGRP

OSPF Area ID: **0**

OSPF Area Control: Send redistributed LSAs into NSSA area Originate summary LSA Suppress forwarding address in translated LSA

OSPF Area Type: NSSA area **Regular area** Stub area

OSPF Area Cost:

Logical Interface Profile - ASA_OUT_IP

Properties

Name: **ASA_OUT_IP**

Description: optional

Label:

ND policy: select a value

Egress Data Plane Policing Policy: select a value

Ingress Data Plane Policing Policy: select a value

Routed interfaces:

Path	IP Address	MAC Address	MTU (Bytes)
No items have been found. Select Actions to create a new item.			

SVI:

Path	IP Address	Side A IP	Side B IP	MAC Address	MTU (Bytes)	Encap
Node-105eth1/2	192.168.1.8/30			00:22:BD:F8:19:FF	1500	vlan-101

Routed Sub-Interfaces:

Path	IP Address	MAC Address	MTU (Bytes)	Encap
No items have been found. Select Actions to create a new item.				

为ASA外部L3Out外部EPG配置子网上的导入/导出路由控制，如图所示：

External Network Instance Profile - ASA_OUT_EXT_NET

Properties

Name: **ASA_OUT_EXT_NET**

Tags:

Description: optional

Configured VRF name: **VRF1**

Resolved VRF: **unitn-t1/ctx-vrf1**

QoS Class: Unspecified

Target DSCP: unspecified

Configuration Status: **applied**

Configuration Issues:

Subnets:	IP Address	Scope	Aggregate	Route Control Profile	Route Summa
	10.10.10.0/24	Export Route Control Subnet			
	20.20.20.0/24	External Subnets for the External EPoS Shared Route Control Subnet			

Route Control Profile:

Name	Direction
No items have been found. Select Actions to create a new item.	

为ASA-Internal配置L3out并与BD2和VRF2关联，如图所示：

L3 Outside - ASA_IN_L3OUT

Properties

Name: **ASA_IN_L3OUT**

Description: optional

Tags: 1

Label:

Target DSCP: unspecified

Route Control Enforcement: Import Export

VRF: **T1/VRF2**

Resolved VRF: **T1/VRF2**

External Routed Domain: **T1_L3OUT**

Route Profile for Interleaf: select a value

Route Control For Dampening:

Address Family Type	Route Dampening Policy
No items have been found. Select Actions to create a new item.	

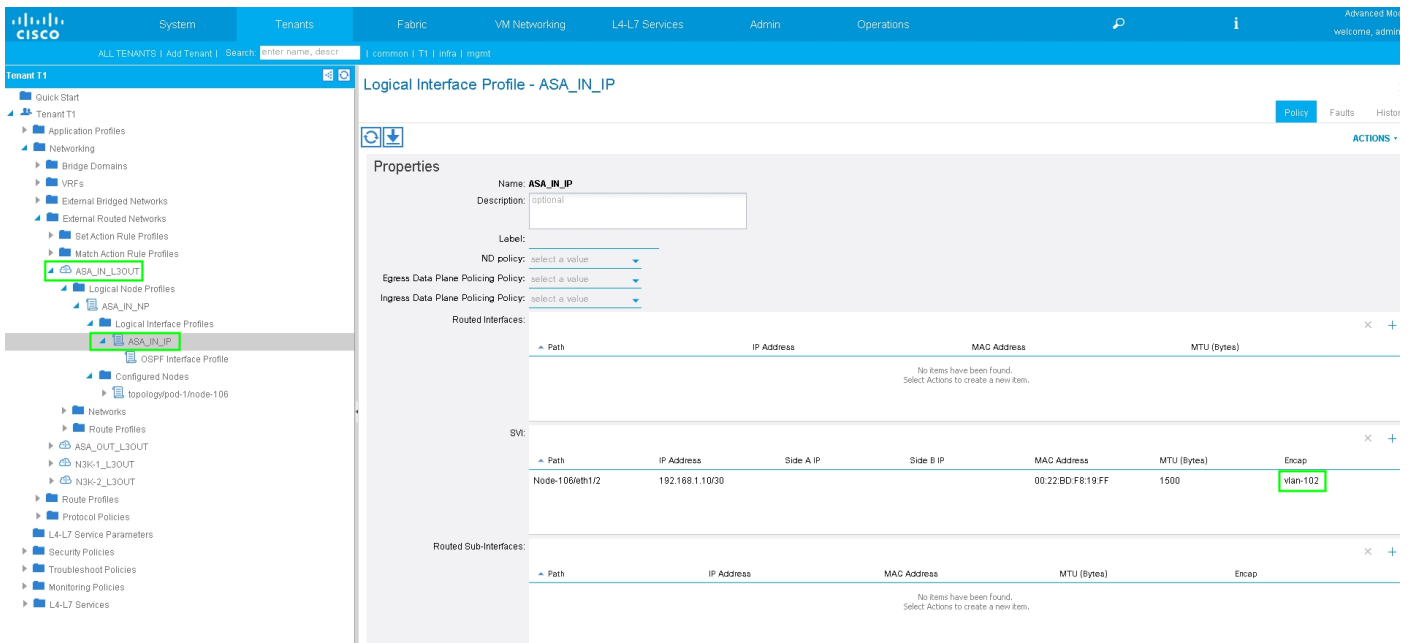
Enable BGP/EIGRP/OSPF: BGP OSPF EIGRP

OSPF Area ID: **0**

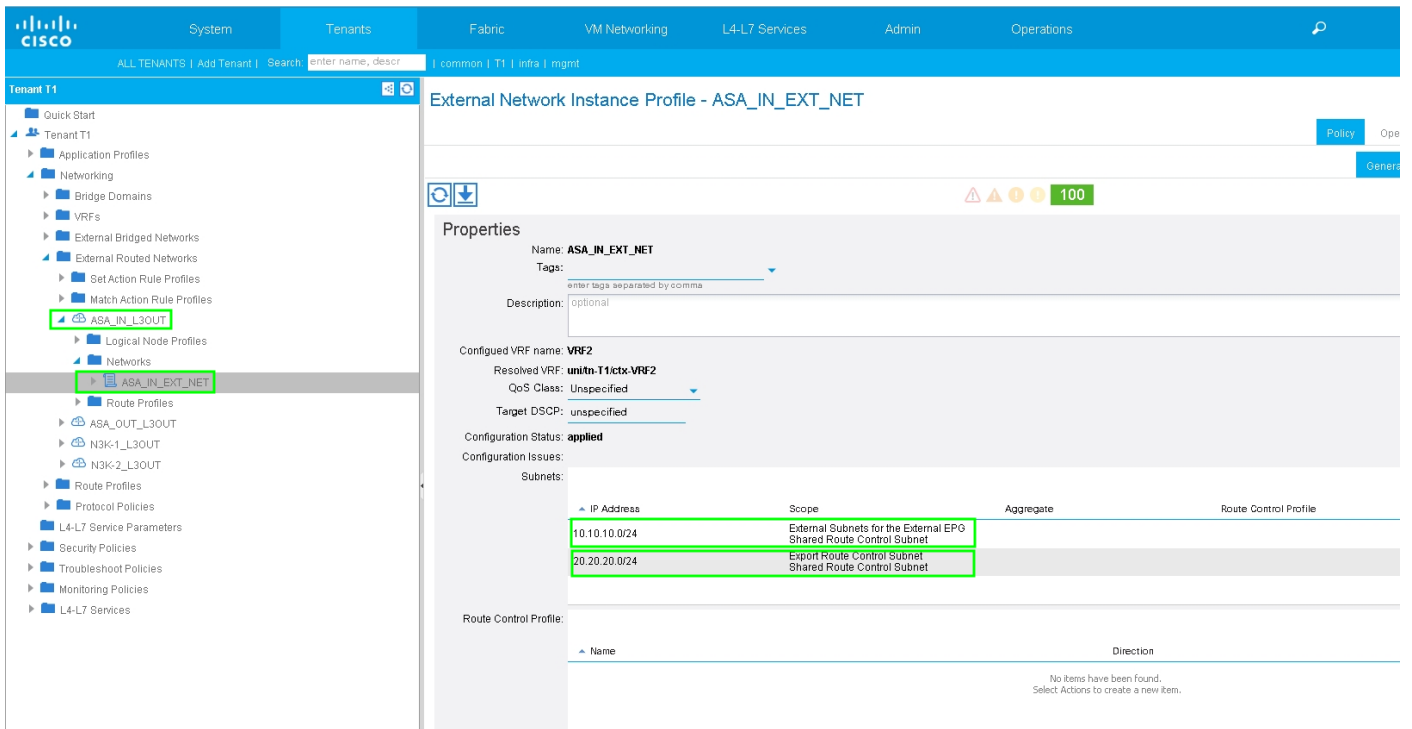
OSPF Area Control: Send redistributed LSAs into NSSA area Originate summary LSA Suppress forwarding address in translated LSA

OSPF Area Type: **NSSA area** **Regular area** Stub area

OSPF Area Cost: 0



为ASA — 内部L3Out外部EPG配置子网上的导入/导出路由控制，如图所示：



为N3K-2配置L3Out并与BD2和VRF2关联，如图所示：

L3 Outside - N3K-2_L3OUT

Properties

Name: **N3K-2_L3OUT**

Description: optional

Tags:

Label:

Target DSCP: unspecified

Route Control Enforcement: Import Export

VRF: **T1/VRF2**

Resolved VRF: **T1/VRF2**

External Routed Domain: T1_L3OUT

Route Profile for Interleaf: select a value

Route Control For Dampening:

Address Family Type	Route Dampening Policy
	No items have been found. Select Actions to create a new item.

Enable BGP/EIGRP/OSPF: BGP OSPF EIGRP

OSPF Area ID: **0.0.0.1**

OSPF Area Control: Send redistributed LSAs into NSSA area Originate summary LSA Suppress forwarding address in translated LSA

OSPF Area Type: NSSA area **Regular area** Stub area

OSPF Area Cost: 0

Logical Interface Profile - N3K-2_IP

Properties

Name: **N3K-2_IP**

Description: optional

Label:

ND policy: select a value

Egress Data Plane Policing Policy: select a value

Ingress Data Plane Policing Policy: select a value

Routed Interfaces:

Path	IP Address	MAC Address	MTU (Bytes)
No items have been found. Select Actions to create a new item.			

SVI:

Path	IP Address	Side A IP	Side B IP	MAC Address	MTU (Bytes)	Encap
Node-1066eth1/4	192.168.1.14/30			00:22:BD:F8:19:FF	1500	vlan-103

Routed Sub-Interfaces:

Path	IP Address	MAC Address	MTU (Bytes)	Encap
No items have been found. Select Actions to create a new item.				

为外部EPG的N3K-2 L3Out配置子网上的导入/导出路由控制，如图所示：

External Network Instance Profile - N3K-2_EXT_NET

Properties

Name: **N3K-2_EXT_NET**

Tags:

Description: optional

Configured VRF name: **VRF2**

Resolved VRF: **unitfn-T1ctx-VRF2**

QoS Class: **Unspecified**

Target DSCP: **unspecified**

Configuration Status: **applied**

Configuration Issues:

Subnets:

IP Address	Scope	Aggregate	Route Control Profile
10.10.10.0/24	Export Route Control Subnet		
20.20.20.0/24	External Subnets for the External EPG		

Route Control Profile:

Name	Direction
No items have been found. Select Actions to create a new item.	

步骤4.创建函数配置文件组并从现有模板配置函数配置文件，如图所示：

L4-L7 Services Function Profile - ASA5585_FP

Properties

Name: **ASA5585_FP**

Description:

Associated Function: **CISCO-ASA-12Firewall**

FEATURES AND PARAMETERS

Features:

- Interfaces
- AccessLists
- NAT
- TrafficSelectionObjects
- All

Basic Parameters

Meta Folder/Param Key	Name	Value	Mandatory	Locked	Shared
Device Config	Device				
Access List	access-list-inbound			false	false
Interface Related Configuration	externalf			false	false
Interface Related Configuration	internalf			false	false
Function Config	Function				
External Interface Configuration	ExtConfig			false	false
Internal Interface Configuration	IntConfig			false	false



Properties

Name: **ASA5585_FP**
 Description:
 Associated Function: **CISCO-ASA-1.2Firewall**

FEATURES AND PARAMETERS

Features:

- [Interfaces](#)
- [AccessLists](#)
- [NAT](#)
- [TrafficSelectionObjects](#)
- All**

Basic Parameters All Parameters

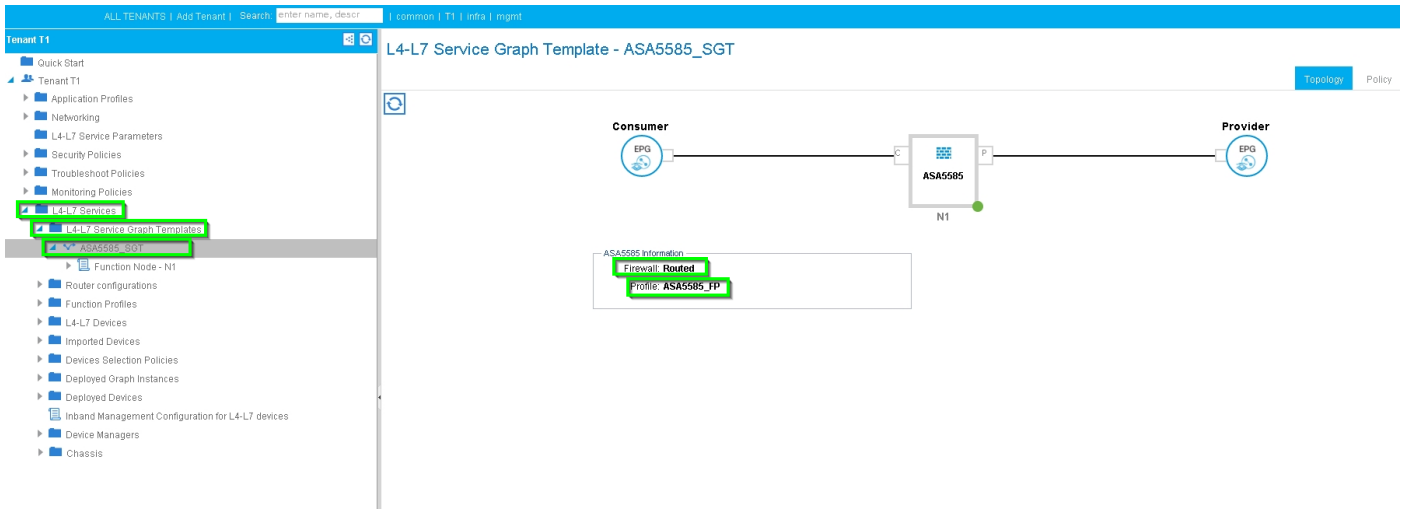
Meta Folder/Param Key	Name	Value	Mandatory	Locked	Shared
Device Config	Device				
Access List	access-list-inbound			false	false
Interface Related Configuration	externalif			false	false
Access Group	ExtAccessGroup			false	
Inbound Access List	name	access-list-inbound	false	false	
Interface Specific Configuration	externalifCfg			false	
IPv4 Address Configuration	IPv4Address			false	
IPv4 Address	ipv4_address	192.168.1.5/30	true	false	
Security Level	external_security_level	50	false	false	
Interface Related Configuration	internalif			false	false
Interface Specific Configuration	internalifCg			false	
IPv4 Address Configuration	IPv4Address			false	
IPv4 Address	ipv4_address	192.168.1.9/30	true	false	
Security Level	internal_security_level	100	false	false	
Function Config	Function				
External Interface Configuration	ExtConfig			false	false
Interface Configuration	ExtConfigrel	externalif	false	false	
Internal Interface Configuration	IntConfig			false	false
Interface Configuration	InConfigrel	internalif	false	false	

步骤5.创建合同并将范围字段修改为租户，如图所示：

The screenshot shows the Cisco ICM interface for configuring a contract named 'PERMIT_ALL'. The left sidebar shows the navigation tree with 'Contracts' selected. The main panel displays the 'Properties' section for the contract. The 'Scope' dropdown menu is highlighted with a green box and is currently set to 'Tenant'. Other fields include 'Label', 'QoS Class' (set to 'Unspecified'), 'Target DSCP' (set to 'unspecified'), and 'Description' (set to 'optional'). The 'Subjects' table below shows one subject named 'PERMIT_ALL' with filters 'T1/PERMIT_ALL'.

步骤6.如图所示，创建L4-L7服务图模板，其中服务图关联涉及将外部路由网络策略和路由器配置与设备选择策略关联。

:



Create L4-L7 Service Graph Template

Drag device clusters to create graph nodes.

Device Clusters

- T1 /ASA5585 (Managed Firewall)

Graph Name: ASA5585_SGT

Graph Type: Create A New One Clone An Existing One

Consumer EPG

ASA5585 N1

Provider EPG

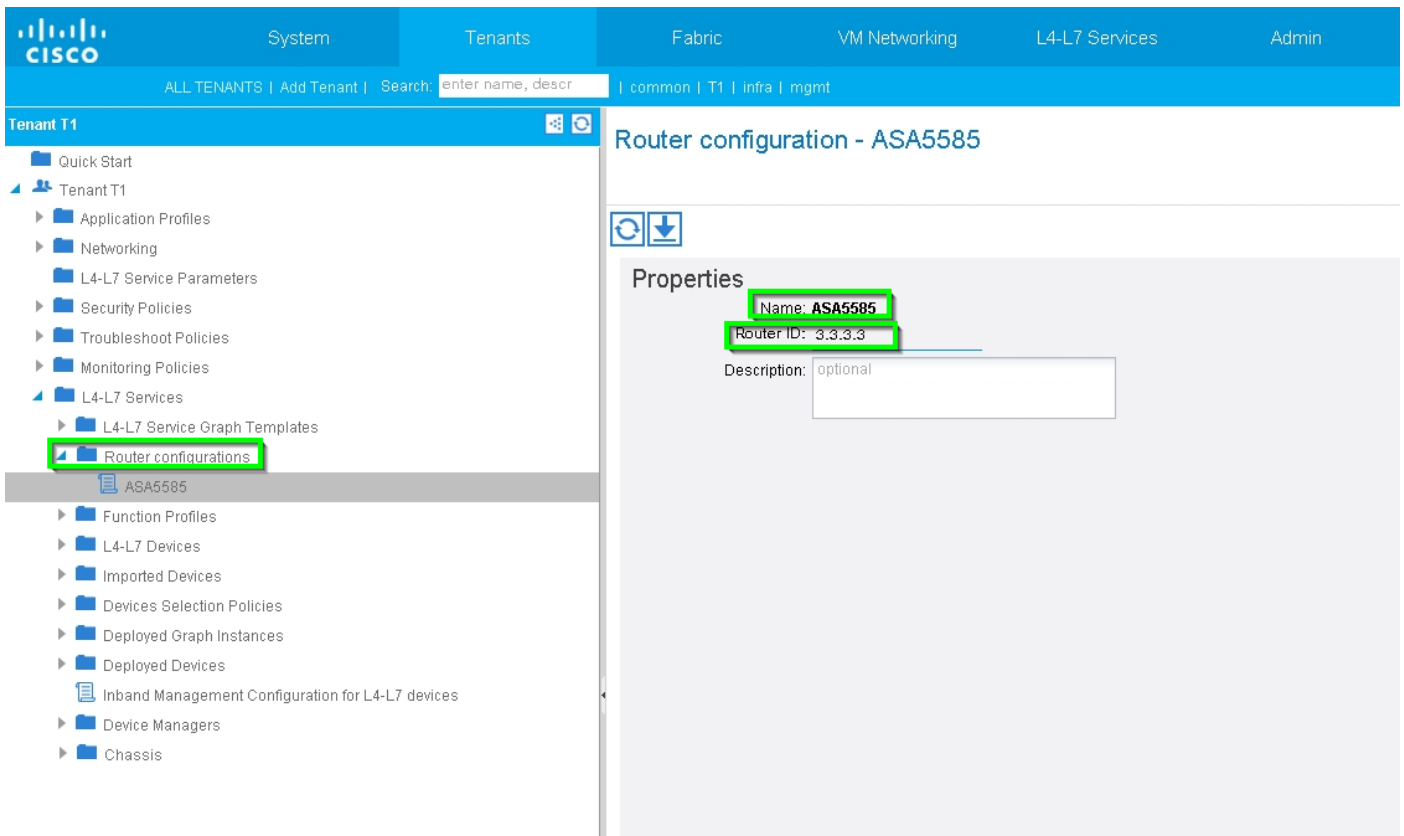
Please drag a device from devices table and drop it here to create a service node.

ASA5585 Information

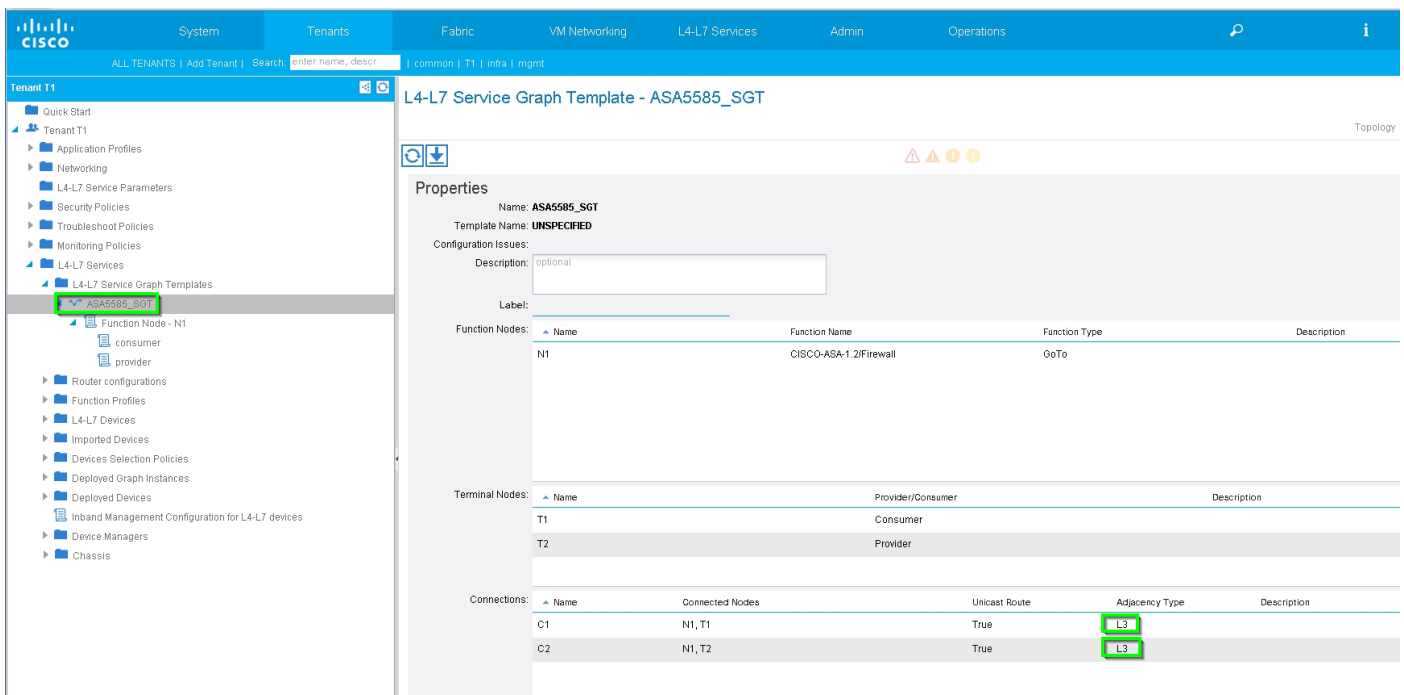
Firewall: Routed Transparent

Profile: T1/ASA5585_FP/ASA5585_FP

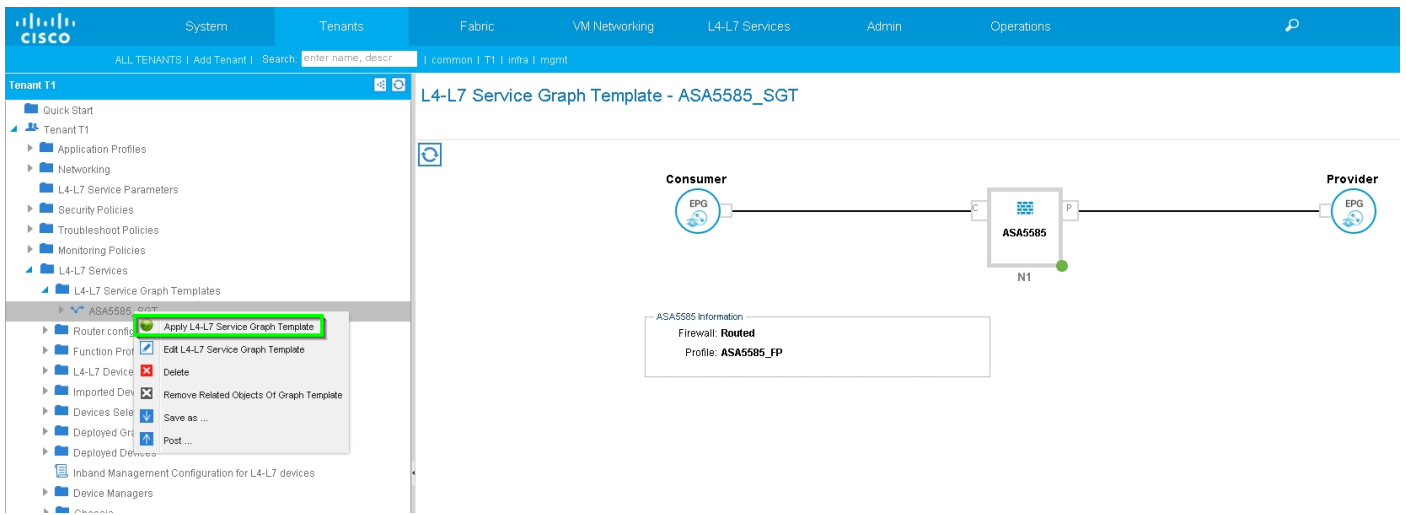
用于指定将在服务设备(ASA 5585)上使用的路由器ID的路由器配置，如图所示：



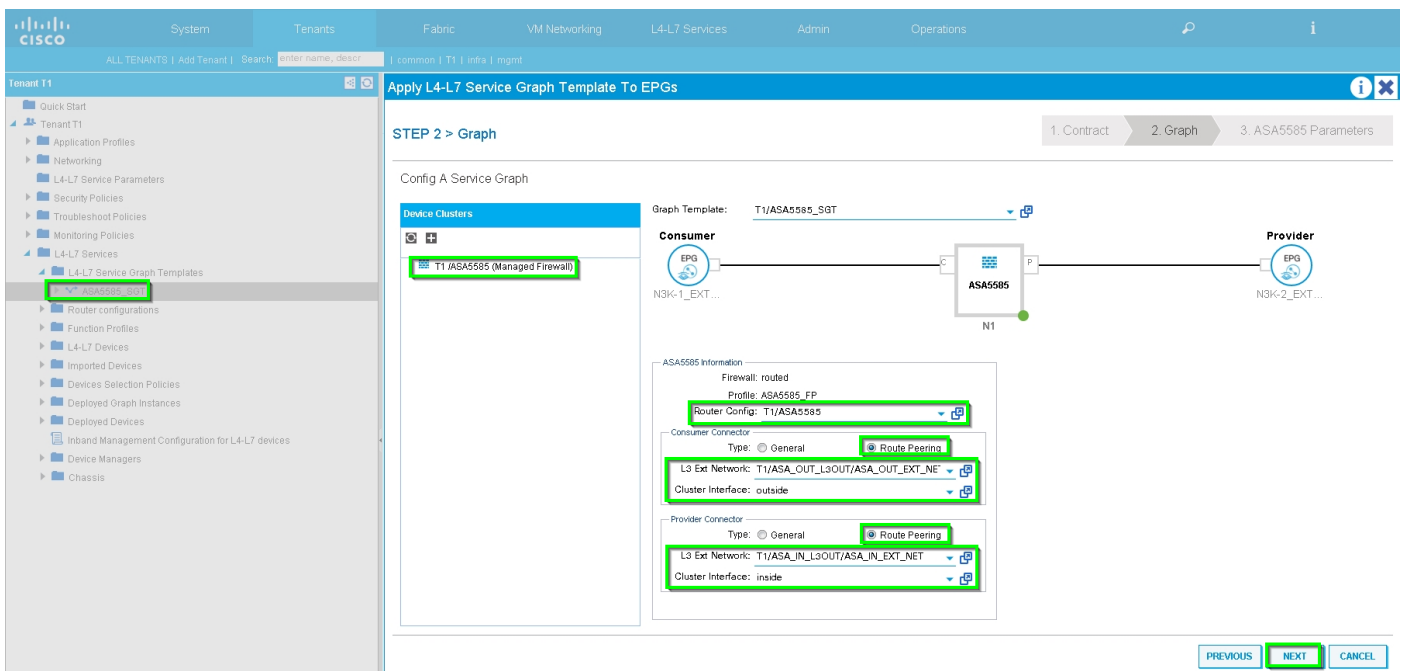
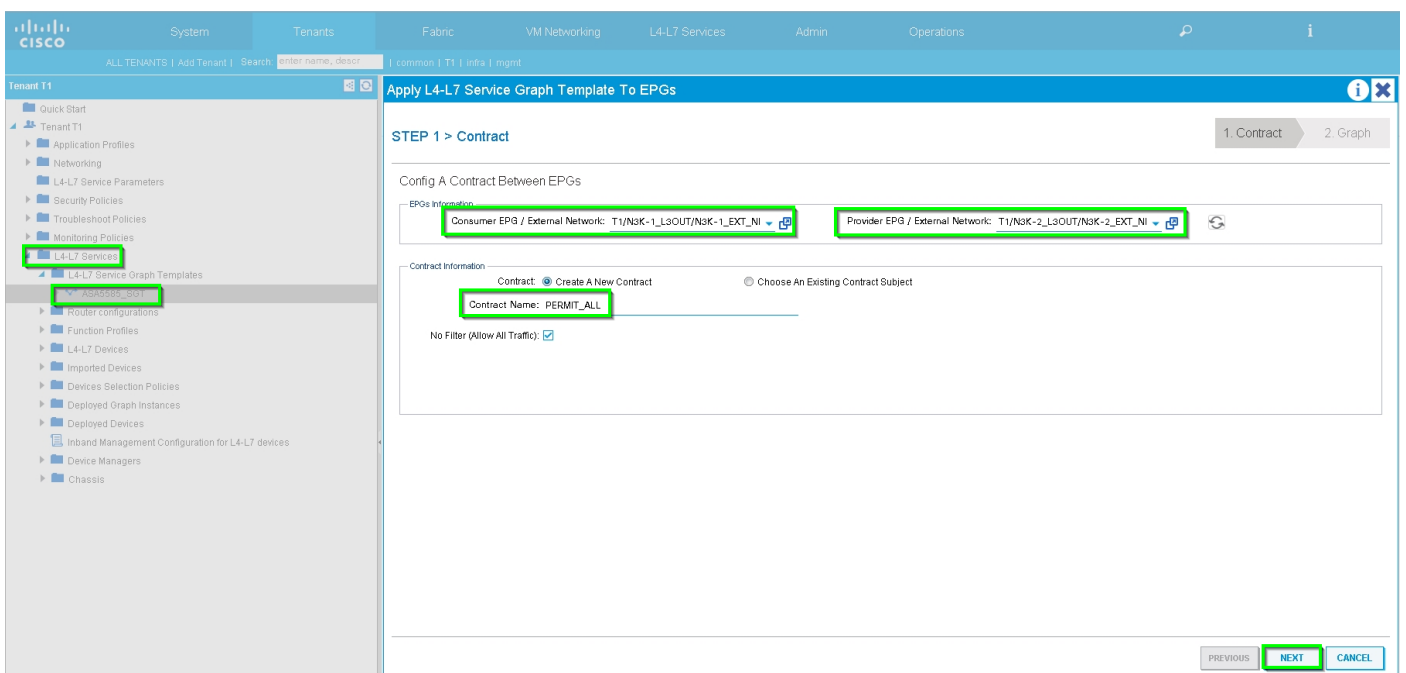
将邻接类型从L2更改为L3，如图所示：



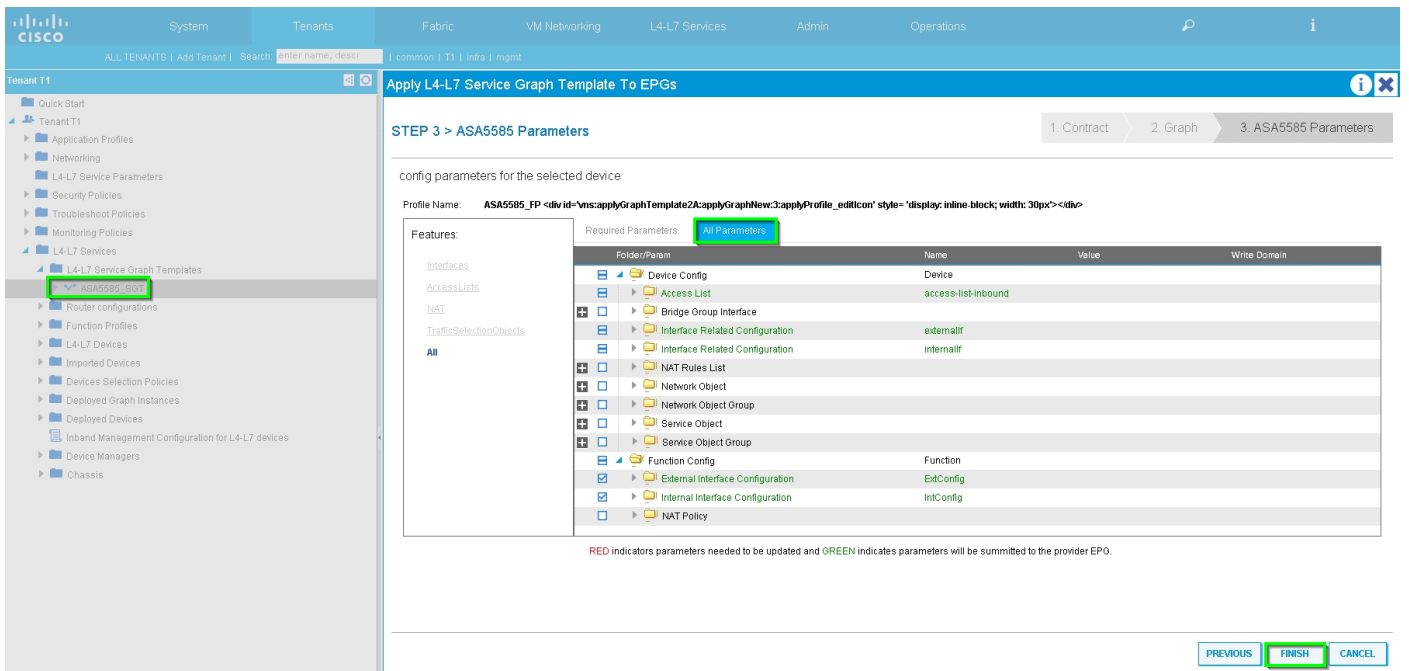
应用服务图模板，如图所示：



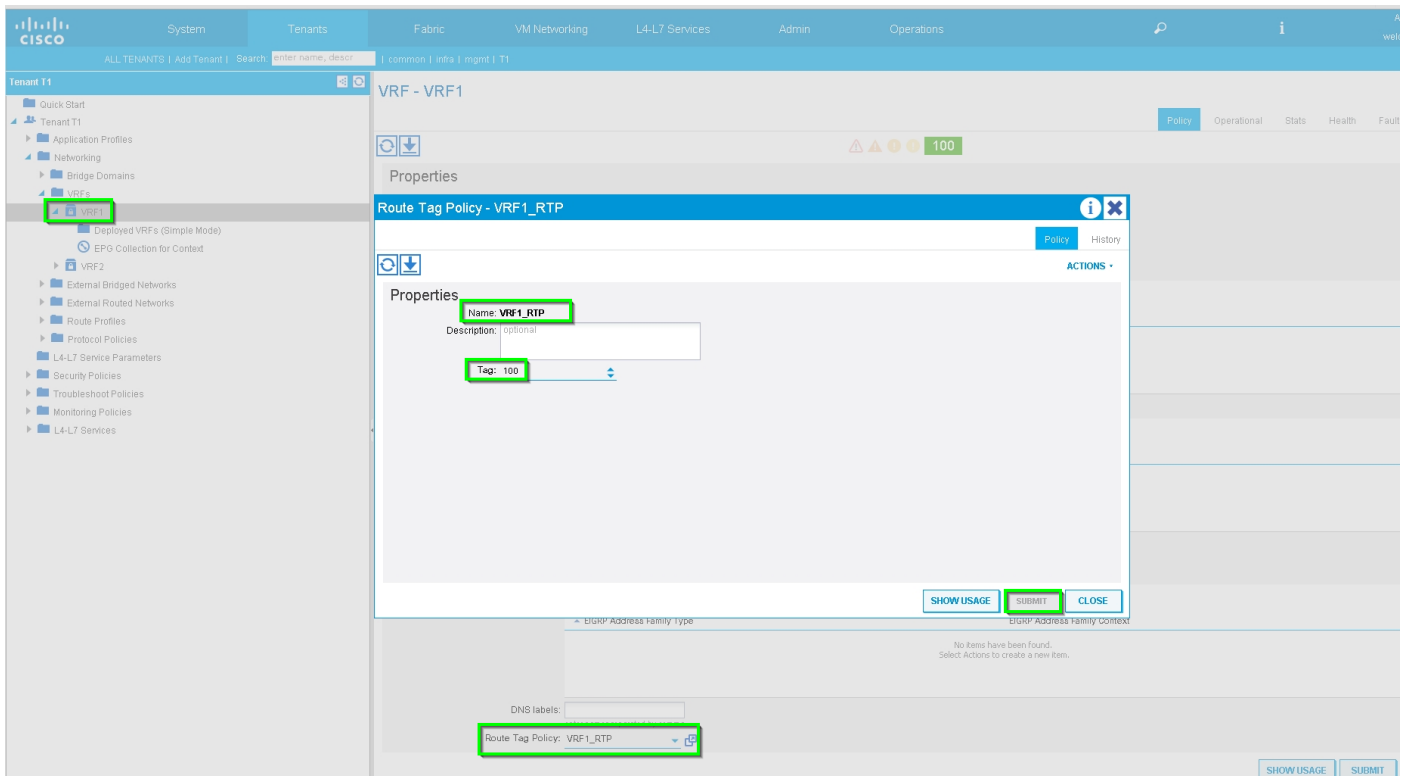
将服务图附加到合同，如图所示：



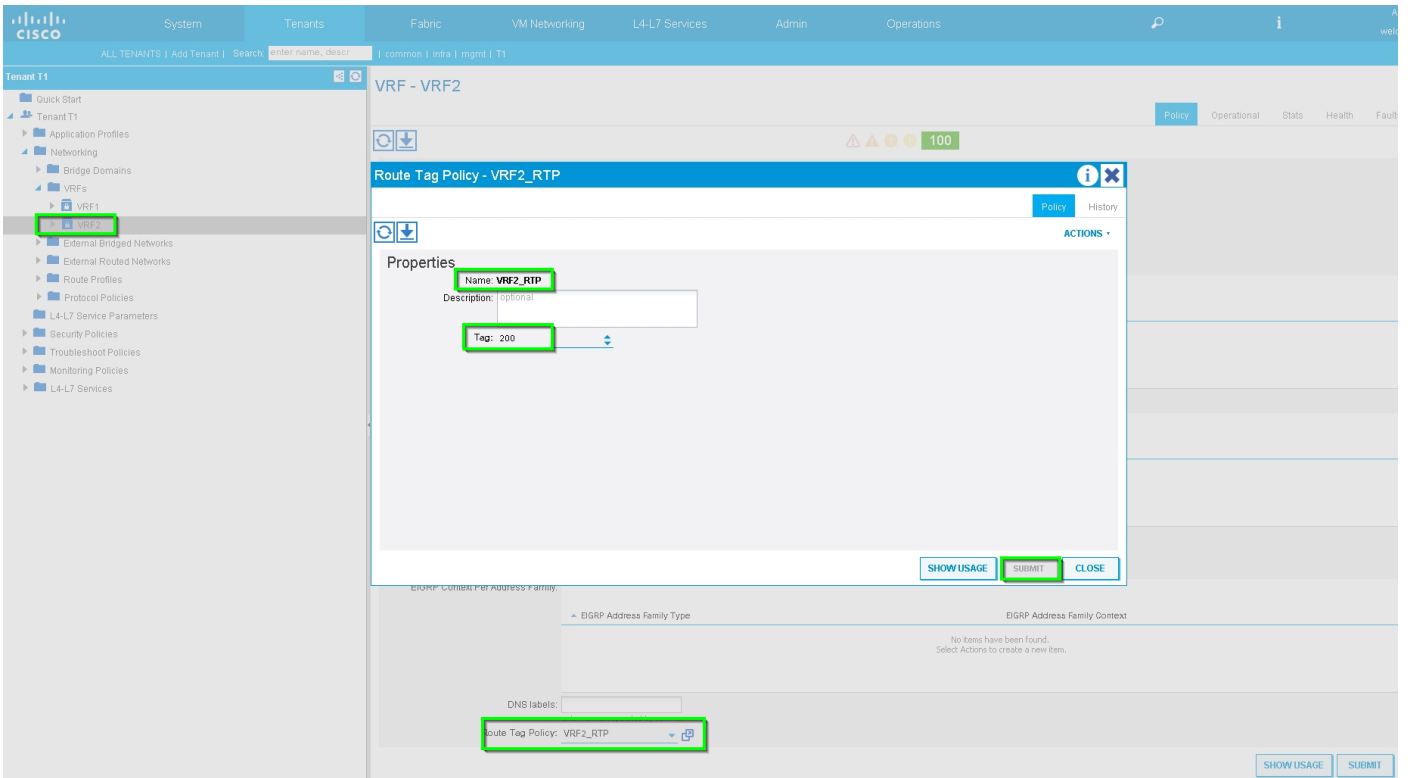
根据需要添加/更改L4-L7参数，如图所示：



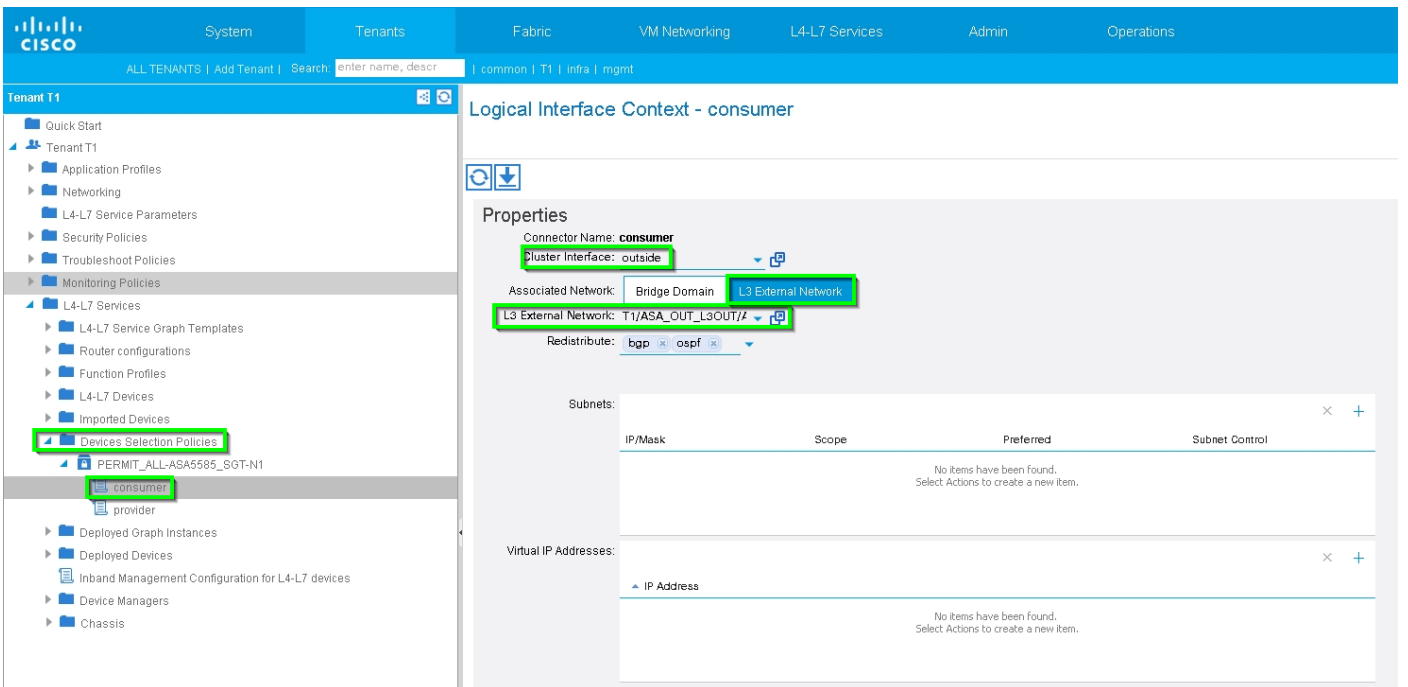
步骤 7：路由标记策略，配置VRF1的路由标记策略（标记：100），如图所示：



配置VRF2的路由标记策略（标记：200），如图所示：



步骤 8::检查状态并验证设备选择策略，如图所示：



System | Tenants | Fabric | VM Networking | L4-L7 Services | Admin | Operations

ALL TENANTS | Add Tenant | Search: enter name, descr | common | T1 | infra | mgmt

Tenant T1

- Quick Start
- Tenant T1
 - Application Profiles
 - Networking
 - L4-L7 Service Parameters
 - Security Policies
 - Troubleshoot Policies
 - Monitoring Policies
 - L4-L7 Services
 - L4-L7 Service Graph Templates
 - Router configurations
 - Function Profiles
 - L4-L7 Devices
 - Imported Devices
 - Devices Selection Policies
 - PERMIT_ALL-ASA5585_SOT-N1
 - consumer
 - provider
 - Deployed Graph Instances
 - Deployed Devices
 - Inband Management Configuration for L4-L7 devices
 - Device Managers
 - Chassis

Logical Interface Context - provider

Properties

Connector Name: provider
 Cluster Interface: inside
 Associated Network: Bridge Domain L3 External Network
 L3 External Network: T1/ASA_IN_L3OUT/AS
 Redistribute: bgp ospf

Subnets:

IP/Mask	Scope	Preferred	Subnet Control
No items have been found. Select Actions to create a new item.			

Virtual IP Addresses:

IP Address
No items have been found. Select Actions to create a new item.

验证已部署的图形实例，如图所示：

System | Tenants | Fabric | VM Networking | L4-L7 Services | Admin | Operations

ALL TENANTS | Add Tenant | Search: enter name, descr | common | T1 | infra | mgmt

Tenant T1

- Quick Start
- Tenant T1
 - Application Profiles
 - Networking
 - L4-L7 Service Parameters
 - Security Policies
 - Troubleshoot Policies
 - Monitoring Policies
 - L4-L7 Services
 - L4-L7 Service Graph Templates
 - Router configurations
 - Function Profiles
 - L4-L7 Devices
 - Imported Devices
 - Devices Selection Policies
 - PERMIT_ALL-ASA5585_SOT-N1
 - consumer
 - provider
 - Deployed Graph Instances
 - PERMIT_ALL-ASA5585_SOT-T1
 - Function Node-N1
 - Deployed Devices
 - Inband Management Configuration for L4-L7 devices
 - Device Managers
 - Chassis

Function Node - N1

Policy | Faults | Hist

Properties

Name: N1
 Function Type: GoTo
 Devices: ASA5585

Cluster Interfaces	Name	Concrete Interfaces	Encap
inside		ASA5585_Device_1(GigabitEthernet0/1)	unknown
outside		ASA5585_Device_1(GigabitEthernet0/0)	unknown

Function Connectors	Name	Encap	Class ID
consumer		vlan-101	32773
provider		vlan-102	49156

Folders And Parameters

Basic Parameters | All Parameters

Meta Folder/Param Key	Name	Value	Override Name/Value To
Features:			

System | Tenants | Fabric | VM Networking | L4-L7 Services | Admin | Operations

ALL TENANTS | Add Tenant | Search: enter name, descr | common | T1 | infra | mgmt

Tenant T1

Deployed Devices

Device Name	VRF
ASA5585	none

System | Tenants | Fabric | VM Networking | L4-L7 Services | Admin | Operations

ALL TENANTS | Add Tenant | Search: enter name, descr | common | T1 | infra | mgmt

Tenant T1

Device OSPF Configurations

Name	Enable	Context Name	Address Family	Area	Area Control	Area Type	Networks
ASA_IN_L3OUT_area_0	True	VRF2	IPv4	Backbone area	Send redistributed LSAs into NSSA area Originate customer LSA	Regular area	ASA_IN_EXT_NET (10.10.10.0/24)
ASA_OUT_L3OUT_area_0	True	VRF1	IPv4	Backbone area	Send redistributed LSAs into NSSA area Originate summary LSA	Regular area	ASA_OUT_EXT_NET (20.20.20.0/24)

验证与故障排除

租户的APIC配置：

```
apic1# sh running-config tenant T1
# Command: show running-config tenant T1
# Time: Thu Feb 25 16:05:14 2016
tenant T1
```

```
access-list PERMIT_ALL
  match ip
  exit
contract PERMIT_ALL
  scope tenant
  subject PERMIT_ALL
    access-group PERMIT_ALL both
    1417 graph ASA5585_SGT
  exit
exit
vrf context VRF1
  exit
vrf context VRF2
  exit
l3out ASA_IN_L3OUT
  vrf member VRF2
  exit
l3out ASA_OUT_L3OUT
  vrf member VRF1
  exit
l3out N3K-1_L3OUT
  vrf member VRF1
  exit
l3out N3K-2_L3OUT
  vrf member VRF2
  exit
bridge-domain BD1
  vrf member VRF1
  exit
bridge-domain BD2
  vrf member VRF2
  exit
application AP1
  epg EPG1
    bridge-domain member BD1
  exit
  epg EPG2
    bridge-domain member BD2
  exit
exit
external-l3 epg ASA_IN_EXT_NET l3out ASA_IN_L3OUT
  vrf member VRF2
  match ip 10.10.10.0/24
  exit
external-l3 epg ASA_OUT_EXT_NET l3out ASA_OUT_L3OUT
  vrf member VRF1
  match ip 20.20.20.0/24
  exit
external-l3 epg N3K-1_EXT_NET l3out N3K-1_L3OUT
  vrf member VRF1
  match ip 10.10.10.0/24
  contract consumer PERMIT_ALL
  exit
external-l3 epg N3K-2_EXT_NET l3out N3K-2_L3OUT
  vrf member VRF2
  match ip 20.20.20.0/24
  contract provider PERMIT_ALL
  exit
interface bridge-domain BD1
  exit
interface bridge-domain BD2
  exit
1417 cluster name ASA5585 type physical vlan-domain T1_PHY service FW function go-to
  cluster-device ASA5585_Device_1
```

```

cluster-interface inside
  member device ASA5585_Device_1 device-interface GigabitEthernet0/1
  interface ethernet 1/2 leaf 106
  exit
exit
cluster-interface outside
  member device ASA5585_Device_1 device-interface GigabitEthernet0/0
  interface ethernet 1/2 leaf 105
  exit
exit
exit
1417 graph ASA5585_SGT contract PERMIT_ALL
  service N1 device-cluster-tenant T1 device-cluster ASA5585 mode FW_ROUTED
  connector consumer cluster-interface outside
    1417-peer tenant T1 out ASA_OUT_L3OUT epg ASA_OUT_EXT_NET redistribute bgp,ospf
  exit
  connector provider cluster-interface inside
    1417-peer tenant T1 out ASA_IN_L3OUT epg ASA_IN_EXT_NET redistribute bgp,ospf
  exit
  rtr-cfg ASA5585
  exit
  connection C1 terminal consumer service N1 connector consumer
  connection C2 terminal provider service N1 connector provider
  exit
rtr-cfg ASA5585
  router-id 3.3.3.3
  exit
exit
apic1#

```

检验枝叶101上的OSPF邻居关系和路由表：

```

leaf101# show ip ospf neighbors vrf T1:VRF1
OSPF Process ID default VRF T1:VRF1
Total number of neighbors: 2
Neighbor ID      Pri State                Up Time  Address      Interface
1.1.1.1          1 FULL/BDR              02:07:19 192.168.1.1  Vlan8
3.3.3.3          1 FULL/BDR              00:38:35 192.168.1.5  Vlan9

leaf101# show ip route vrf T1:VRF1
IP Route Table for VRF "T1:VRF1"
'*' denotes best ucast next-hop
'***' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]
'%<string>' in via output denotes VRF <string>

10.10.10.0/24, ubest/mbest: 1/0
  *via 192.168.1.1, vlan8, [110/8], 01:59:50, ospf-default, intra
20.20.20.0/24, ubest/mbest: 1/0
  *via 192.168.1.5, vlan9, [110/22], 00:30:20, ospf-default, inter
100.100.100.100/32, ubest/mbest: 2/0, attached, direct
  *via 100.100.100.100, lo1, [1/0], 02:21:22, local, local
  *via 100.100.100.100, lo1, [1/0], 02:21:22, direct
192.168.1.0/30, ubest/mbest: 1/0, attached, direct
  *via 192.168.1.2, vlan8, [1/0], 02:35:53, direct
192.168.1.2/32, ubest/mbest: 1/0, attached
  *via 192.168.1.2, vlan8, [1/0], 02:35:53, local, local
192.168.1.4/30, ubest/mbest: 1/0, attached, direct
  *via 192.168.1.6, vlan9, [1/0], 02:20:53, direct
192.168.1.6/32, ubest/mbest: 1/0, attached
  *via 192.168.1.6, vlan9, [1/0], 02:20:53, local, local

```

```
192.168.1.8/30, ubest/mbest: 1/0
  *via 192.168.1.5, vlan9, [110/14], 00:30:20, ospf-default, intra
200.200.200.200/32, ubest/mbest: 1/0
  *via 192.168.1.5, vlan9, [110/15], 00:30:20, ospf-default, intra
```

检验枝叶102上的OSPF邻居关系和路由表：

```
leaf102# show ip ospf neighbors vrf T1:VRF2
OSPF Process ID default VRF T1:VRF2
Total number of neighbors: 2
Neighbor ID      Pri State           Up Time  Address      Interface
3.3.3.3          1 FULL/BDR         00:37:07 192.168.1.9  Vlan14
2.2.2.2          1 FULL/BDR         02:09:59 192.168.1.13 Vlan15
```

```
leaf102# show ip route vrf T1:VRF2
IP Route Table for VRF "T1:VRF2"
'*' denotes best ucast next-hop
***' denotes best mcast next-hop
'[x/y]' denotes [preference/metric]
'%<string>' in via output denotes VRF <string>
```

```
10.10.10.0/24, ubest/mbest: 1/0
  *via 192.168.1.9, vlan14, [110/22], 00:35:22, ospf-default, inter
20.20.20.0/24, ubest/mbest: 1/0
  *via 192.168.1.13, vlan15, [110/8], 02:08:13, ospf-default, intra
192.168.1.4/30, ubest/mbest: 1/0
  *via 192.168.1.9, vlan14, [110/14], 00:35:22, ospf-default, intra
192.168.1.8/30, ubest/mbest: 1/0, attached, direct
  *via 192.168.1.10, vlan14, [1/0], 02:14:29, direct
192.168.1.10/32, ubest/mbest: 1/0, attached
  *via 192.168.1.10, vlan14, [1/0], 02:14:29, local, local
192.168.1.12/30, ubest/mbest: 1/0, attached, direct
  *via 192.168.1.14, vlan15, [1/0], 02:09:04, direct
192.168.1.14/32, ubest/mbest: 1/0, attached
  *via 192.168.1.14, vlan15, [1/0], 02:09:04, local, local
200.200.200.200/32, ubest/mbest: 2/0, attached, direct
  *via 200.200.200.200, lo4, [1/0], 02:10:02, local, local
  *via 200.200.200.200, lo4, [1/0], 02:10:02, direct
```

检验ASA 5585上的配置、OSPF邻居关系和路由表：

```
ASA5585# sh run interface
!
interface GigabitEthernet0/0
 no nameif
 security-level 0
 no ip address
!
interface GigabitEthernet0/0.101
 nameif externalIf
 security-level 50
 ip address 192.168.1.5 255.255.255.252
!
interface GigabitEthernet0/1
 no nameif
 security-level 100
 no ip address
!
interface GigabitEthernet0/1.102
 nameif internalIf
```

```
security-level 100
ip address 192.168.1.9 255.255.255.252
!
interface Management0/0
management-only
nameif management
security-level 0
ip address 172.23.97.1 255.255.254.0
```

```
ASA5585# sh run router
router ospf 1
router-id 3.3.3.3
network 192.168.1.4 255.255.255.252 area 0
network 192.168.1.8 255.255.255.252 area 0
area 0
log-adj-changes
!
```

```
ASA5585# sh ospf neighbor
```

Neighbor ID	Pri	State	Dead Time	Address	Interface
100.100.100.100	1	FULL/DR	0:00:38	192.168.1.6	externalIf
200.200.200.200	1	FULL/DR	0:00:33	192.168.1.10	internalIf

```
ASA5585# sh route ospf
```

```
Routing Table: T1
```

```
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, + - replicated route
Gateway of last resort is not set
```

```
O IA    10.10.10.0 255.255.255.0
        [110/18] via 192.168.1.6, 00:22:57, externalIf
O IA    20.20.20.0 255.255.255.0
        [110/18] via 192.168.1.10, 00:22:47, internalIf
O       200.200.200.200 255.255.255.255
        [110/11] via 192.168.1.10, 00:22:47, internalIf
```

```
ASA5585# sh access-list
access-list cached ACL log flows: total 0, denied 0 (deny-flow-max 4096)
        alert-interval 300
access-list access-list-inbound; 3 elements; name hash: 0xcb5bd6c7
access-list access-list-inbound line 1 extended permit tcp any any eq www (hitcnt=0) 0xc873a747
access-list access-list-inbound line 2 extended permit tcp any any eq https (hitcnt=0)
0x48bedbdd
```

```
access-list access-list-inbound line 3 extended permit icmp any any (hitcnt=6) 0xe4b5a75d
```

检验N3K-1上的配置、OSPF邻居关系和路由表:

```

N3K-1# sh run ospf

!Command: show running-config ospf
!Time: Thu Feb 25 15:40:55 2016

version 6.0(2)U3(7)
feature ospf

router ospf 1
  router-id 1.1.1.1

interface Ethernet1/21
  ip router ospf 1 area 0.0.0.1

interface Ethernet1/47
  ip router ospf 1 area 0.0.0.1

```

```

N3K-1# sh ip ospf neighbors
OSPF Process ID 1 VRF default
Total number of neighbors: 1
Neighbor ID      Pri State                Up Time  Address      Interface
100.100.100.100  1 FULL/DR              01:36:24 192.168.1.2  Eth1/47

```

```

N3K-1# sh ip ospf route
OSPF Process ID 1 VRF default, Routing Table
(D) denotes route is directly attached      (R) denotes route is in RIB
10.10.10.0/24 (intra)(D) area 0.0.0.1
  via 10.10.10.0/Eth1/21* , cost 4
20.20.20.0/24 (inter)(R) area 0.0.0.1
  via 192.168.1.2/Eth1/47 , cost 62
100.100.100.100/32 (intra)(R) area 0.0.0.1
  via 192.168.1.2/Eth1/47 , cost 41
192.168.1.0/30 (intra)(D) area 0.0.0.1
  via 192.168.1.1/Eth1/47* , cost 40

```

检验N3K-2上的配置、OSPF邻居关系和路由表:

```

N3K-2# sh run ospf

!Command: show running-config ospf
!Time: Thu Feb 25 15:44:47 2016

version 6.0(2)U3(7)
feature ospf

router ospf 1
  router-id 2.2.2.2

interface loopback0
  ip ospf network point-to-point
  ip router ospf 1 area 0.0.0.0

interface Ethernet1/21
  ip router ospf 1 area 0.0.0.1

interface Ethernet1/47
  ip router ospf 1 area 0.0.0.1

```

```
N3K-2# sh ip ospf neighbors
OSPF Process ID 1 VRF default
Total number of neighbors: 1
Neighbor ID      Pri State                Up Time  Address      Interface
200.200.200.200  1 FULL/DR              01:43:50 192.168.1.14 Eth1/47
```

```
N3K-2# sh ip ospf route
OSPF Process ID 1 VRF default, Routing Table
(D) denotes route is directly attached      (R) denotes route is in RIB
2.2.2.0/30 (intra)(D) area 0.0.0.0
  via 2.2.2.0/Lo0* , cost 1
10.10.10.0/24 (inter)(R) area 0.0.0.1
  via 192.168.1.14/Eth1/47 , cost 62
20.20.20.0/24 (intra)(D) area 0.0.0.1
  via 20.20.20.0/Eth1/21* , cost 4
192.168.1.12/30 (intra)(D) area 0.0.0.1
  via 192.168.1.13/Eth1/47* , cost 40
```

验证枝叶上的合同过滤器规则和数据包命中计数：。

```
leaf101# show system internal policy-mgr stats
Requested Rule Statistics
[CUT]
Rule (4107) DN (sys/actrl/scope-3112964/rule-3112964-s-32773-d-49158-f-33)      Ingress: 1316,
Egress: 0, Pkts: 0 RevPkts: 0
Rule (4108) DN (sys/actrl/scope-3112964/rule-3112964-s-49158-d-32773-f-33)      Ingress: 1317,
Egress: 0, Pkts: 0 RevPkts: 0
```

```
leaf101# show system internal policy-mgr stats
Requested Rule Statistics
[CUT]
Rule (4107) DN (sys/actrl/scope-3112964/rule-3112964-s-32773-d-49158-f-33)      Ingress: 2317,
Egress: 0, Pkts: 0 RevPkts: 0
Rule (4108) DN (sys/actrl/scope-3112964/rule-3112964-s-49158-d-32773-f-33)      Ingress: 2317,
Egress: 0, Pkts: 0 RevPkts: 0
```

```
leaf102# show system internal policy-mgr stats Requested Rule Statistics [CUT] Rule (4103) DN
(sys/actrl/scope-2752520/rule-2752520-s-49156-d-6019-f-default) Ingress: 3394, Egress: 0, Pkts:
0 RevPkts: 0 Rule (4104) DN (sys/actrl/scope-2752520/rule-2752520-s-6019-d-49156-f-default)
Ingress: 3394, Egress: 0, Pkts: 0 RevPkts: 0 [CUT] leaf102# show system internal policy-mgr
stats Requested Rule Statistics [CUT] Rule (4103) DN (sys/actrl/scope-2752520/rule-2752520-s-
49156-d-6019-f-default) Ingress: 4392, Egress: 0, Pkts: 0 RevPkts: 0 Rule (4104) DN
(sys/actrl/scope-2752520/rule-2752520-s-6019-d-49156-f-default) Ingress: 4392, Egress: 0, Pkts:
0 RevPkts: 0 [CUT]
```

N3K-1和N3K-2之间的连通性测试：

```
N3K-1# ping 20.20.20.1 source 10.10.10.1
PING 20.20.20.1 (20.20.20.1) from 10.10.10.1: 56 data bytes
64 bytes from 20.20.20.1: icmp_seq=0 ttl=250 time=2.098 ms
64 bytes from 20.20.20.1: icmp_seq=1 ttl=250 time=0.922 ms
64 bytes from 20.20.20.1: icmp_seq=2 ttl=250 time=0.926 ms
64 bytes from 20.20.20.1: icmp_seq=3 ttl=250 time=0.893 ms
64 bytes from 20.20.20.1: icmp_seq=4 ttl=250 time=0.941 ms
```

```
--- 20.20.20.1 ping statistics ---
```



```
5 packets transmitted, 5 packets received, 0.00% packet loss  
round-trip min/avg/max = 0.893/1.156/2.098 ms
```

```
N3K-2# ping 10.10.10.1 source 20.20.20.1
```

```
PING 10.10.10.1 (10.10.10.1) from 20.20.20.1: 56 data bytes
```

```
64 bytes from 10.10.10.1: icmp_seq=0 ttl=250 time=2.075 ms
```

```
64 bytes from 10.10.10.1: icmp_seq=1 ttl=250 time=0.915 ms
```

```
64 bytes from 10.10.10.1: icmp_seq=2 ttl=250 time=0.888 ms
```

```
64 bytes from 10.10.10.1: icmp_seq=3 ttl=250 time=1.747 ms
```

```
64 bytes from 10.10.10.1: icmp_seq=4 ttl=250 time=0.828 ms
```

```
--- 10.10.10.1 ping statistics ---
```

```
5 packets transmitted, 5 packets received, 0.00% packet loss
```

```
round-trip min/avg/max = 0.828/1.29/2.075 ms
```

附加的是租户和ASA功能配置文件的XML配置文件，用于本演示。