Firepower威胁防御IGMP和组播基础故障排除

目录

简介

本文档介绍组播的基础知识，以及Firepower威胁防御(FTD)如何实施互联网组管理协议(IGMP)。

先决条件

要求

基本IP路由知识。

使用的组件

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。

本文内容也适用于自适应安全设备(ASA)软件。

本文档中的信息基于以下软件和硬件版本：

- 思科Firepower 4125威胁防御版本7.1.0。
- Firepower管理中心(FMC)版本7.1.0。
- ASA 9.19.1 版.

背景信息

定义

- 单播=从一台主机到另一台主机（一对一）。
- 广播=从一台主机到所有可能的主机（一对全）。
- 组播=从一组主机的主机到一组主机（一对多或多对多）。
- 任播=从主机到组的最近主机（一对多对一）。

基本信息

- 组播RFC 988由Steve Deering于1986年编写。
- IPv4组播使用的范围是224.0.0.0/4（前4位1110） — 224.0.0.0 - 239.255.255.255。
- 对于IPv4，第2层MAC地址来自第3层组播IP:01005e（24位）+第25位，始终为0 +组播IPv4地址的低23位。
- IPv6组播使用范围FF00::/8，它比IPv4组播更灵活，因为它可以嵌入交汇点(RP)IP。
- 对于IPv6,L2 MAC地址来自L3组播：333 + 32位组播IPv6地址。
- 组播优势：由于源上的负载减少，效率提高。性能，因为它避免了流量重复或泛洪。
- 组播的缺点：传输不可靠（基于UDP）、无拥塞避免、传输顺序不当。
- 公共互联网不支持组播，因为它需要路径中的所有设备才能启用组播。通常，当所有设备都受同一管理权限管理时使用。
- 典型组播应用：内部视频流、视频会议。

组播与复制单播

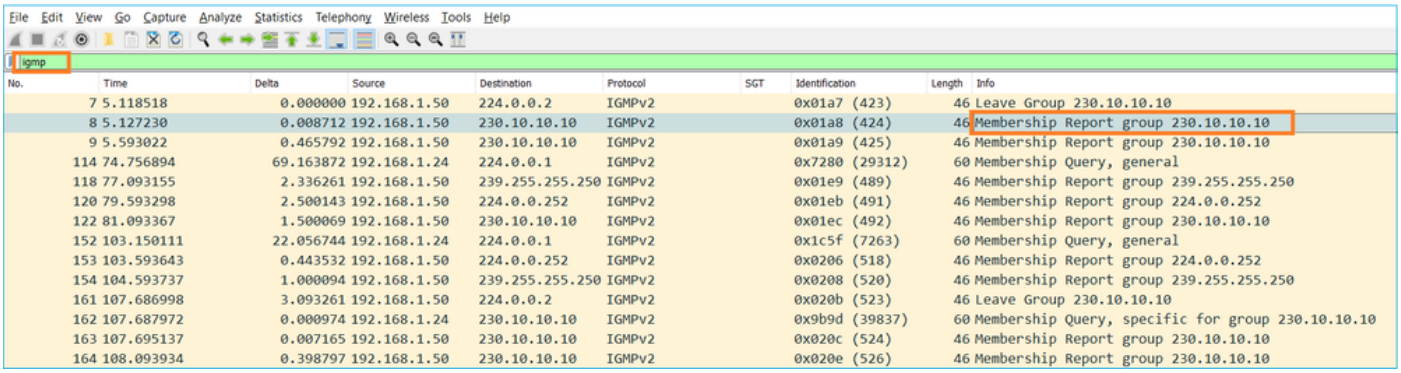
在复制单播中，源创建同一单播数据包（副本）的多个副本，并将它们发送到多个目标主机。组播将负担从源主机转移到网络，而在复制单播中，所有工作都在源主机上完成。

配置

IGMP基础知识

- IGMP是组播接收器和本地L3设备（通常为路由器）之间的“语言”。
- IGMP是第3层协议（与ICMP类似），使用IP协议编号2。
- 当前有3个IGMP版本。防火墙上的默认IGMP版本是版本2。当前仅支持版本1和2。
- IGMPv1和IGMPv2之间的主要区别如下：
    - IGMPv1没有离开组消息。
    - IGMPv1没有特定于组的查询（当主机离开组播组时，防火墙会使用它）。
    - IGMPv1没有查询器选举过程。
- ASA/FTD目前不支持IGMPv3，但作为参考，IGMPv2和IGMPv3之间的重要区别在于IGMPv3中包含组和源特定查询，该查询用于源特定组播(SSM)。

- IGMPv1/IGMPv2/IGMPv3查询= 224.0.0.1
  IGMPv2离开= 224.0.0.2
  IGMPv3成员报告= 224.0.0.22
- 如果主机要加入，可以发送未经请求的IGMP成员身份报告消息：



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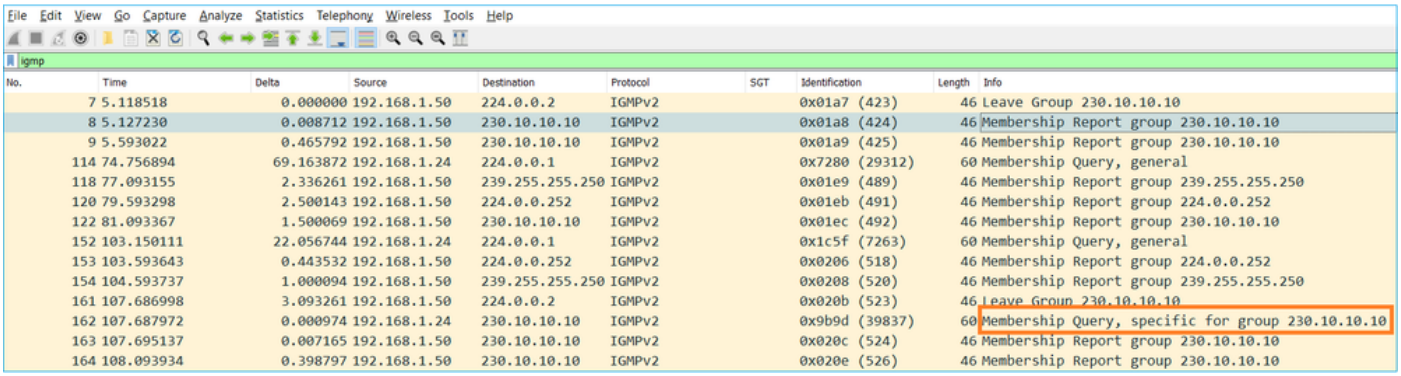
igmp

No.	Time	Delta	Source	Destination	Protocol	SGT	Identification	Length	Info
7	5.118518	0.000000	192.168.1.50	224.0.0.2	IGMPv2		0x01a7 (423)	46	Leave Group 230.10.10.10
8	5.127230	0.008712	192.168.1.50	230.10.10.10	IGMPv2		0x01a8 (424)	46	Membership Report group 230.10.10.10
9	5.593022	0.465792	192.168.1.50	230.10.10.10	IGMPv2		0x01a9 (425)	46	Membership Report group 230.10.10.10
114	74.756894	69.163872	192.168.1.24	224.0.0.1	IGMPv2		0x7280 (29312)	60	Membership Query, general
118	77.093155	2.336261	192.168.1.50	239.255.255.250	IGMPv2		0x01e9 (489)	46	Membership Report group 239.255.255.250
120	79.593298	2.500143	192.168.1.50	224.0.0.252	IGMPv2		0x01eb (491)	46	Membership Report group 224.0.0.252
122	81.093367	1.500069	192.168.1.50	230.10.10.10	IGMPv2		0x01ec (492)	46	Membership Report group 230.10.10.10
152	103.150111	22.056744	192.168.1.24	224.0.0.1	IGMPv2		0x1c5f (7263)	60	Membership Query, general
153	103.593643	0.443532	192.168.1.50	224.0.0.252	IGMPv2		0x0206 (518)	46	Membership Report group 224.0.0.252
154	104.593737	1.000094	192.168.1.50	239.255.255.250	IGMPv2		0x0208 (520)	46	Membership Report group 239.255.255.250
161	107.686998	3.093261	192.168.1.50	224.0.0.2	IGMPv2		0x020b (523)	46	Leave Group 230.10.10.10
162	107.687972	0.000974	192.168.1.24	230.10.10.10	IGMPv2		0x9b9d (39837)	60	Membership Query, specific for group 230.10.10.10
163	107.695137	0.007165	192.168.1.50	230.10.10.10	IGMPv2		0x020c (524)	46	Membership Report group 230.10.10.10
164	108.093934	0.398797	192.168.1.50	230.10.10.10	IGMPv2		0x020e (526)	46	Membership Report group 230.10.10.10

- 从防火墙的角度来看，IGMP查询有两种类型：常规查询和特定组的查询
- 当防火墙收到IGMP离开组消息时，它必须检查该子网上是否有该组的其它成员。因此，防火墙会发送组特定查询：



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igmp

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- 在有多台路由器/防火墙的子网上，选择querier（发送所有IGMP查询的设备）：

<#root>

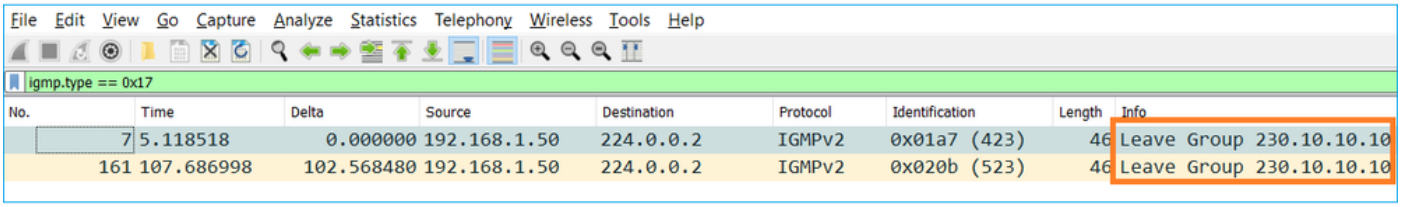
```
firepower#

show igmp interface INSIDE

INSIDE is up, line protocol is up
  Internet address is 192.168.1.97/24
  IGMP is enabled on interface
  Current IGMP version is 2
  IGMP query interval is 125 seconds
  IGMP querier timeout is 60 seconds
  IGMP max query response time is 10 seconds
  Last member query response interval is 1 seconds
  Inbound IGMP access group is:
  IGMP limit is 500, currently active joins: 2
  Cumulative IGMP activity: 21 joins, 20 leaves


 IGMP querying router is 192.168.1.97 (this system)
```

```
<-- IGMP querier
```

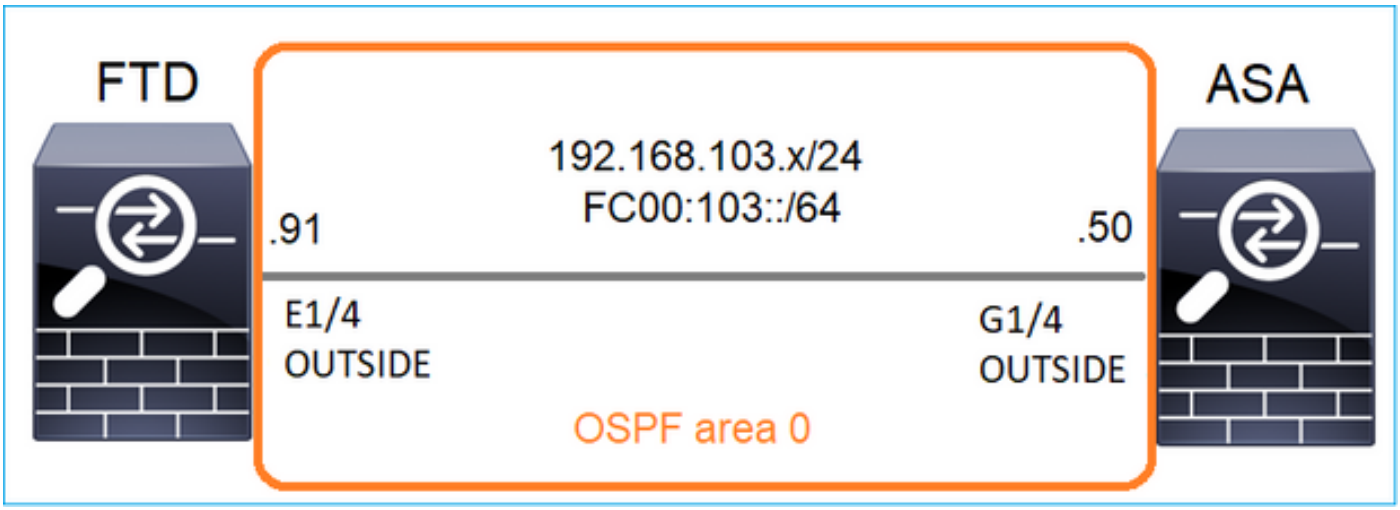
- 在FTD上（类似于传统ASA），您可以启用debug igmp以查看与IGMP相关的消息：

```
<#root>

firepower#

debug igmp

IGMP debugging is on
IGMP: Received v2 Query on DMZ from 192.168.6.1

IGMP: Received v2 Report on INSIDE from 192.168.1.50 for 239.255.255.250

<-- Received an IGMP packet
IGMP: group_db: add new group 239.255.255.250 on INSIDE
IGMP: MRIB updated (*,239.255.255.250) : Success
IGMP: Switching to EXCLUDE mode for 239.255.255.250 on INSIDE
IGMP: Updating EXCLUDE group timer for 239.255.255.250
IGMP: Received v2 Report on INSIDE from 192.168.1.50 for 230.10.10.10
IGMP: group_db: add new group 230.10.10.10 on INSIDE
IGMP: MRIB updated (*,230.10.10.10) : Success
IGMP: Switching to EXCLUDE mode for 230.10.10.10 on INSIDE
IGMP: Updating EXCLUDE group timer for 230.10.10.10
IGMP: Send v2 general Query on INSIDE
IGMP: Received v2 Query on INSIDE from 192.168.1.97
IGMP: Send v2 general Query on OUTSIDE
IGMP: Received v2 Query on OUTSIDE from 192.168.103.91
IGMP: Received v2 Report on INSIDE from 192.168.1.50 for 239.255.255.250
IGMP: Updating EXCLUDE group timer for 239.255.255.250
IGMP: Received v2 Report on INSIDE from 192.168.1.50 for 230.10.10.10
IGMP: Updating EXCLUDE group timer for 230.10.10.10
```

- 主机通常使用离开组消息(IGMPv2)离开组播组。



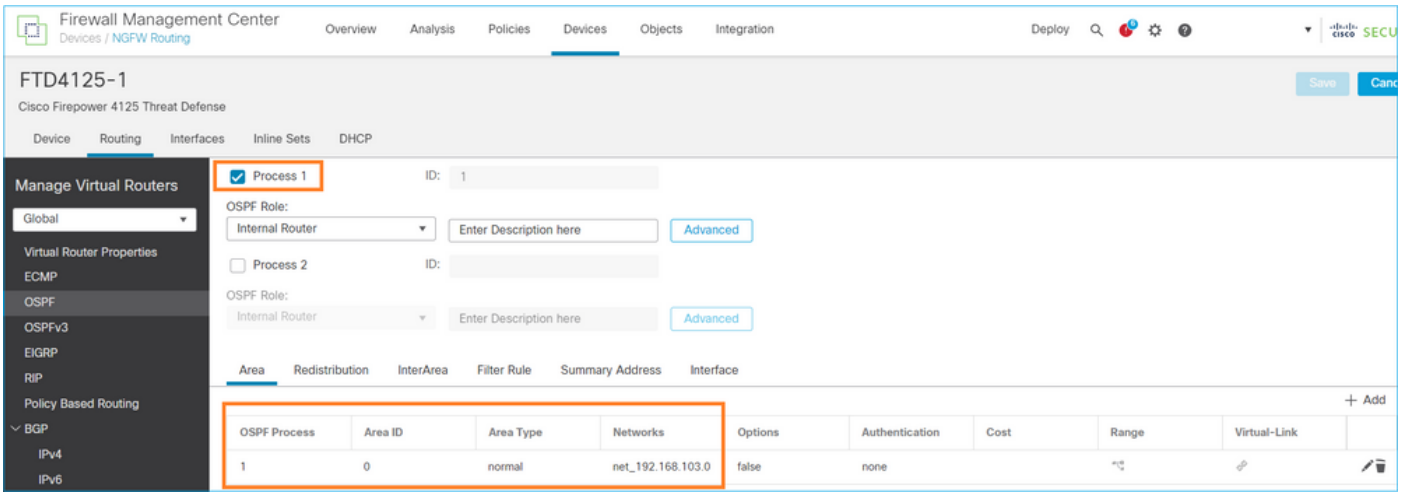
任务1 — 控制平面组播流量

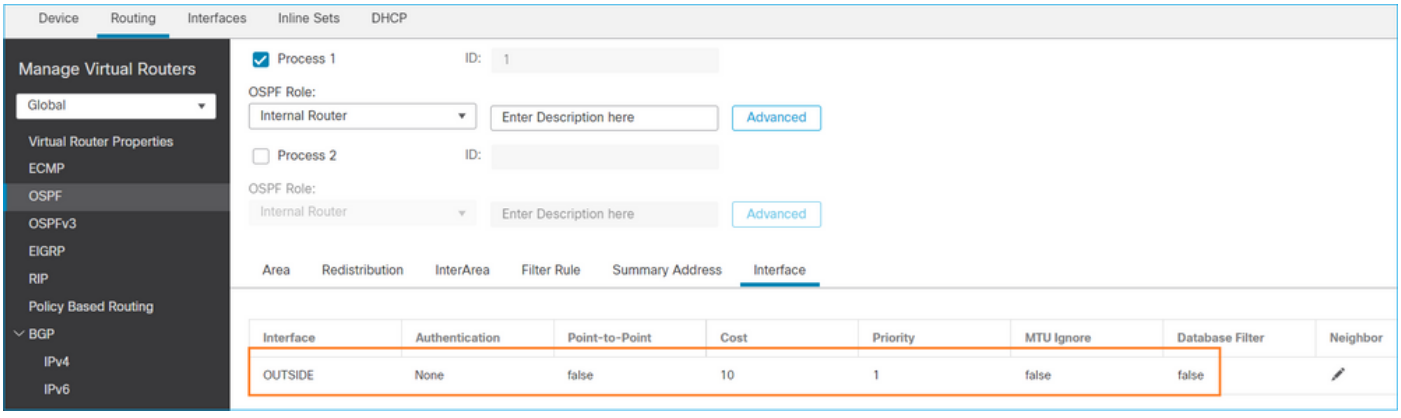


在FTD和ASA之间配置OSPFv2和OSPFv3。检查2台设备如何处理OSPF生成的L2和L3组播流量。

解决方案

OSPFv2配置





同样，对于OSPFv3

FTD CLI上的配置：

<#root>

```
router ospf 1

 network 192.168.103.0 255.255.255.0 area 0

 log-adj-changes
!

ipv6 router ospf 1

 no graceful-restart helper
 log-adjacency-changes
!
interface Ethernet1/4
nameif OUTSIDE
security-level 0
ip address 192.168.103.91 255.255.255.0
ipv6 address fc00:103::91/64
ospf authentication null

ipv6 ospf 1 area 0
```

配置会在FTD加速安全路径(ASP)允许表中创建以下条目，以便入口组播流量不会被阻止：

```
<#root>

firepower#

show asp table classify domain permit

...
in id=0x14f922db85f0, priority=13,

domain=permit, deny=false

<-- permit the packets
        hits=1, user_data=0x0, cs_id=0x0, reverse, flags=0x0, protocol=89
        src ip/id=0.0.0.0, mask=0.0.0.0, port=0, tag=any


dst ip/id=224.0.0.5, mask=255.255.255.255,

 port=0, tag=any, dscp=0x0, nsg_id=none     <-- OSPF for IPv4


input_ifc=OUTSIDE

(vrfid:0), output_ifc=identity(vrfid:0)     <-- ingress interface
in id=0x14f922db9350, priority=13,

domain=permit, deny=false

<-- permit the packets
        hits=0, user_data=0x0, cs_id=0x0, reverse, flags=0x0, protocol=89
        src ip/id=0.0.0.0, mask=0.0.0.0, port=0, tag=any


 dst ip/id=224.0.0.6, mask=255.255.255.255

, port=0, tag=any, dscp=0x0, nsg_id=none     <-- OSPF for IPv4


input_ifc=OUTSIDE
```

```
(vrfid:0), output_ifc=identity(vrfid:0)     <-- ingress interface
```

对于IPv6:

<#root>

```
...
in id=0x14f923fb16f0, priority=13,
```

domain=permit, deny=false

```
 <-- permit the packets
        hits=1, user_data=0x0, cs_id=0x0, reverse, flags=0x0, protocol=89
        src ip/id=::/0, port=0, tag=any
```

dst ip/id=ff02::5/128

```
, port=0, tag=any, , nsg_id=none     <-- OSPF for IPv6
```

input_ifc=OUTSIDE

```
(vrfid:0), output_ifc=identity(vrfid:0)  <-- ingress interface
in id=0x14f66e9d4780, priority=13,
```

domain=permit, deny=false

```
<-- permit the packets
        hits=0, user_data=0x0, cs_id=0x0, reverse, flags=0x0, protocol=89
        src ip/id=::/0, port=0, tag=any
```

dst ip/id=ff02::6/128

```
, port=0, tag=any, , nsg_id=none     <-- OSPF for IPv6
```

input_ifc=OUTSIDE

```
(vrfid:0), output_ifc=identity(vrfid:0)  <-- ingress interface
...
```

OSPFv2和OSPFv3邻接关系为UP:

<#root>

```
firepower#
```

show ospf neighbor

```
Neighbor ID Pri State Dead Time Address Interface
192.168.103.50 1
```

FULL/BDR

```
 0:00:35 192.168.103.50 OUTSIDE   <-- OSPF neighbor is up
```

```
firepower#
show ipv6 ospf neighbor

Neighbor ID Pri State Dead Time Interface ID Interface
192.168.103.50 1
FULL/BDR
 0:00:34 3267035482 OUTSIDE       <-- OSPF neighbor is up
```

以下是终止到该设备的组播OSPF会话：

```
<#root>
firepower#
show conn all | include OSPF

OSPF OUTSIDE fe80::2be:75ff:fef6:1d8e NP Identity Ifc ff02::5, idle 0:00:09, bytes 5924, flags
OSPF OUTSIDE 192.168.103.50 NP Identity Ifc 224.0.0.5, idle 0:00:03, bytes 8904, flags
OSPF OUTSIDE ff02::5 NP Identity Ifc fe80::f6db:e6ff:fe33:442e, idle 0:00:01, bytes 6304, flags
OSPF OUTSIDE 224.0.0.5 NP Identity Ifc 192.168.103.91, idle 0:00:00, bytes 25220, flags
```

作为测试，启用IPv4捕获并清除与设备的连接：

```
<#root>
firepower#
capture CAP interface OUTSIDE trace
firepower#
clear conn all
12 connection(s) deleted.
firepower#
clear capture CAP
firepower# !
```

⚠ 警告：这会导致中断！显示的示例仅用于演示目的！

捕获的OSPF数据包：

```
<#root>
firepower# show capture CAP | include proto-89
```

```
1: 12:25:33.142189 192.168.103.50 > 224.0.0.5 ip-proto-89, length 60
2: 12:25:33.702691 192.168.103.91 > 224.0.0.5 ip-proto-89, length 60
7: 12:25:36.317000 192.168.206.100 > 224.0.0.5 ip-proto-89, length 56
8: 12:25:36.952587 fe80::2be:75ff:fef6:1d8e > ff02::5 ip-proto-89 40 [flowlabel 0xe] [hlim 1]
12: 12:25:41.282608 fe80::f6db:e6ff:fe33:442e > ff02::5 ip-proto-89 40 [flowlabel 0xe] [hlim 1]
```

以下是防火墙处理OSPFv2组播数据包的方式：

<#root>

```
firepower#

show capture CAP packet-number 1 trace

115 packets captured


1: 12:25:33.142189 192.168.103.50 > 224.0.0.5 ip-proto-89, length 60

<-- The first packet of the flow
Phase: 1
Type: CAPTURE
Subtype:
Result: ALLOW
Elapsed time: 6344 ns
Config:
Additional Information:
MAC Access list

Phase: 2
Type: ACCESS-LIST
Subtype:
Result: ALLOW
Elapsed time: 6344 ns
Config:
Implicit Rule
Additional Information:
MAC Access list

Phase: 3
Type: ROUTE-LOOKUP
Subtype: No ECMP load balancing
Result: ALLOW
Elapsed time: 10736 ns
Config:
Additional Information:
Destination is locally connected. No ECMP load balancing.
Found next-hop 192.168.103.50 using egress ifc OUTSIDE(vrfid:0)

Phase: 4
Type: ACCESS-LIST
Subtype:
Result: ALLOW
Elapsed time: 5205 ns
Config:
Implicit Rule
Additional Information:

Phase: 5
```

Type: NAT
Subtype: per-session
Result: ALLOW
Elapsed time: 5205 ns
Config:
Additional Information:

Phase: 6
Type: IP-OPTIONS
Subtype:
Result: ALLOW
Elapsed time: 5205 ns
Config:
Additional Information:

Phase: 7
Type: CLUSTER-REDIRECT
Subtype: cluster-redirect
Result: ALLOW
Elapsed time: 29280 ns
Config:
Additional Information:

Phase: 8
Type: MULTICAST
Subtype:
Result: ALLOW
Elapsed time: 976 ns
Config:
Additional Information:

Phase: 9

Type: OSPF

<-- The OSPF process

Subtype: ospf

Result: ALLOW

Elapsed time: 488 ns

Config:

Additional Information:

Phase: 10
Type: FLOW-CREATION
Subtype:
Result: ALLOW
Elapsed time: 13176 ns
Config:

```
Additional Information:
New flow created with id 620, packet dispatched to next module

Result:
input-interface: OUTSIDE(vrfid:0)
input-status: up
input-line-status: up
output-interface: OUTSIDE(vrfid:0)
output-status: up
output-line-status: up
Action: allow
Time Taken: 82959 ns
```

以下是防火墙处理OSPFv3组播数据包的方式：

<#root>

```
firepower#

show capture CAP packet-number 8 trace


274 packets captured


8: 12:25:36.952587 fe80::2be:75ff:fef6:1d8e > ff02::5 ip-proto-89 40 [flowlabel 0xe] [hlim 1]

<-- The first packet of the flow
Phase: 1
Type: CAPTURE
Subtype:
Result: ALLOW
Elapsed time: 7564 ns
Config:
Additional Information:
MAC Access list

Phase: 2
Type: ACCESS-LIST
Subtype:
Result: ALLOW
Elapsed time: 7564 ns
Config:
Implicit Rule
Additional Information:
MAC Access list

Phase: 3
Type: ROUTE-LOOKUP
Subtype: No ECMP load balancing
Result: ALLOW
Elapsed time: 8296 ns
Config:
Additional Information:
Destination is locally connected. No ECMP load balancing.
Found next-hop ff02::5 using egress ifc identity(vrfid:0)

Phase: 4
```

Type: ACCESS-LIST
Subtype:
Result: ALLOW
Elapsed time: 8784 ns
Config:
Implicit Rule
Additional Information:

Phase: 5
Type: NAT
Subtype: per-session
Result: ALLOW
Elapsed time: 8784 ns
Config:
Additional Information:

Phase: 6
Type: CLUSTER-REDIRECT
Subtype: cluster-redirect
Result: ALLOW
Elapsed time: 27816 ns
Config:
Additional Information:

Phase: 7

Type: OSPF

<-- The OSPF process

Subtype: ospf

Result: ALLOW

Elapsed time: 976 ns

Config:

Additional Information:

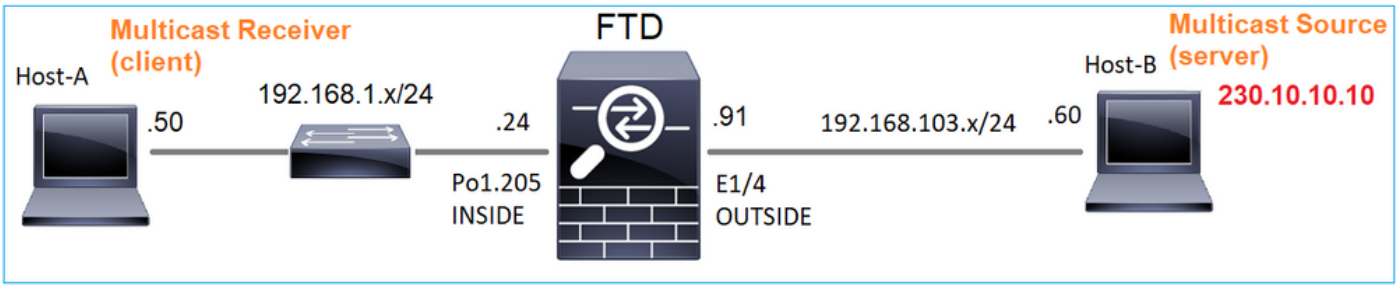
Phase: 8
Type: FLOW-CREATION
Subtype:
Result: ALLOW
Elapsed time: 13664 ns
Config:
Additional Information:
New flow created with id 624, packet dispatched to next module

Result:
input-interface: OUTSIDE(vrfid:0)
input-status: up
input-line-status: up

```
output-interface: NP Identity Ifc
Action: allow
Time Taken: 83448 ns
```

任务2 — 配置基本组播

拓扑



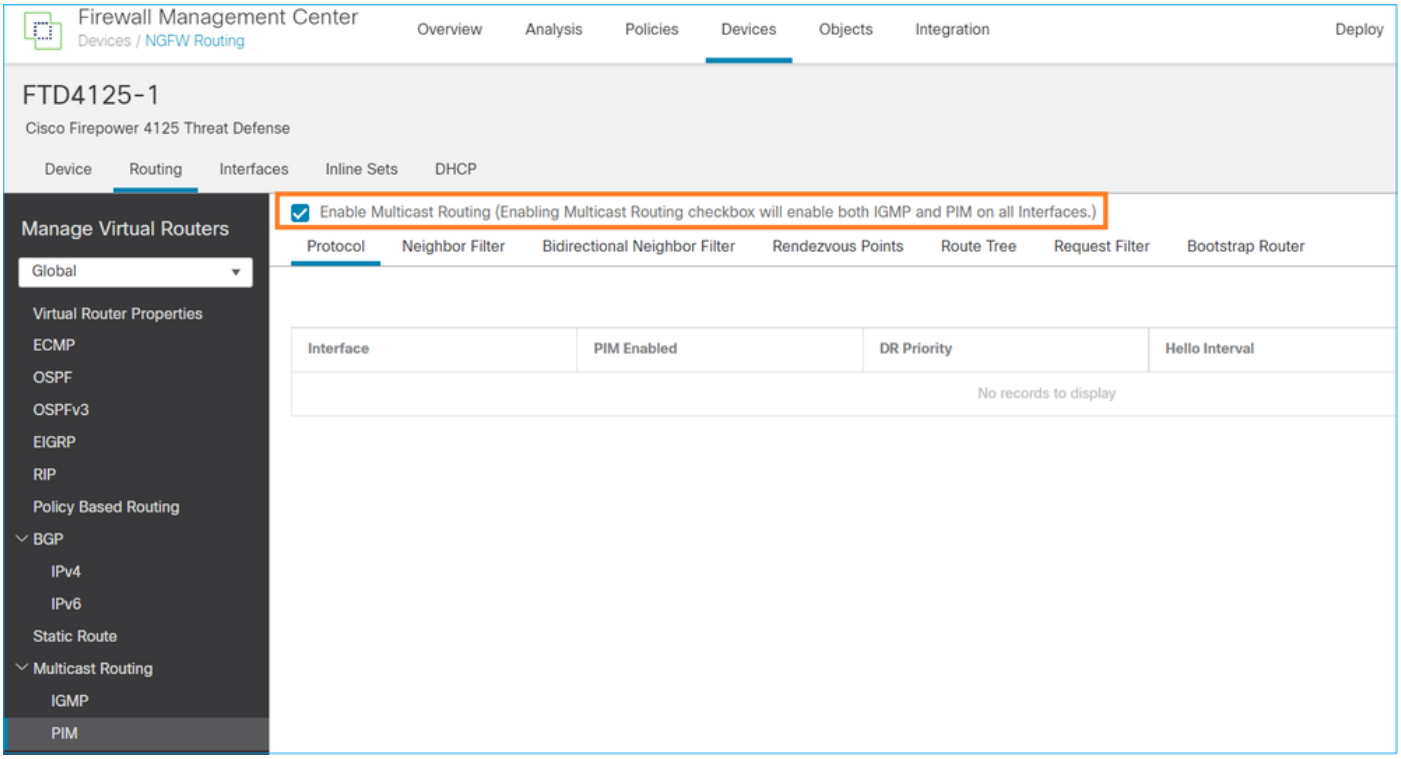
要求

配置防火墙，以便将来自服务器的组播流量流传输到IP 230.10.10.10上的组播客户端

解决方案

从防火墙角度来看，最低配置是全局启用组播路由。这将在所有防火墙接口上启用后台IGMP和PIM。

在FMC UI上：



在防火墙CLI上，这是推送的配置：

<#root>

firepower#

show run multicast-routing

multicast-routing

<-- Multicast routing is enabled

IGMP验证

<#root>

firepower#

show igmp interface

diagnostic is up, line protocol is up
  Internet address is 0.0.0.0/0
  IGMP is disabled on interface

INSIDE is up, line protocol is up

<-- The interface is UP
  Internet address is 192.168.1.24/24

  IGMP is enabled on interface

<-- IGMP is enabled on the interface

  Current IGMP version is 2

<-- IGMP version
  IGMP query interval is 125 seconds
  IGMP querier timeout is 255 seconds
  IGMP max query response time is 10 seconds
  Last member query response interval is 1 seconds
  Inbound IGMP access group is:
  IGMP limit is 500, currently active joins: 1
  Cumulative IGMP activity: 4 joins, 3 leaves
  IGMP querying router is 192.168.1.24 (this system)

OUTSIDE is up, line protocol is up

<-- The interface is UP
  Internet address is 192.168.103.91/24

  IGMP is enabled on interface

<-- IGMP is enabled on the interface

  Current IGMP version is 2

<-- IGMP version
  IGMP query interval is 125 seconds
  IGMP querier timeout is 255 seconds
  IGMP max query response time is 10 seconds
  Last member query response interval is 1 seconds
  Inbound IGMP access group is:
  IGMP limit is 500, currently active joins: 1
  Cumulative IGMP activity: 1 joins, 0 leaves

```
  IGMP querying router is 192.168.103.91 (this system)
```

<#root>

```
firepower#
```

show igmp group

```
IGMP Connected Group Membership
Group Address Interface Uptime Expires Last Reporter
239.255.255.250 INSIDE 00:09:05 00:03:19 192.168.1.50
239.255.255.250 OUTSIDE 00:06:01 00:02:33 192.168.103.60
```

<#root>

```
firepower#
```

show igmp traffic

```
IGMP Traffic Counters
Elapsed time since counters cleared: 03:40:48 Received Sent

                            Received     Sent
Valid IGMP Packets          21           207
Queries                     0            207
Reports                     15           0       <-- IGMP Reports received and sent
Leaves                      6            0
Mtrace packets              0            0
DVMRP packets               0            0
PIM packets                 0            0

Errors:
Malformed Packets           0
Martian source              0
Bad Checksums               0
```

PIM验证

<#root>

```
firepower#
```

show pim interface

```
Address          Interface          PIM  Nbr   Hello  DR         DR
                                       Count Intvl  Prior

0.0.0.0          diagnostic         off  0     30     1          not elected
192.168.1.24     INSIDE             on   0     30     1          this system
192.168.103.91   OUTSIDE            on   0     30     1          this system
```

MFIB验证

<#root>

```
firepower#
```

show mfib

```
Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
             AR - Activity Required, K - Keepalive
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts: Total/RPF failed/Other drops
Interface Flags: A - Accept, F - Forward, NS - Negate Signalling
             IC - Internal Copy, NP - Not platform switched
             SP - Signal Present
Interface Counts: FS Pkt Count/PS Pkt Count

(*,224.0.1.39) Flags: S K
```

Forwarding: 0/0/0/0

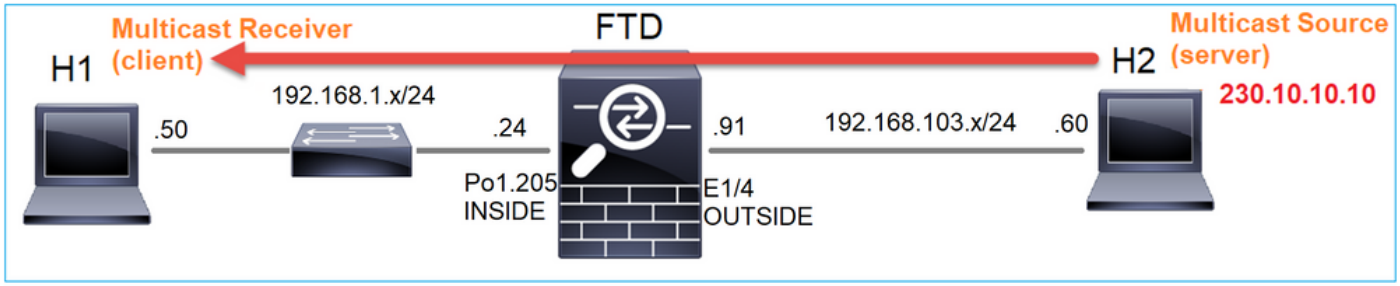
```
, Other: 0/0/0   <-- The Forwarding counters are: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per seco
(*,224.0.1.40) Flags: S K
   Forwarding: 0/0/0/0,
```

Other: 8/8/0

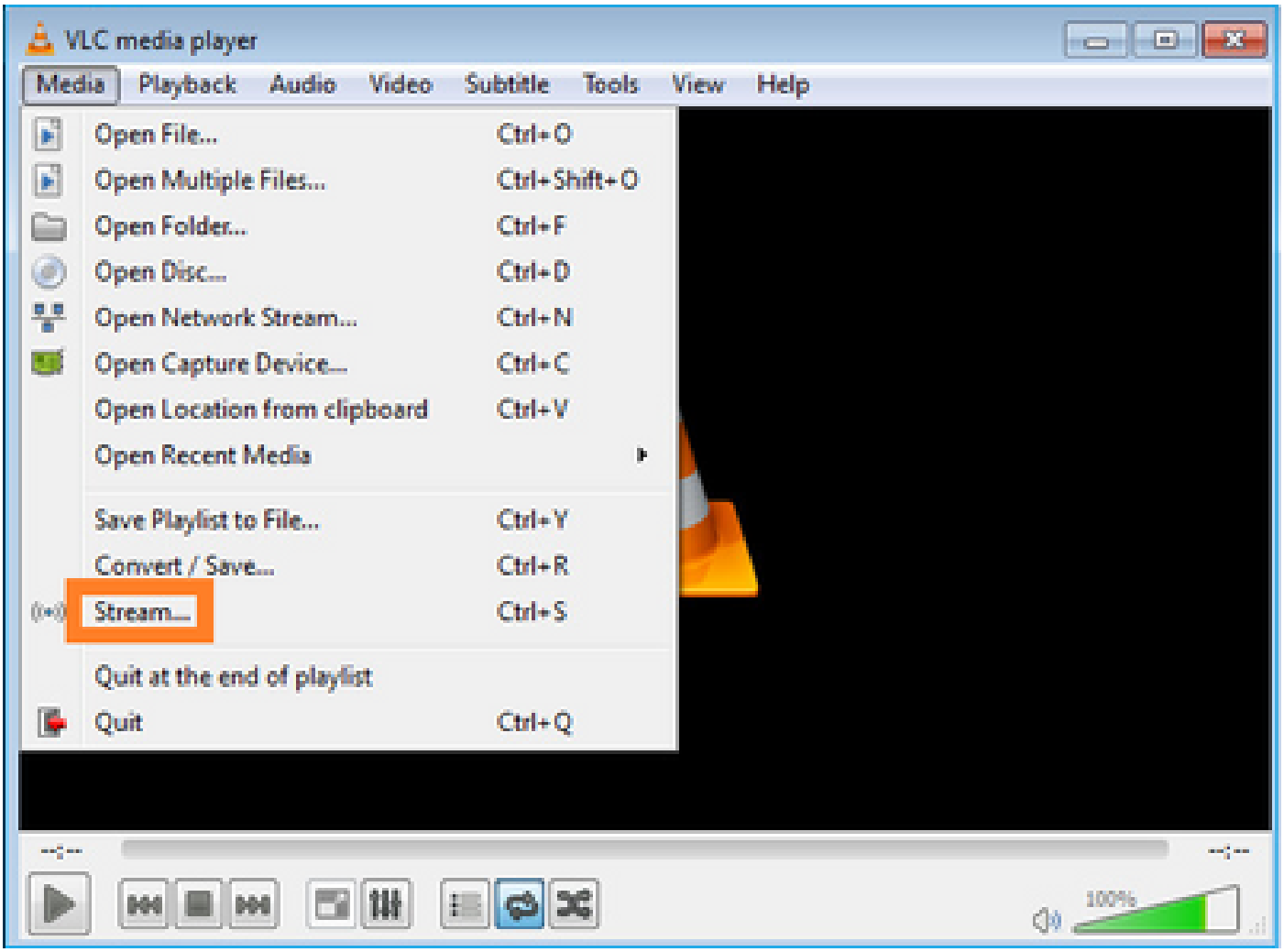
```
   <-- The Other counters are: Total/RPF failed/Other drops
(*,232.0.0.0/8) Flags: K
   Forwarding: 0/0/0/0, Other: 0/0/0
```

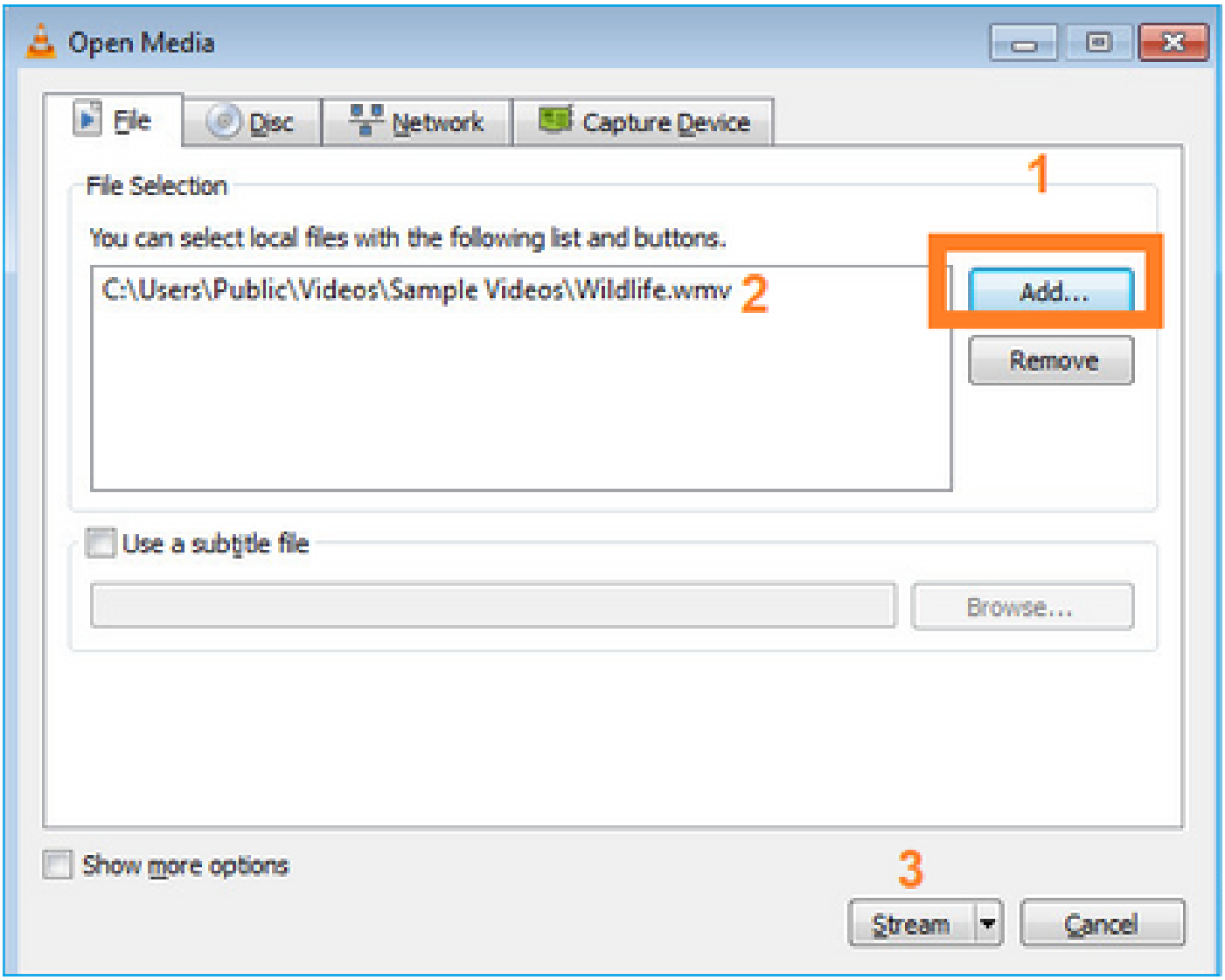
通过防火墙的组播流量

在这种情况下，VLC媒体播放器应用用作组播服务器和客户端来测试组播流量：



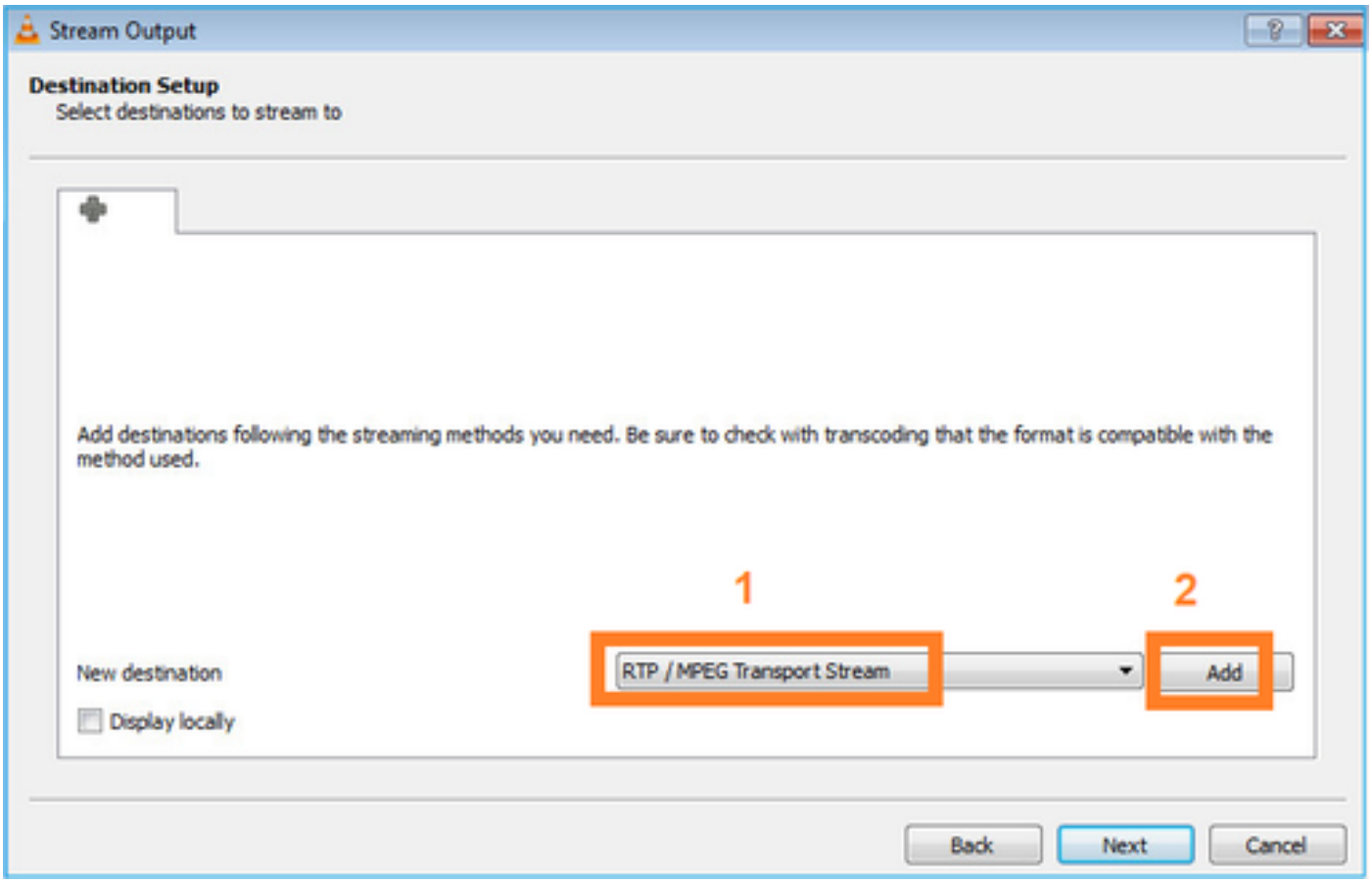
VLC组播服务器配置：


VLC media player
Media
Playback
Audio
Video
Subtitle
Tools
View
Help
Open File... Ctrl+O
Open Multiple Files... Ctrl+Shift+O
Open Folder... Ctrl+F
Open Disc... Ctrl+D
Open Network Stream... Ctrl+N
Open Capture Device... Ctrl+C
Open Location from clipboard Ctrl+V
Open Recent Media
Save Playlist to File... Ctrl+Y
Convert / Save... Ctrl+R
Stream... Ctrl+S
Quit at the end of playlist
Quit Ctrl+Q
--:--
--:--
100%

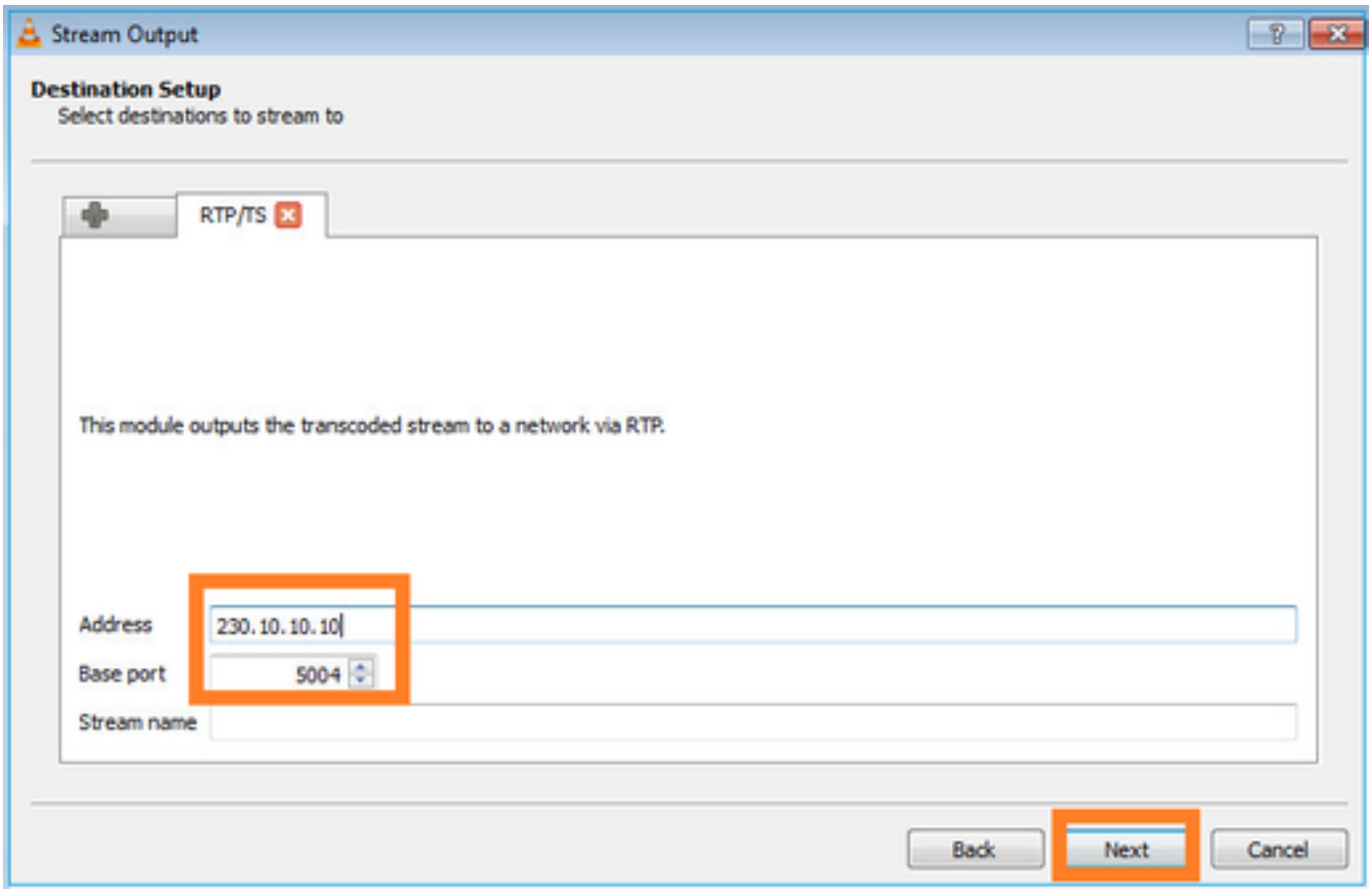


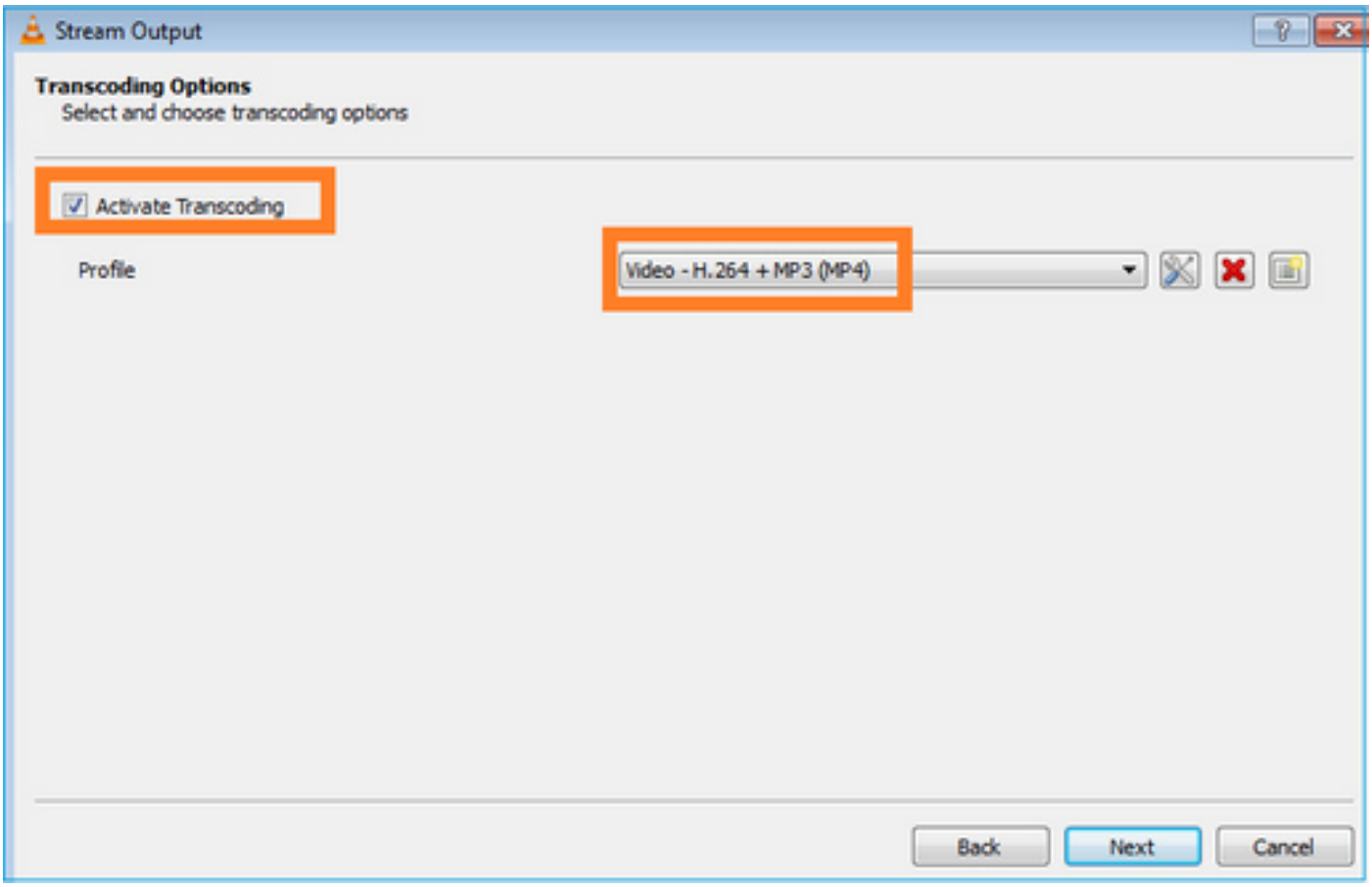
在下一个屏幕上，选择Next。

选择格式：


Stream Output
Destination Setup
Select destinations to stream to
Add destinations following the streaming methods you need. Be sure to check with transcoding that the format is compatible with the method used.
1
2
New destination
RTP / MPEG Transport Stream
Add
Display locally
Back
Next
Cancel

指定组播IP和端口：


Stream Output
Destination Setup
Select destinations to stream to
RTP/TS
This module outputs the transcoded stream to a network via RTP.
Address
230.10.10.10
Base port
5004
Stream name
Back
Next
Cancel



在FTD防火墙上启用LINA捕获：

<#root>

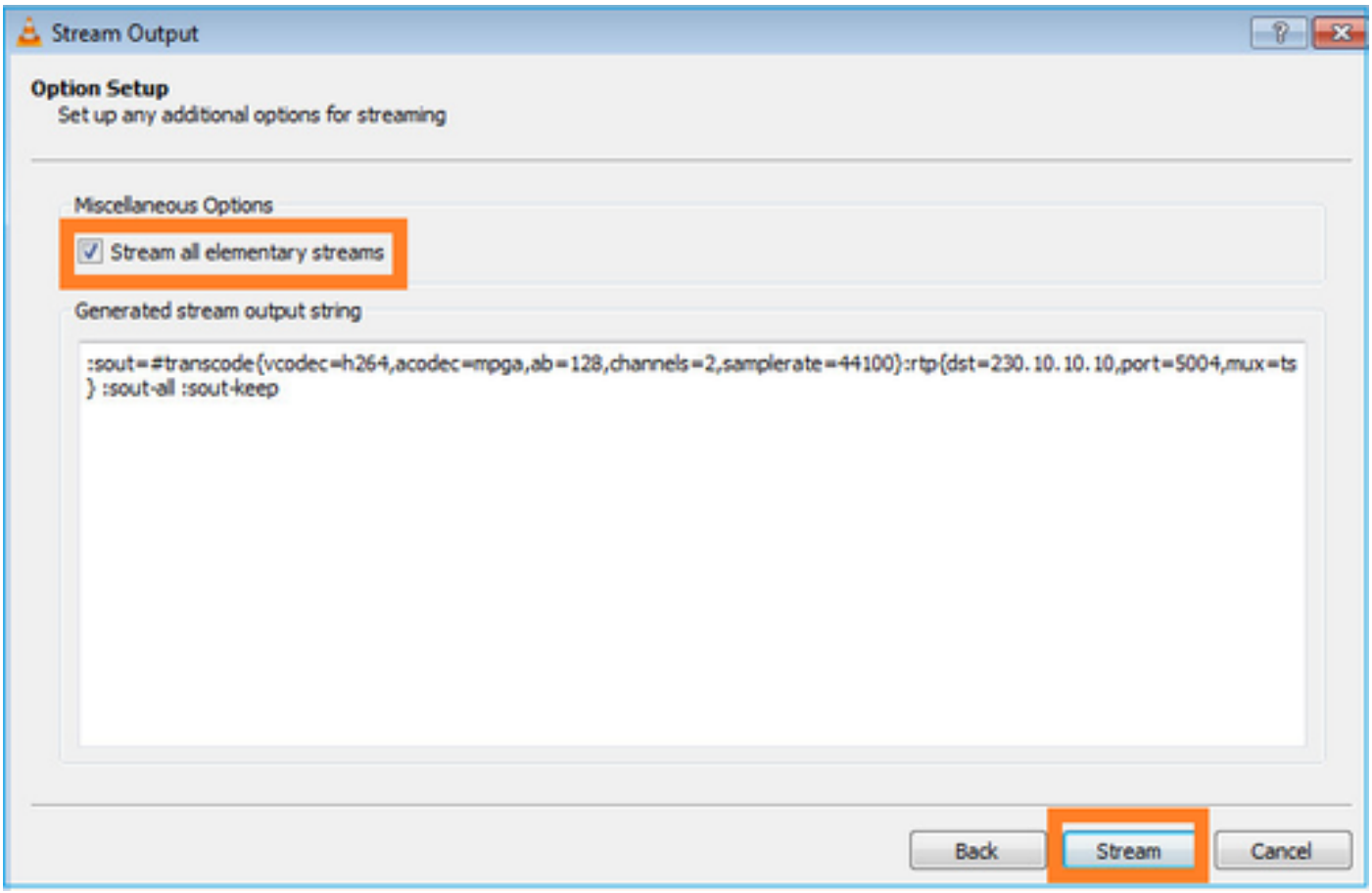
firepower#

capture INSIDE interface INSIDE match ip host 192.168.103.60 host 230.10.10.10

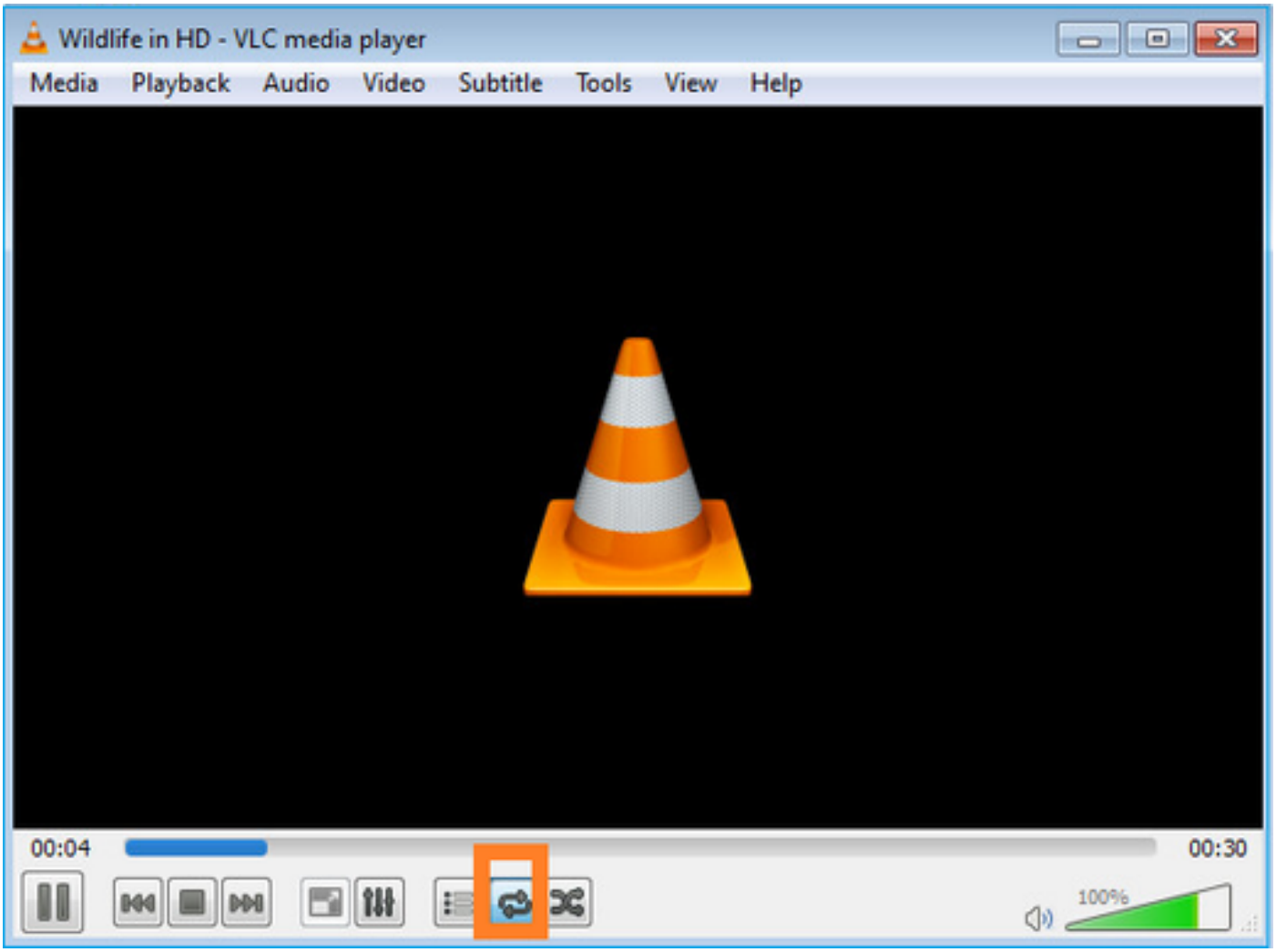
firepower#

capture OUTSIDE interface OUTSIDE trace match ip host 192.168.103.60 host 230.10.10.10

为设备选择流按钮以启动组播流：



启用“loop”选项，以便连续发送流：



验证（非操作场景）

此场景演示了一个非操作场景。目标是演示防火墙行为。

防火墙设备获取组播流，但不转发它：

<#root>

firepower#

show capture

capture INSIDE type raw-data interface INSIDE

[Capturing - 0 bytes]

<-- No packets sent or received
match ip host 192.168.103.60 host 230.10.10.10
capture OUTSIDE type raw-data trace interface OUTSIDE

[Buffer Full - 524030 bytes]

<-- The buffer is full
match ip host 192.168.103.60 host 230.10.10.10

Firewall LINA ASP drops显示：

```
<#root>

firepower#

clear asp drop

firepower#

show asp drop


Frame drop:

Punt rate limit exceeded (punt-rate-limit)                          232

<-- The multicast packets were dropped
  Flow is denied by configured rule (acl-drop)                        2
  FP L2 rule drop (l2_acl)                                            2

Last clearing: 18:38:42 UTC Oct 12 2018 by enable_15

Flow drop:

Last clearing: 08:45:41 UTC May 17 2022 by enable_15
```

要跟踪数据包，需要捕获组播流的第一个数据包。因此，请清除当前流量：

```
<#root>

firepower#

clear capture OUTSIDE


firepower#

clear conn all addr 230.10.10.10

2 connection(s) deleted.

firepower#

show capture OUTSIDE



379 packets captured

1: 08:49:04.537875 192.168.103.60.54100 > 230.10.10.10.5005: udp 64
2: 08:49:04.537936 192.168.103.60.54099 > 230.10.10.10.5004: udp 1328
3: 08:49:04.538027 192.168.103.60.54099 > 230.10.10.10.5004: udp 1328
4: 08:49:04.538058 192.168.103.60.54099 > 230.10.10.10.5004: udp 1328
5: 08:49:04.538058 192.168.103.60.54099 > 230.10.10.10.5004: udp 1328
6: 08:49:04.538073 192.168.103.60.54099 > 230.10.10.10.5004: udp 1328
...
```

“detail”选项显示组播MAC地址：

```
<#root>

firepower#

show capture OUTSIDE detail



379 packets captured

1: 08:49:04.537875 0050.569d.344a

0100.5e0a.0a0a

 0x0800 Length: 106
192.168.103.60.54100 > 230.10.10.10.5005: [udp sum ok] udp 64 (ttl 100, id 19759)
2: 08:49:04.537936 0050.569d.344a

0100.5e0a.0a0a

 0x0800 Length: 1370
192.168.103.60.54099 > 230.10.10.10.5004: [udp sum ok] udp 1328 (ttl 100, id 19760)
3: 08:49:04.538027 0050.569d.344a 0100.5e0a.0a0a 0x0800 Length: 1370
192.168.103.60.54099 > 230.10.10.10.5004: [udp sum ok] udp 1328 (ttl 100, id 19761)
...
```

实际数据包的跟踪显示数据包被允许，但实际发生的情况并非如此：

```
<#root>

firepower#

show capture OUTSIDE packet-number 1 trace


379 packets captured

1: 08:49:04.537875 192.168.103.60.54100 > 230.10.10.10.5005: udp 64
Phase: 1
Type: CAPTURE
Subtype:
Result: ALLOW
Elapsed time: 11712 ns
Config:
Additional Information:
MAC Access list

Phase: 2
Type: ACCESS-LIST
Subtype:
Result: ALLOW
Elapsed time: 11712 ns
Config:
Implicit Rule
Additional Information:
```

```
MAC Access list

Phase: 3
Type: ROUTE-LOOKUP
Subtype: No ECMP load balancing
Result: ALLOW
Elapsed time: 7808 ns
Config:
Additional Information:
Destination is locally connected. No ECMP load balancing.
Found next-hop 192.168.103.60 using egress ifc OUTSIDE(vrfid:0)

Phase: 4
Type: ACCESS-LIST
Subtype: log
Result: ALLOW
Elapsed time: 5246 ns
Config:
access-group CSM_FW_ACL_ global
access-list CSM_FW_ACL_ advanced permit ip any any rule-id 268434432
access-list CSM_FW_ACL_ remark rule-id 268434432: ACCESS POLICY: mzafeiro_empty - Default
access-list CSM_FW_ACL_ remark rule-id 268434432: L4 RULE: DEFAULT ACTION RULE
Additional Information:
This packet will be sent to snort for additional processing where a verdict will be reached

Phase: 5
Type: CONN-SETTINGS
Subtype:
Result: ALLOW
Elapsed time: 5246 ns
Config:
class-map class-default
match any
policy-map global_policy
class class-default
set connection advanced-options UM_STATIC_TCP_MAP
service-policy global_policy global
Additional Information:

Phase: 6
Type: NAT
Subtype: per-session
Result: ALLOW
Elapsed time: 5246 ns
Config:
Additional Information:

Phase: 7
Type: IP-OPTIONS
Subtype:
Result: ALLOW
Elapsed time: 5246 ns
Config:
Additional Information:

Phase: 8
Type: CLUSTER-REDIRECT
Subtype: cluster-redirect
Result: ALLOW
Elapsed time: 31232 ns
Config:
Additional Information:
```

```
Phase: 9
```

Type: MULTICAST

```
<-- multicast process
Subtype:
Result: ALLOW
Elapsed time: 976 ns
Config:
Additional Information:

Phase: 10
```

Type: FLOW-CREATION

```
<-- the packet belongs to a new flow
Subtype:
Result: ALLOW
Elapsed time: 20496 ns
Config:
Additional Information:
New flow created with id 3705, packet dispatched to next module

Result:
input-interface: OUTSIDE(vrfid:0)
input-status: up
input-line-status: up
output-interface: OUTSIDE(vrfid:0)
output-status: up
output-line-status: up
```

Action: allow

```
<-- The packet is allowed
Time Taken: 104920 ns
```

根据mroute和mfib计数器，数据包被丢弃，因为传出接口列表(OIL)为空：

<#root>

```
firepower#
```

show mroute

```
Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group,
C - Connected, L - Local, I - Received Source Specific Host Report,
P - Pruned, R - RP-bit set, F - Register flag, T - SPT-bit set,
J - Join SPT
Timers: Uptime/Expires
Interface state: Interface, State
```

(192.168.103.60, 230.10.10.10), 00:01:33/00:01:56, flags: SPF

Incoming interface: OUTSIDE

```
RPF nbr: 192.168.103.60

Outgoing interface list: Null

<-- The OIL is empty!

(*, 239.255.255.250), 00:01:50/never, RP 0.0.0.0, flags: SCJ
Incoming interface: Null
RPF nbr: 0.0.0.0
Immediate Outgoing interface list:
INSIDE, Forward, 00:01:50/never
```

MFIB计数器显示RPF故障，在本例中，RPF故障并不是实际发生的情况：

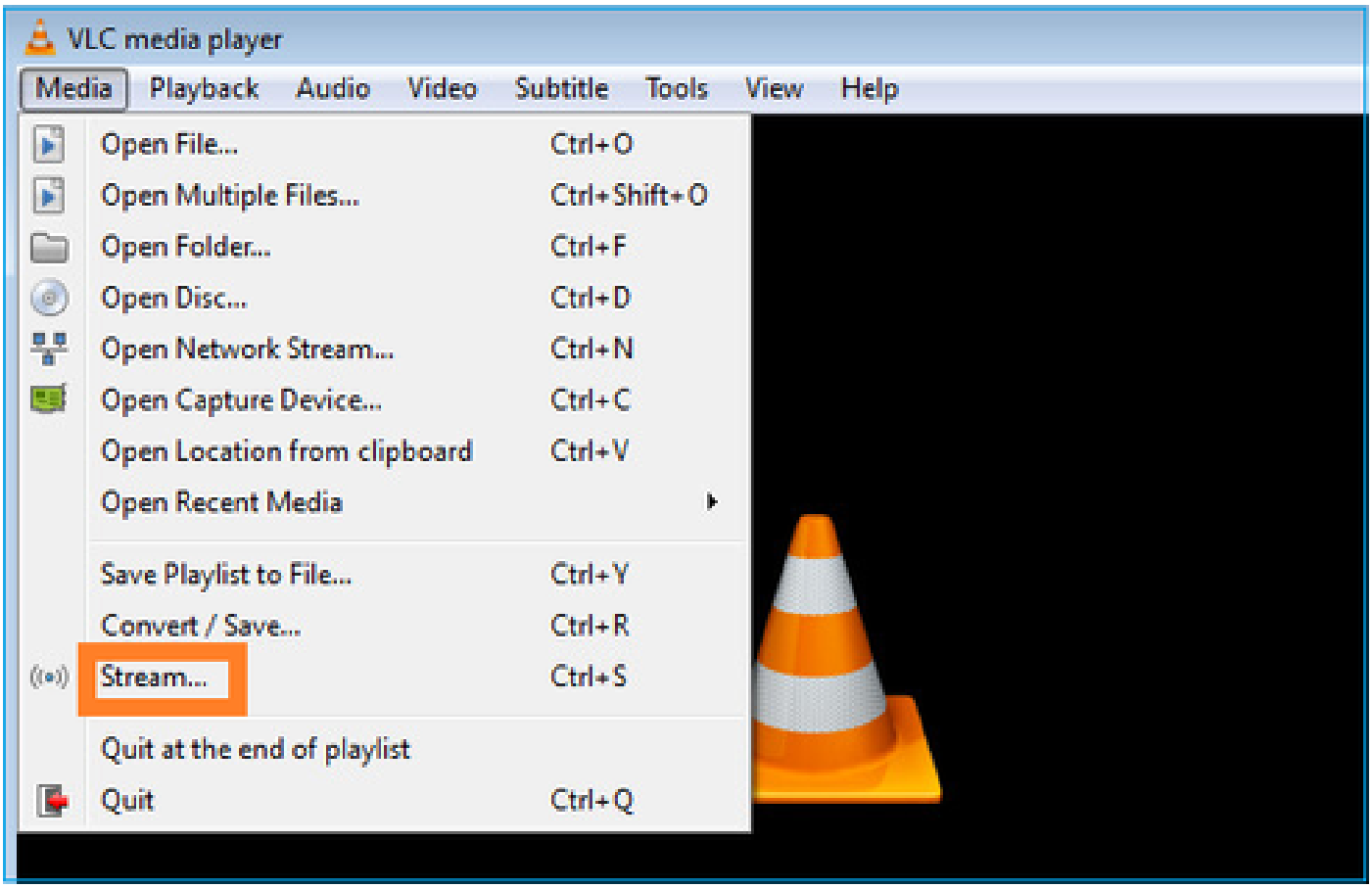
```
<#root>

firepower#

 show mfib 230.10.10.10

Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
             AR - Activity Required, K - Keepalive
firepower# show mfib 230.10.10.10
Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
AR - Activity Required, K - Keepalive

Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second

<-- Multicast forwarding counters

Other counts: Total/RPF failed

/Other drops            <-- Multicast drop counters
Interface Flags: A - Accept, F - Forward, NS - Negate Signalling
             IC - Internal Copy, NP - Not platform switched
             SP - Signal Present
Interface Counts: FS Pkt Count/PS Pkt Count

(192.168.103.60,230.10.10.10) Flags: K


Forwarding: 0/0/0/0

,

Other: 650/650

/0       <-- Allowed and dropped multicast packets
```

“show mfib count”输出中的类似RPF故障：

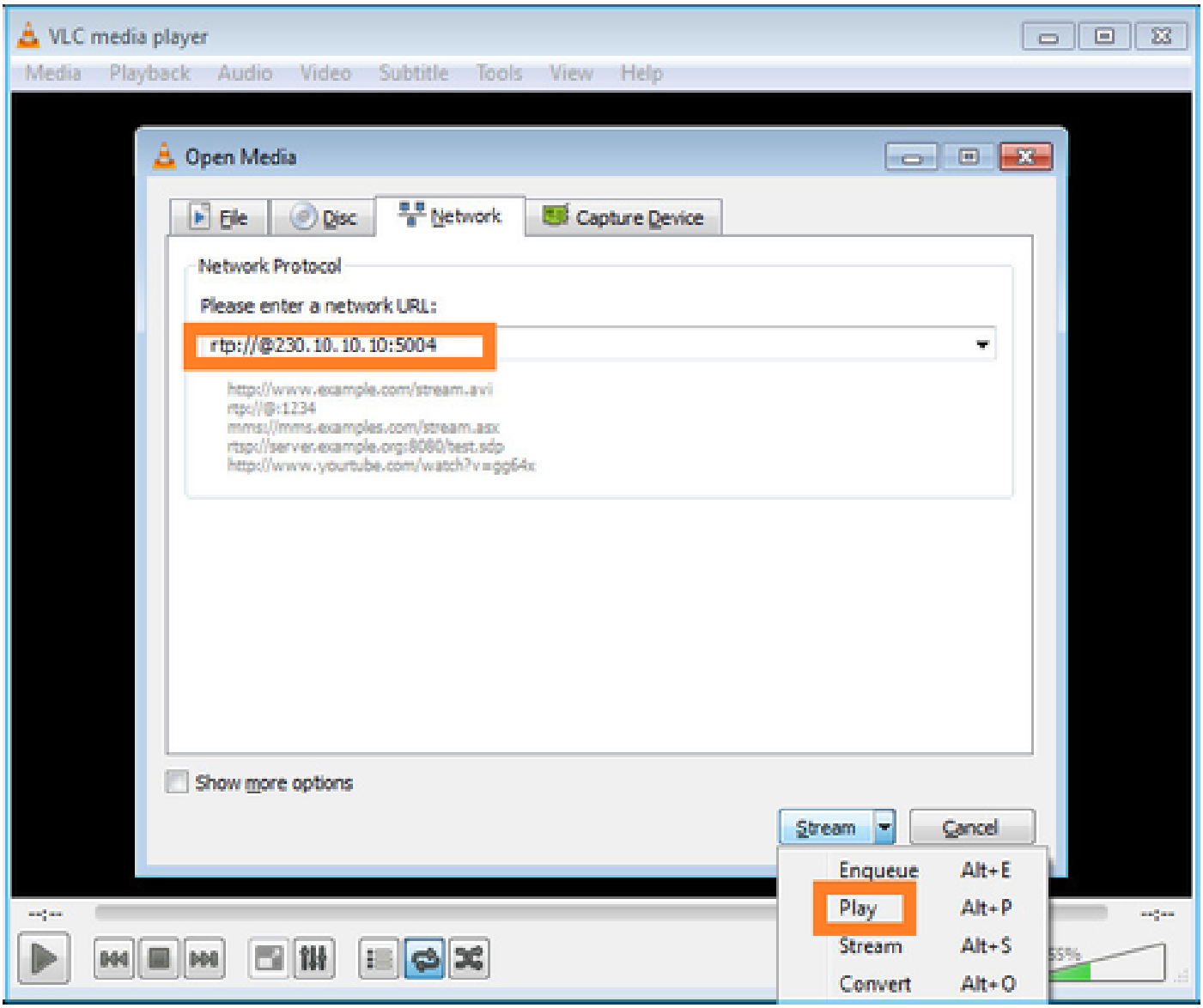
```
<#root>

firepower#

show mfib count
```

```
IP Multicast Statistics
8 routes, 4 groups, 0.25 average sources per group
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second
Other counts:

Total/RPF failed

/Other drops(OIF-null, rate-limit etc)
Group: 224.0.1.39
  RP-tree:
    Forwarding: 0/0/0/0, Other: 0/0/0
Group: 224.0.1.40
  RP-tree:
    Forwarding: 0/0/0/0, Other: 0/0/0

Group: 230.10.10.10


  Source: 192.168.103.60,
    Forwarding: 0/0/0/0,

Other: 1115/1115

/0   <-- Allowed and dropped multicast packets
  Tot. shown: Source count: 1, pkt count: 0
Group: 232.0.0.0/8
  RP-tree:
    Forwarding: 0/0/0/0, Other: 0/0/0
Group: 239.255.255.250
  RP-tree:
    Forwarding: 0/0/0/0, Other: 0/0/0
```

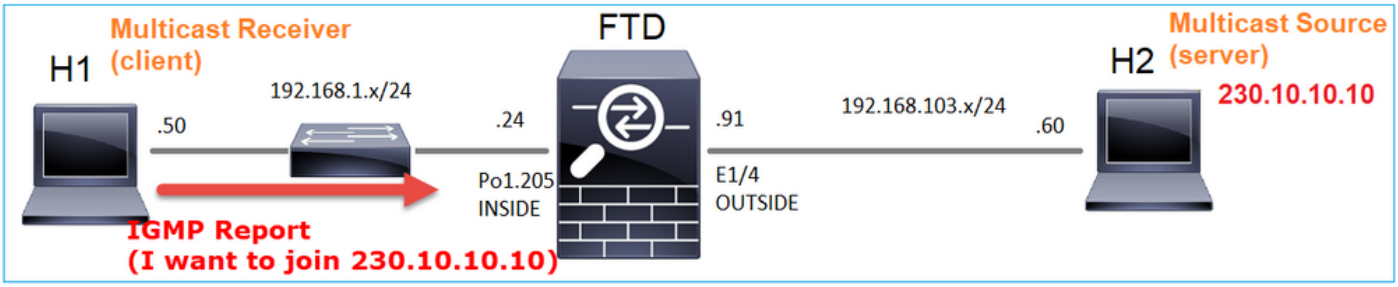
配置VLC组播接收器：



指定组播源IP并选择播放：



在后端中，只要选择播放，主机就会宣布愿意加入特定组播组并发送IGMP报告消息：



如果启用调试，您可以看到IGMP报告消息：

<#root>

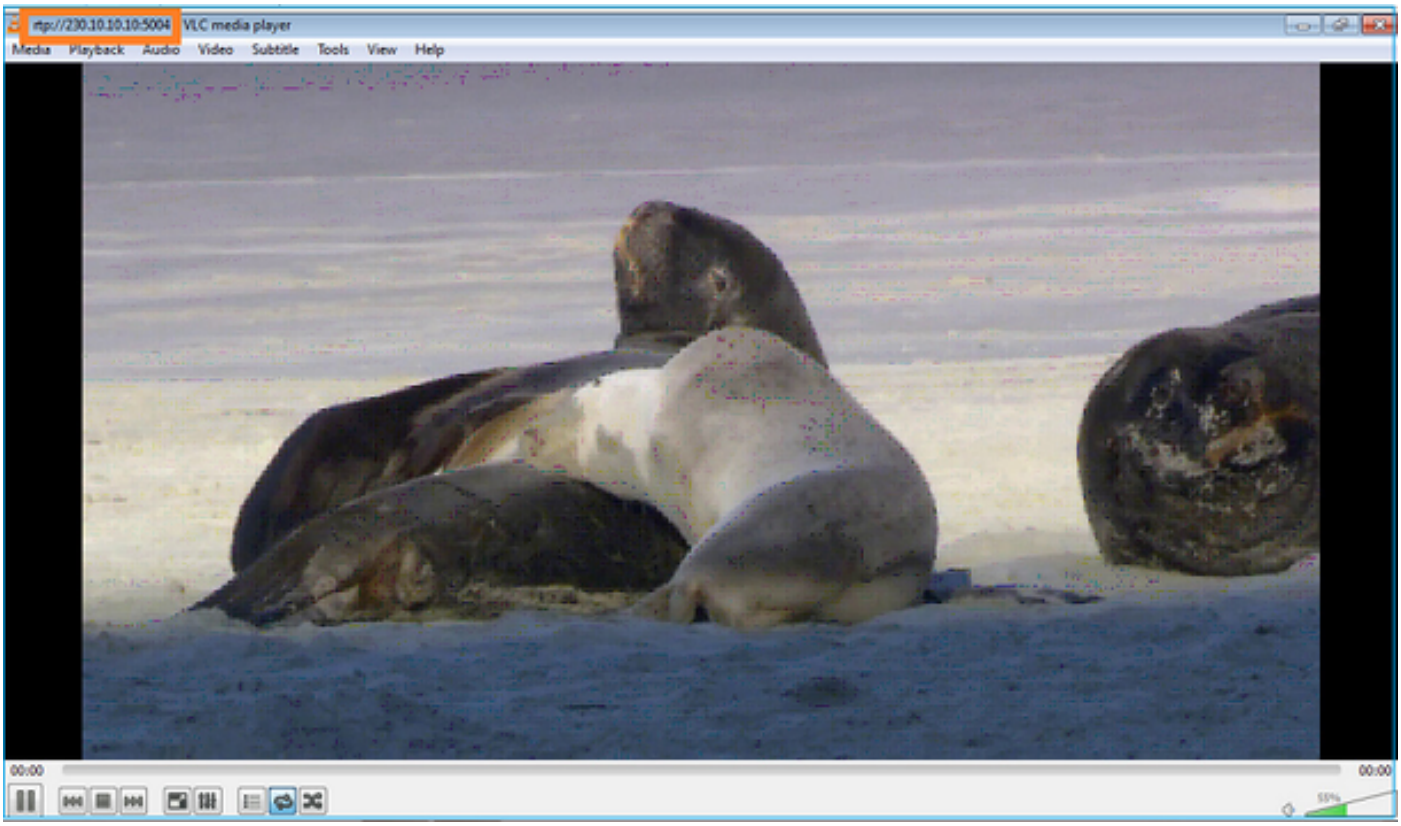
```
firepower#
```

debug igmp group 230.10.10.10

IGMP: Received v2 Report on INSIDE from 192.168.1.50 for 230.10.10.10

```
<-- IGMPv2 Report received
IGMP: group_db: add new group 230.10.10.10 on INSIDE
IGMP: MRIB updated (*,230.10.10.10) : Success
IGMP: Switching to EXCLUDE mode for 230.10.10.10 on INSIDE
IGMP: Updating EXCLUDE group timer for 230.10.10.10
```

数据流开始于：



验证（操作场景）

<#root>

firepower#

show capture

capture INSIDE type raw-data interface INSIDE

[Buffer Full - 524156 bytes]

<-- Multicast packets on the egress interface
match ip host 192.168.103.60 host 230.10.10.10
capture OUTSIDE type raw-data trace interface OUTSIDE

[Buffer Full - 524030 bytes]

<-- Multicast packets on the ingress interface
match ip host 192.168.103.60 host 230.10.10.10

防火墙的mroute表

<#root>

firepower#

show mroute

```
Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group,
       C - Connected, L - Local, I - Received Source Specific Host Report,
       P - Pruned, R - RP-bit set, F - Register flag, T - SPT-bit set,
       J - Join SPT
Timers: Uptime/Expires
Interface state: Interface, State

(*, 230.10.10.10), 00:00:34/never, RP 0.0.0.0, flags: SCJ
  Incoming interface: Null
  RPF nbr: 0.0.0.0
  Immediate Outgoing interface list:
    INSIDE, Forward, 00:00:34/never

(192.168.103.60, 230.10.10.10), 00:01:49/00:03:29, flags: SFJT

  Incoming interface: OUTSIDE

  RPF nbr: 192.168.103.60

  Inherited Outgoing interface list:

    INSIDE, Forward, 00:00:34/never
```

<-- The OIL shows an interface

<#root>

firepower#

show mfib 230.10.10.10

```
Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
             AR - Activity Required, K - Keepalive

Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second

Other counts: Total/RPF failed/Other drops
Interface Flags: A - Accept, F - Forward, NS - Negate Signalling
             IC - Internal Copy, NP - Not platform switched
```

```
            SP - Signal Present
Interface Counts: FS Pkt Count/PS Pkt Count

(*,230.10.10.10) Flags: C K
  Forwarding: 0/0/0/0, Other: 0/0/0
  INSIDE Flags: F NS
    Pkts: 0/0
```

(192.168.103.60,230.10.10.10) Flags: K

Forwarding: 6373/0/1354/0,

```
Other: 548/548/0      <-- There are multicast packets forwarded
```

OUTSIDE Flags: A

INSIDE Flags: F NS

Pkts: 6373/6

mfib计数器：

<#root>

```
firepower#
```

show mfib count

```
IP Multicast Statistics
10 routes, 5 groups, 0.40 average sources per group
```

Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second

```
Other counts: Total/RPF failed/Other drops(OIF-null, rate-limit etc)
Group: 224.0.1.39
  RP-tree:
    Forwarding: 0/0/0/0, Other: 0/0/0
Group: 224.0.1.40
  RP-tree:
    Forwarding: 0/0/0/0, Other: 0/0/0
```

Group: 230.10.10.10

RP-tree:

Forwarding: 0/0/0/0, Other: 0/0/0

Source: 192.168.103.60,

```
    Forwarding: 7763/0/1354/0,

Other: 548/548/0   <-- There are multicast packets forwarded
  Tot. shown: Source count: 1, pkt count: 0
Group: 232.0.0.0/8
  RP-tree:
    Forwarding: 0/0/0/0, Other: 0/0/0
Group: 239.255.255.250
  RP-tree:
    Forwarding: 0/0/0/0, Other: 0/0/0
  Source: 192.168.1.50,
    Forwarding: 7/0/500/0, Other: 0/0/0
  Tot. shown: Source count: 1, pkt count: 0
```

IGMP 侦听

- IGMP监听是交换机上使用的一种机制，用于防止组播泛洪。
- 交换机监控IGMP报告，以确定主机（接收器）的位置。
- 交换机监控IGMP查询，以确定路由器/防火墙（发送方）位于何处。
- IGMP监听在大多数思科交换机上默认启用。有关详细信息，请查看相关的交换指南。以下是L3 Catalyst交换机的输出示例：

<#root>

```
switch#

show ip igmp snooping statistics


  Current number of Statistics entries    : 15
  Configured Statistics database limit    : 32000
  Configured Statistics database threshold: 25600
  Configured Statistics database limit    : Not exceeded
  Configured Statistics database threshold: Not exceeded

Snooping statistics for Vlan204
#channels: 3
#hosts   : 5

Source/Group                    Interface       Reporter        Uptime   Last-Join Last-Leave
0.0.0.0/230.10.10.10            Vl204:Gi1/48    192.168.1.50    2d13h        -     2d12h
0.0.0.0/230.10.10.10            Vl204:Gi1/48    192.168.1.97    2d13h    2d12h         -
0.0.0.0/230.10.10.10            Vl204:Gi2/1     192.168.1.50    2d10h    02:20:05  02:20:00
0.0.0.0/239.255.255.250         Vl204:Gi2/1     192.168.1.50    2d11h    02:20:05  02:20:00
0.0.0.0/239.255.255.250         Vl204:Gi2/1     192.168.2.50    2d14h    2d13h         -
0.0.0.0/239.255.255.250         Vl204:Gi2/1     192.168.6.50    2d13h        -     2d13h
0.0.0.0/224.0.1.40              Vl204:Gi2/26    192.168.2.1     2d14h    00:00:39  2d13h

Snooping statistics for Vlan206
#channels: 4
#hosts   : 3

Source/Group                    Interface       Reporter        Uptime   Last-Join Last-Leave
0.0.0.0/230.10.10.10            Vl206:Gi1/48    192.168.6.91    00:30:15 2d13h     2d13h
0.0.0.0/239.10.10.10            Vl206:Gi1/48    192.168.6.91    2d14h    2d13h         -
0.0.0.0/239.255.255.250         Vl206:Gi2/1     192.168.6.50    2d12h    00:52:49  00:52:45
```

```
0.0.0.0/224.0.1.40              Vl206:Gi2/26    192.168.6.1     00:20:10 2d13h     2d13h
0.0.0.0/230.10.10.10            Vl206:Gi2/26    192.168.6.1     2d13h    2d13h         -
0.0.0.0/230.10.10.10            Vl206:Gi2/26    192.168.6.91    2d13h         -     2d13h
0.0.0.0/239.10.10.10            Vl206:Gi2/26    192.168.6.1     2d14h    2d14h         -
0.0.0.0/239.10.10.10            Vl206:Gi2/26    192.168.6.91    2d14h         -     2d14h
```

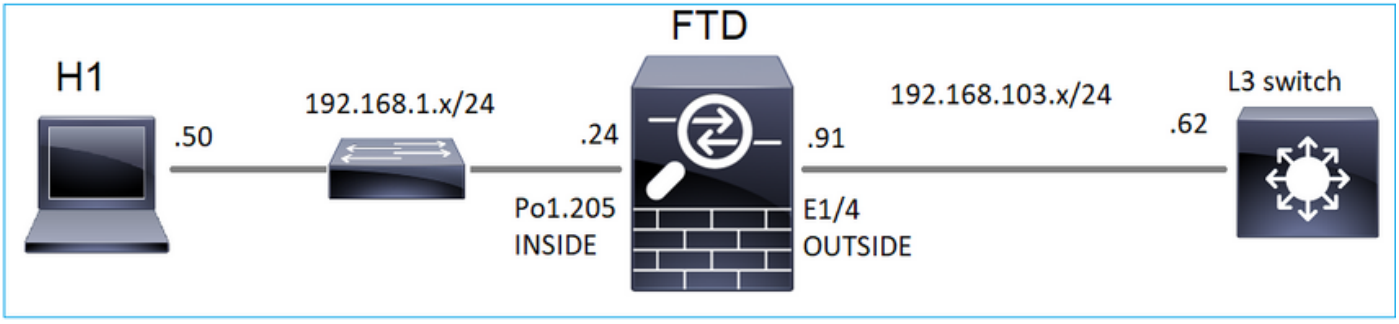
任务3 - IGMP静态组与IGMP加入组

概述

	ip igmp static-group	ip igmp join-group
是否应用于FTD接口？	Yes	Yes
FTD是否吸引组播流？	是，PIM加入发送到上游设备。源或交汇点(RP)。仅当使用此命令的FTD是该接口上的PIM指定路由器(DR)时，才会出现这种情况。	是，PIM加入发送到上游设备。源或交汇点(RP)。仅当使用此命令的FTD是该接口上的PIM指定路由器(DR)时，才会出现这种情况。
FTD是否将组播流量从接口转发出去？	Yes	Yes
FTD是否消耗并回复组播流量	无	是，FTD将组播流传送到CPU，使用它，然后回复源。
CPU影响	最小，因为数据包未传送到CPU。	可以影响FTD CPU，因为属于组的每个组播数据包都会被传送到FTD CPU。

任务要求

请思考以下拓扑：



在防火墙上启用以下捕获：

<#root>

```
firepower#
```

```
 capture CAPI interface OUTSIDE trace match icmp host 192.168.103.62 any

firepower#

 capture CAPO interface INSIDE match icmp host 192.168.103.62 any
```

1. 使用来自L3交换机的ICMP ping将组播流量发送到IP 230.11.11.11，并检查防火墙如何处理该流量。
2. 在防火墙INSIDE接口上启用igmp static-group命令，并检查防火墙如何处理组播流(IP 230.11.11.11)。
3. 在防火墙INSIDE接口上启用igmp static-group命令，并检查防火墙如何处理组播流(IP 230.11.11.11)。

解决方案

防火墙没有IP 230.11.11.11的任何路由：

<#root>

```
firepower#

show mroute


Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group,
       C - Connected, L - Local, I - Received Source Specific Host Report,
       P - Pruned, R - RP-bit set, F - Register flag, T - SPT-bit set,
       J - Join SPT
Timers: Uptime/Expires
Interface state: Interface, State

(*, 239.255.255.250), 00:43:21/never, RP 0.0.0.0, flags: SCJ
  Incoming interface: Null
  RPF nbr: 0.0.0.0
  Immediate Outgoing interface list:
    OUTSIDE, Forward, 00:05:41/never
    INSIDE, Forward, 00:43:21/never
```

测试组播的一种简单方法是使用ICMP ping工具。在这种情况下，从R2对组播IP地址230.11.11.11发起ping:

<#root>

```
L3-Switch#

ping 230.11.11.11 re 100

Type escape sequence to abort.
Sending 100, 100-byte ICMP Echos to 230.11.11.11, timeout is 2 seconds:
.............................
```

在防火墙上，动态创建mroute，且OIL为空：

```
<#root>

firepower#

show mroute


Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group,
C - Connected, L - Local, I - Received Source Specific Host Report,
P - Pruned, R - RP-bit set, F - Register flag, T - SPT-bit set,
J - Join SPT
Timers: Uptime/Expires
Interface state: Interface, State


(192.168.103.62, 230.11.11.11), 00:02:33/00:00:56, flags: SPF

<-- The mroute is added

  Incoming interface: OUTSIDE


  RPF nbr: 192.168.103.62


 Outgoing interface list: Null

<-- The OIL is empty
```

防火墙上的捕获显示：

```
<#root>

firepower# show capture

capture CAPI type raw-data trace interface OUTSIDE

[Capturing - 1040 bytes]

<-- There are ICMP packets captured on ingress interface
match icmp host 192.168.103.62 any
capture CAPO type raw-data interface INSIDE

[Capturing - 0 bytes]

<-- There are no ICMP packets on egress
match icmp host 192.168.103.62 any
```

防火墙会为每个ping创建连接，但会以静默方式丢弃数据包：

```
<#root>
```

```
firepower#

show log | include 230.11.11.11


May 17 2022 11:05:47: %FTD-7-609001:

Built local-host identity:230.11.11.11

<-- A new connection is created
May 17 2022 11:05:47: %FTD-6-302020: Built inbound ICMP connection for faddr 192.168.1.99/6 gaddr 230.1
May 17 2022 11:05:47: %FTD-6-302020: Built inbound ICMP connection for faddr 192.168.103.62/6 gaddr 230
May 17 2022 11:05:49: %FTD-6-302021: Teardown ICMP connection for faddr 192.168.1.99/6 gaddr 230.11.11.
May 17 2022 11:05:49: %FTD-6-302021: Teardown ICMP connection for faddr 192.168.103.62/6 gaddr 230.11.1
May 17 2022 11:05:49: %FTD-7-609002:

Teardown local-host identity:230.11.11.11 duration 0:00:02

<-- The connection is closed
May 17 2022 11:05:51: %FTD-7-609001:

Built local-host identity:230.11.11.11

<

--

A new connection is created
May 17 2022 11:05:51: %FTD-6-302020: Built inbound ICMP connection for faddr 192.168.1.99/6 gaddr 230.1
May 17 2022 11:05:51: %FTD-6-302020: Built inbound ICMP connection for faddr 192.168.103.62/6 gaddr 230
May 17 2022 11:05:53: %FTD-6-302021: Teardown ICMP connection for faddr 192.168.1.99/6 gaddr 230.11.11.
May 17 2022 11:05:53: %FTD-6-302021: Teardown ICMP connection for faddr 192.168.103.62/6 gaddr 230.11.1
May 17 2022 11:05:53: %FTD-7-609002:

Teardown local-host identity:230.11.11.11 duration 0:00:02

<-- The connection is closed
```

注意：LINA ASP丢弃捕获不会显示丢弃的数据包

组播数据包丢弃的主要指示如下：

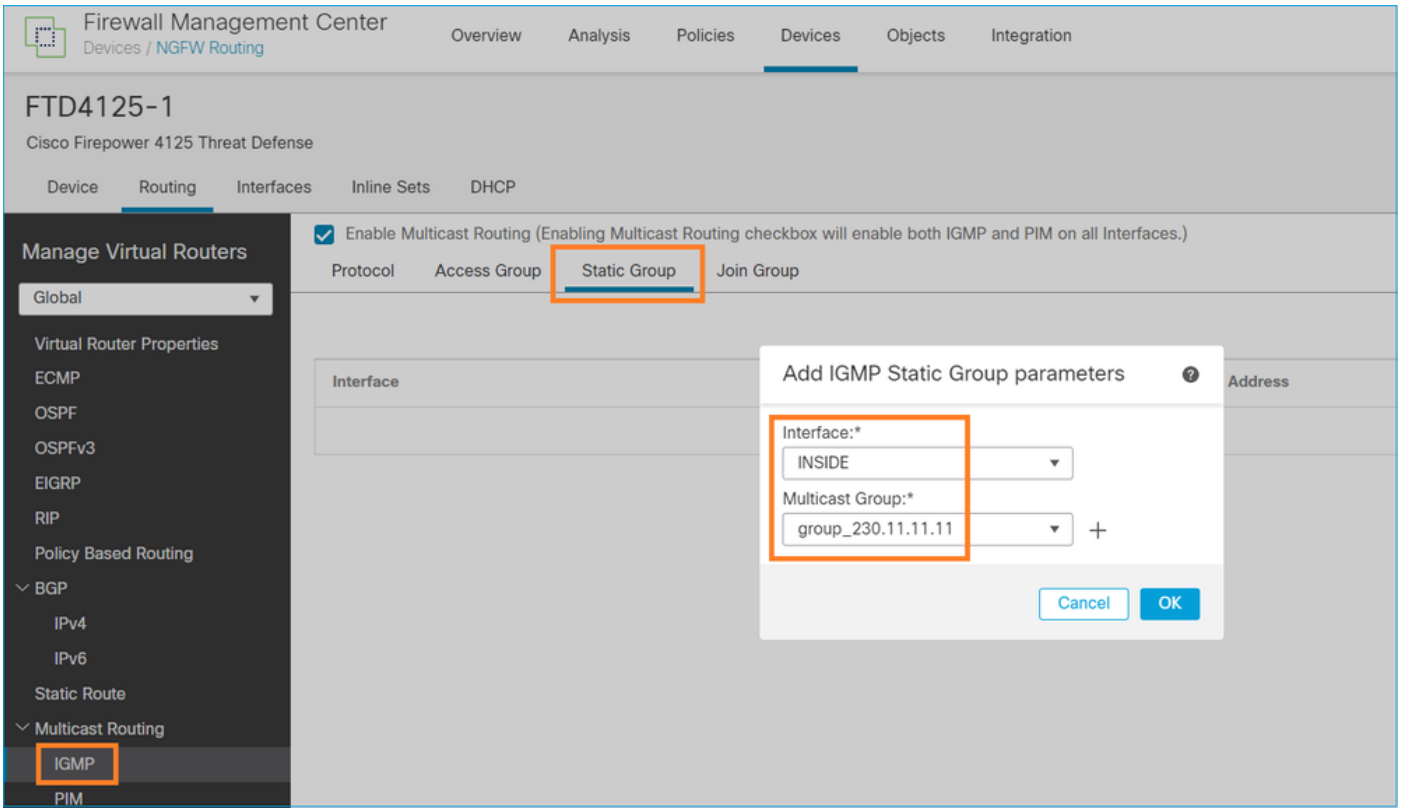
<#root>

```
firepower#

show mfib

Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
             AR - Activity Required, K - Keepalive
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second

Other counts: Total/RPF failed/Other drops

Interface Flags: A - Accept, F - Forward, NS - Negate Signalling
             IC - Internal Copy, NP - Not platform switched
             SP - Signal Present
Interface Counts: FS Pkt Count/PS Pkt Count

(*,224.0.1.39) Flags: S K
  Forwarding: 0/0/0/0, Other: 0/0/0
```

```
(*,224.0.1.40) Flags: S K
  Forwarding: 0/0/0/0, Other: 0/0/0

(192.168.103.62,230.11.11.11)

 Flags: K          <-- The multicast stream
  Forwarding: 0/0/0/0,

Other: 27/27/0

<-- The packets are dropped
```

igmp static-group

在FMC上配置静态IGMP组：



下面是后台部署的内容：

<#root>

```
interface Port-channel1.205
 vlan 205
 nameif INSIDE
 cts manual
  propagate sgt preserve-untag
  policy static sgt disabled trusted
 security-level 0
 ip address 192.168.1.24 255.255.255.0

 igmp static-group 230.11.11.11
```

```
<-- IGMP static group is enabled on the interface
```

ping失败，但ICMP组播流量现在通过防火墙转发：

```
<#root>

L3-Switch#

ping 230.11.11.11 re 10000

Type escape sequence to abort.
Sending 10000, 100-byte ICMP Echos to 230.11.11.11, timeout is 2 seconds:
.............................
```

```
<#root>

firepower#

show capture


capture CAPI type raw-data trace interface OUTSIDE

[Capturing - 650 bytes]

<-- ICMP packets are captured on ingress interface
match icmp host 192.168.103.62 any
capture CAPO type raw-data interface INSIDE

[Capturing - 670 bytes]

<-- ICMP packets are captured on egress interface
match icmp host 192.168.103.62 any
```

```
<#root>

firepower#

show capture CAPI

8 packets captured

1: 11:31:32.470541 192.168.103.62 > 230.11.11.11 icmp: echo request
2: 11:31:34.470358 192.168.103.62 > 230.11.11.11 icmp: echo request
3: 11:31:36.470831 192.168.103.62 > 230.11.11.11 icmp: echo request
4: 11:31:38.470785 192.168.103.62 > 230.11.11.11 icmp: echo request
...

firepower#

show capture CAPO


11 packets captured

1: 11:31:32.470587 802.1Q vlan#205 P0 192.168.103.62 > 230.11.11.11 icmp: echo request
```

```
2: 11:31:34.470404 802.1Q vlan#205 P0 192.168.103.62 > 230.11.11.11 icmp: echo request
3: 11:31:36.470861 802.1Q vlan#205 P0 192.168.103.62 > 230.11.11.11 icmp: echo request
4: 11:31:38.470816 802.1Q vlan#205 P0 192.168.103.62 > 230.11.11.11 icmp: echo request
```

注意：数据包的跟踪显示不正确的输出(入口接口与出口相同。有关详细信息，请查看Cisco Bug ID CSCvm89673。

<#root>

```
firepower#
```

show capture CAPI packet-number 1 trace

1: 11:39:33.553987 192.168.103.62 > 230.11.11.11 icmp: echo request

```
Phase: 1
Type: CAPTURE
Subtype:
Result: ALLOW
Elapsed time: 3172 ns
Config:
Additional Information:
MAC Access list

Phase: 2
Type: ACCESS-LIST
Subtype:
Result: ALLOW
Elapsed time: 3172 ns
Config:
Implicit Rule
Additional Information:
MAC Access list

Phase: 3
Type: ROUTE-LOOKUP
Subtype: No ECMP load balancing
Result: ALLOW
Elapsed time: 9760 ns
Config:
Additional Information:
Destination is locally connected. No ECMP load balancing.
Found next-hop 192.168.103.62 using egress ifc OUTSIDE(vrfid:0)

Phase: 4
Type: ACCESS-LIST
Subtype:
Result: ALLOW
Elapsed time: 5368 ns
Config:
Implicit Rule
Additional Information:

Phase: 5
Type: CONN-SETTINGS
```

```
Subtype:
Result: ALLOW
Elapsed time: 5368 ns
Config:
class-map class-default
match any
policy-map global_policy
class class-default
set connection advanced-options UM_STATIC_TCP_MAP
service-policy global_policy global
Additional Information:

Phase: 6
Type: NAT
Subtype: per-session
Result: ALLOW
Elapsed time: 5368 ns
Config:
Additional Information:

Phase: 7
Type: IP-OPTIONS
Subtype:
Result: ALLOW
Elapsed time: 5368 ns
Config:
Additional Information:

Phase: 8
Type: CLUSTER-REDIRECT
Subtype: cluster-redirect
Result: ALLOW
Elapsed time: 31720 ns
Config:
Additional Information:

Phase: 9
Type: INSPECT
Subtype: np-inspect
Result: ALLOW
Elapsed time: 488 ns
Config:
class-map inspection_default
match default-inspection-traffic
policy-map global_policy
class inspection_default
inspect icmp
service-policy global_policy global
Additional Information:

Phase: 10
Type: INSPECT
Subtype: np-inspect
Result: ALLOW
Elapsed time: 2440 ns
Config:
Additional Information:
```

Phase: 11

Type: MULTICAST

<-- The packet is multicast

Subtype:

Result: ALLOW

Elapsed time: 976 ns

Config:

Additional Information:

Phase: 12

Type: FLOW-CREATION

<-- A new flow is created
Subtype:
Result: ALLOW
Elapsed time: 56120 ns
Config:
Additional Information:
New flow created with id 5690, packet dispatched to next module

Phase: 13
Type: CAPTURE
Subtype:
Result: ALLOW
Elapsed time: 10248 ns
Config:
Additional Information:
MAC Access list

Result:

input-interface: OUTSIDE(vrfid:0)

input-status: up
input-line-status: up

output-interface: OUTSIDE(vrfid:0)

output-status: up
output-line-status: up

Action: allow

<-- The packet is allowed
Time Taken: 139568 ns

提示：可以从源主机使用超时0执行ping操作，还可以检查防火墙mfib计数器：

<#root>

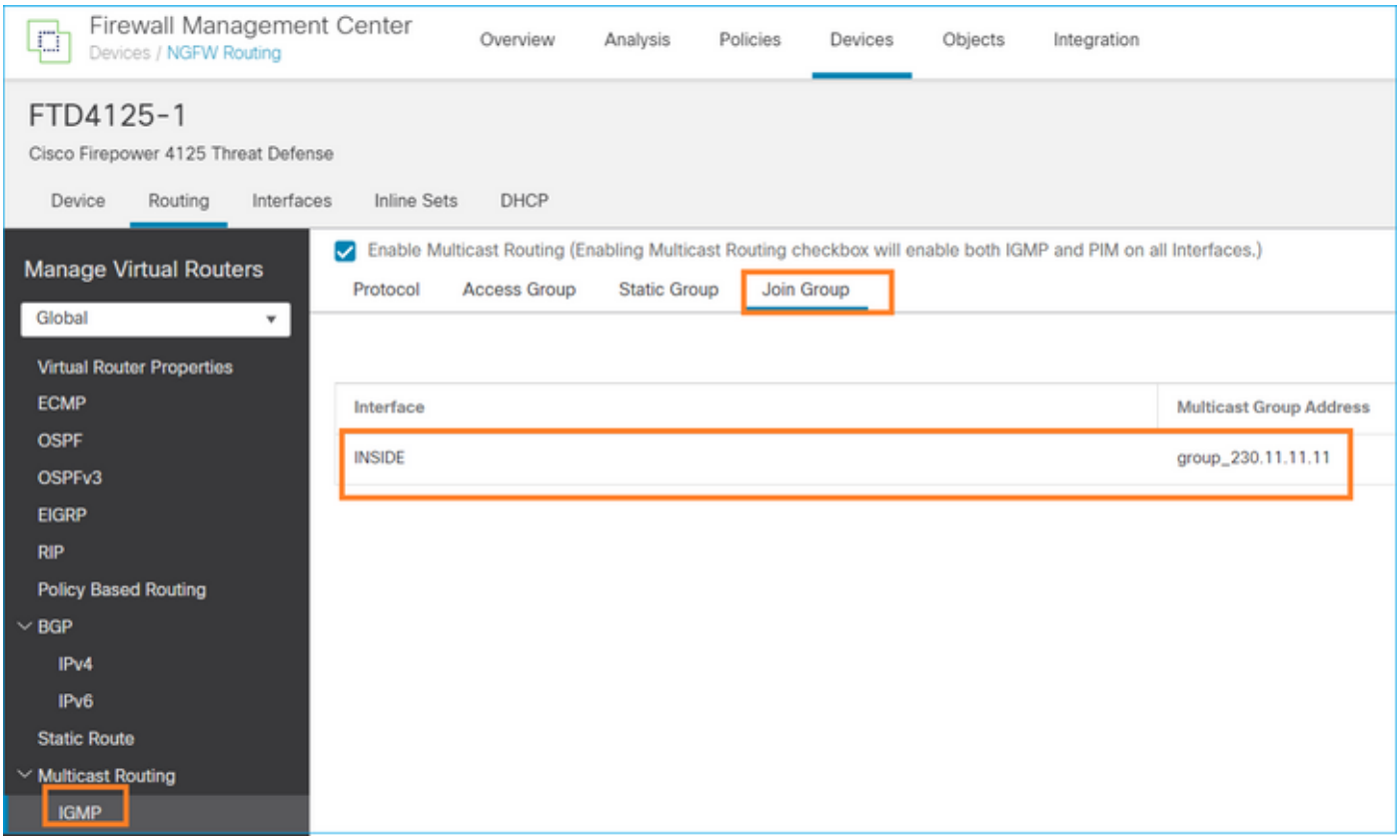
```
L3-Switch#

ping 230.11.11.11 re 500 timeout 0

Type escape sequence to abort.
Sending 1000, 100-byte ICMP Echos to 230.11.11.11, timeout is 0 seconds:
.....................................................................
.....................................................................
.....................................................................
.....................
```

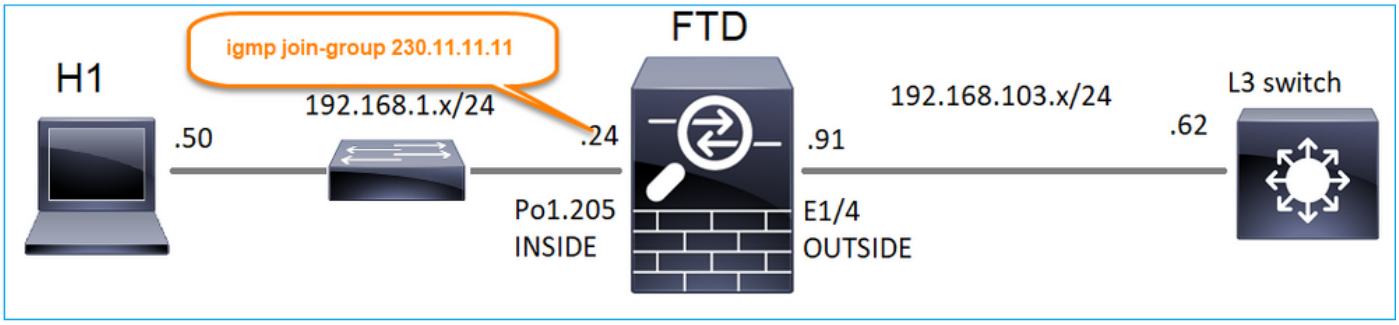
<#root>

```
firepower# clear mfib counters

firepower# !ping from the source host.

firepower#

show mfib 230.11.11.11


Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
AR - Activity Required, K - Keepalive

Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second


Other counts: Total/RPF failed/Other drops
Interface Flags: A - Accept, F - Forward, NS - Negate Signalling
IC - Internal Copy, NP - Not platform switched
SP - Signal Present
Interface Counts: FS Pkt Count/PS Pkt Count

(*,230.11.11.11) Flags: C K
  Forwarding: 0/0/0/0, Other: 0/0/0
  INSIDE Flags: F NS
    Pkts: 0/0
(192.168.103.62,230.11.11.11) Flags: K


Forwarding: 500/0/100/0, Other: 0/0/0

<-- 500 multicast packets forwarded. The average size of each packet is 100 Bytes
  OUTSIDE Flags: A
  INSIDE Flags: F NS
    Pkts: 500/0
```

igmp join-group

在FMC远程上，配置先前配置的静态组配置并配置IGMP加入组：





已部署的配置：

<#root>

```
firepower#
```

show run interface Port-channel1.205

```
!
interface Port-channel1.205
vlan 205
nameif INSIDE
cts manual
propagate sgt preserve-untag
policy static sgt disabled trusted
security-level 0
ip address 192.168.1.24 255.255.255.0
```

igmp join-group 230.11.11.11

```
<-- The interface joined the multicast group
```

IGMP组：

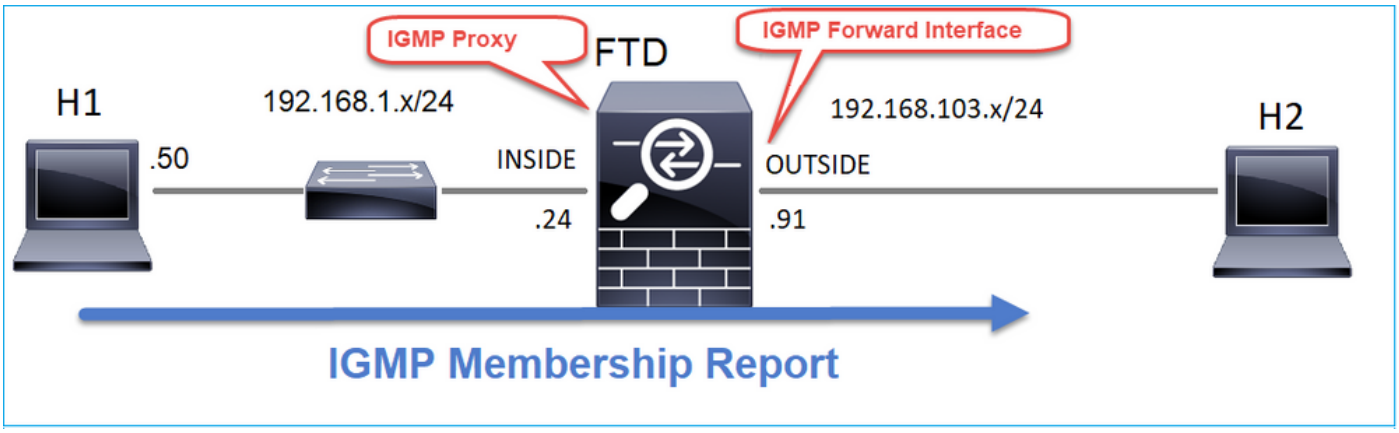
```
<#root>

firepower#

show igmp group


IGMP Connected Group Membership
Group Address Interface Uptime Expires Last Reporter

230.11.11.11 INSIDE 00:30:43 never 192.168.1.24

<-- The group is enabled on the interface
```

从源主机，尝试对230.11.11.11 IP执行第一个ICMP组播测试：

```
<#root>

L3-Switch#

ping 230.11.11.11 repeat 10


Type escape sequence to abort.
Sending 10, 100-byte ICMP Echos to 230.11.11.11, timeout is 2 seconds:

Reply to request 0 from 192.168.1.24, 12 ms
Reply to request 1 from 192.168.1.24, 8 ms
Reply to request 2 from 192.168.1.24, 8 ms
Reply to request 3 from 192.168.1.24, 8 ms
Reply to request 4 from 192.168.1.24, 8 ms
Reply to request 5 from 192.168.1.24, 12 ms
Reply to request 6 from 192.168.1.24, 8 ms
Reply to request 7 from 192.168.1.24, 8 ms
Reply to request 8 from 192.168.1.24, 8 ms
Reply to request 9 from 192.168.1.24, 8 ms
```

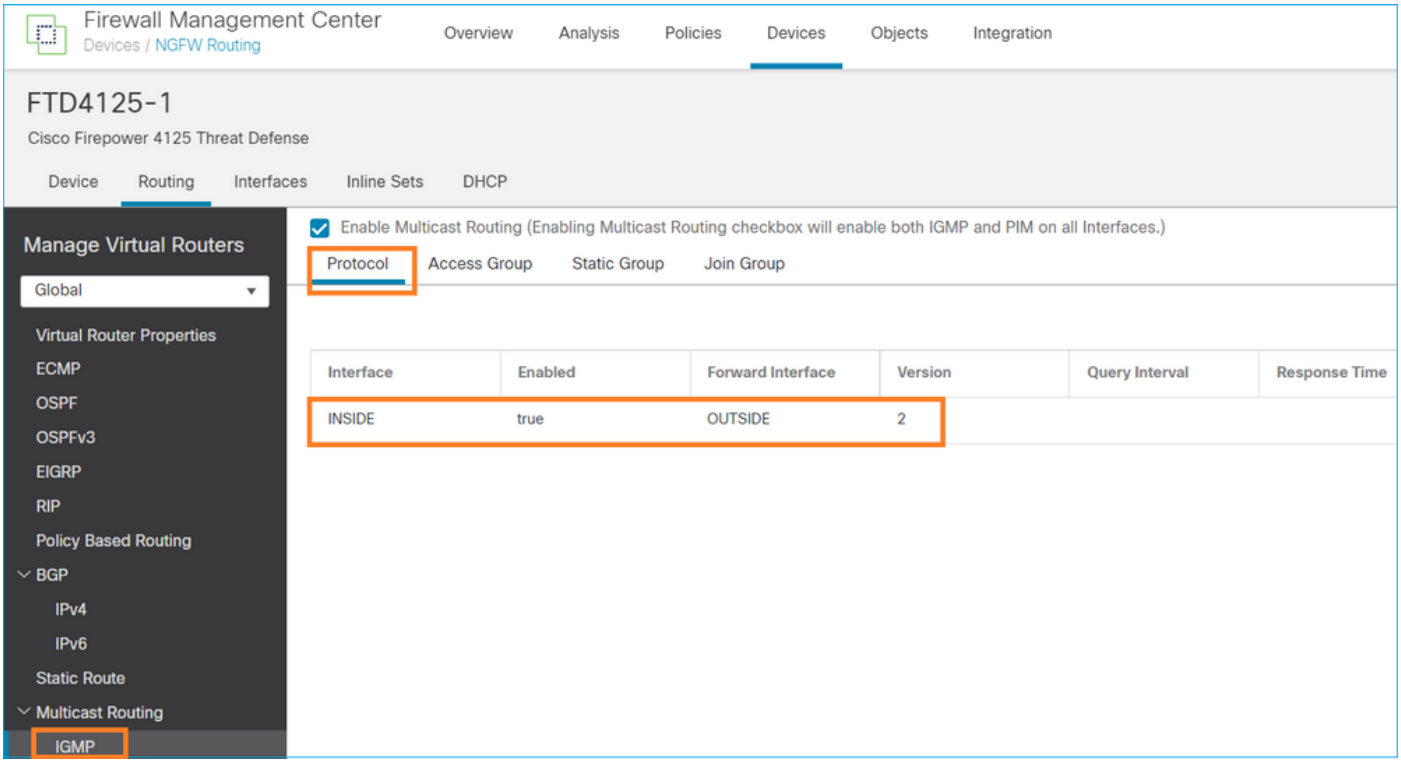

注意：如果您没有看到所有回复，请检查Cisco Bug ID CSCvm90069。

任务4 — 配置IGMP末节组播路由



在FTD上配置末节组播路由，以便将INSIDE接口上收到的IGMP成员身份报告消息转发到OUTSIDE接口。

解决方案



已部署的配置：

<#root>

```
firepower#
```

show run multicast-routing

multicast-routing

```
<-- Multicast routing is enabled
firepower#
```

show run interface Port-channel1.205

```
!
interface Port-channel1.205
 vlan 205
 nameif INSIDE
 cts manual
  propagate sgt preserve-untag
  policy static sgt disabled trusted
 security-level 0
 ip address 192.168.1.24 255.255.255.0
 igmp forward interface OUTSIDE
<-- The interface does stub multicast routing
```

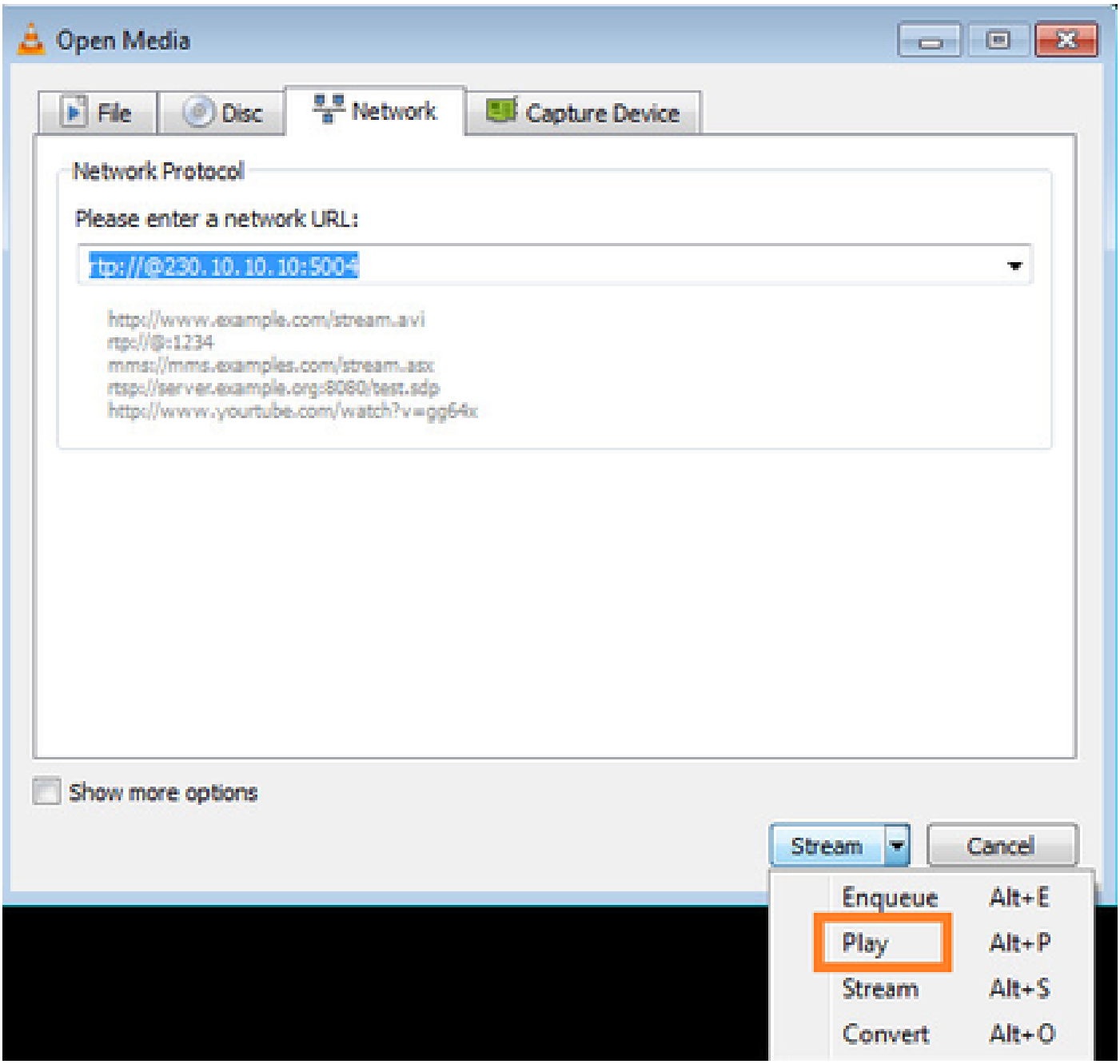
确认

在FTD上启用捕获：

```
<#root>
firepower#
capture CAPI interface INSIDE trace match igmp any host 230.10.10.10

firepower#
capture CAPO interface OUTSIDE match igmp any host 230.10.10.10
```

确认

要强制IGMP成员报告，您可以使用类似VLC的应用程序：



FTD代理IGMP数据包：

<#root>

```
firepower#
```

show capture

```
capture CAPI type raw-data trace interface INSIDE
```

[Capturing - 66 bytes]

```
<-- IGMP packets captured on ingress
match igmp any host 230.10.10.10
capture CAPO type raw-data interface OUTSIDE
```

[Capturing - 62 bytes]

```
<-- IGMP packets captured on egress
match igmp any host 230.10.10.10
```

FTD更改源IP:

```
<#root>

firepower#

show capture CAPI



1 packet captured

   1: 12:21:12.820483 802.1Q vlan#205 P6

192.168.1.50

 > 230.10.10.10 ip-proto-2, length 8    <-- The source IP of the packet on ingress interface
1 packet shown
firepower#

show capture CAPO



1 packet captured

   1: 12:21:12.820743

192.168.103.91

 > 230.10.10.10 ip-proto-2, length 8  <-- The source IP of the packet on egress interface
1 packet shown
```

如果检查Wireshark中的pcap，可以看到数据包完全由防火墙重新生成（IP标识更改）。

在FTD上创建组条目：

```
<#root>

firepower#

show igmp group

IGMP Connected Group Membership
Group Address    Interface            Uptime    Expires   Last Reporter

230.10.10.10     INSIDE               00:15:22  00:03:28  192.168.1.50

<-- IGMP group is enabled on the ingress interface
239.255.255.250  INSIDE               00:15:27  00:03:29  192.168.1.50
```

FTD防火墙创建2个控制平面连接：

```
<#root>

firepower#

show conn all address 230.10.10.10


9 in use, 28 most used
Inspect Snort:
preserve-connection: 0 enabled, 0 in effect, 0 most enabled, 0 most in effect

IGMP INSIDE 192.168.1.50 NP Identity Ifc 230.10.10.10, idle 0:00:09, bytes 8, flags

<-- Connection terminated on the ingress interface

IGMP OUTSIDE 230.10.10.10 NP Identity Ifc 192.168.103.91, idle 0:00:09, bytes 8, flags

<-- Connection terminated on the egress interface
```

第一个数据包的跟踪：

```
<#root>

firepower#

show capture CAPI packet-number 1 trace


6 packets captured


1: 12:21:12.820483 802.1Q vlan#205 P6 192.168.1.50 > 230.10.10.10 ip-proto-2, length 8

<-- The first packet of the flow
Phase: 1
Type: CAPTURE
Subtype:
Result: ALLOW
Elapsed time: 5124 ns
Config:
Additional Information:
MAC Access list

Phase: 2
Type: ACCESS-LIST
Subtype:
Result: ALLOW
Elapsed time: 5124 ns
Config:
Implicit Rule
Additional Information:
MAC Access list

Phase: 3
Type: ROUTE-LOOKUP
Subtype: No ECMP load balancing
```

```
Result: ALLOW
Elapsed time: 7808 ns
Config:
Additional Information:
Destination is locally connected. No ECMP load balancing.
Found next-hop 192.168.1.50 using egress ifc INSIDE(vrfid:0)

Phase: 4
Type: CLUSTER-DROP-ON-SLAVE
Subtype: cluster-drop-on-slave
Result: ALLOW
Elapsed time: 5368 ns
Config:
Additional Information:

Phase: 5
Type: ACCESS-LIST
Subtype:
Result: ALLOW
Elapsed time: 5368 ns
Config:
Implicit Rule
Additional Information:

Phase: 6
Type: IP-OPTIONS
Subtype:
Result: ALLOW
Elapsed time: 5368 ns
Config:
Additional Information:

Phase: 7
Type: NAT
Subtype: per-session
Result: ALLOW
Elapsed time: 5368 ns
Config:
Additional Information:

Phase: 8
Type: CLUSTER-REDIRECT
Subtype: cluster-redirect
Result: ALLOW
Elapsed time: 40504 ns
Config:
Additional Information:
```

Phase: 9

Type: MULTICAST

<-- The packet is multicast

Subtype:

Result: ALLOW

Elapsed time: 976 ns

Config:

Additional Information:

Phase: 10

Type: FLOW-CREATION

<-- A new flow is created

Subtype:

Result: ALLOW

Elapsed time: 17568 ns

Config:

Additional Information:

New flow created with id 5945, packet dispatched to next module

Phase: 11

Type: FLOW-CREATION

<-- A second flow is created

Subtype:

Result: ALLOW

Elapsed time: 39528 ns

Config:

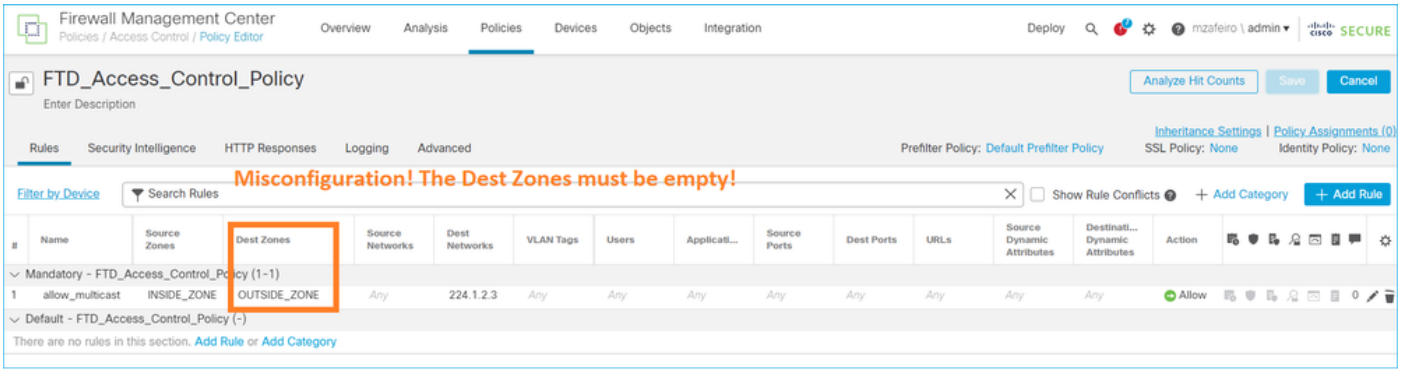
Additional Information:

```
New flow created with id 5946, packet dispatched to next module


Phase: 12
Type: NEXTHOP-LOOKUP-FROM-OUTPUT-ROUTE-LOOKUP
Subtype: Lookup Nexthop on interface
Result: ALLOW
Elapsed time: 6344 ns
Config:
Additional Information:
Found next-hop 230.10.10.10 using egress ifc OUTSIDE(vrfid:0)

Phase: 13
Type: CAPTURE
Subtype:
Result: ALLOW
Elapsed time: 9760 ns
Config:
Additional Information:
MAC Access list

Result:
input-interface: INSIDE(vrfid:0)
input-status: up
input-line-status: up
output-interface: INSIDE(vrfid:0)
output-status: up
output-line-status: up
Action: allow
Time Taken: 154208 ns
```

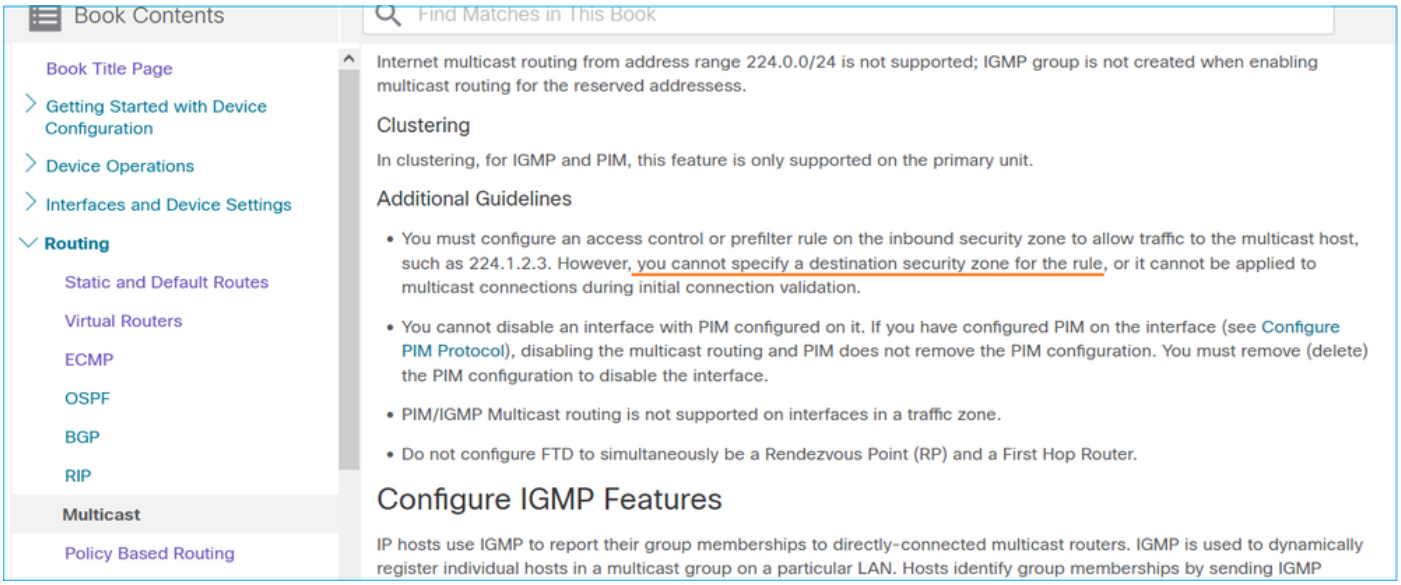
已知问题

过滤目标区域上的组播流量

您不能为匹配组播流量的访问控制策略规则指定目标安全区域：



FMC用户指南中也介绍了以下内容：



当超过IGMP接口限制时，防火墙会拒绝IGMP报告

默认情况下，防火墙允许接口上最多有500个当前活动联接（报告）。如果超过此阈值，防火墙会忽略来自组播接收器的其他传入IGMP报告。

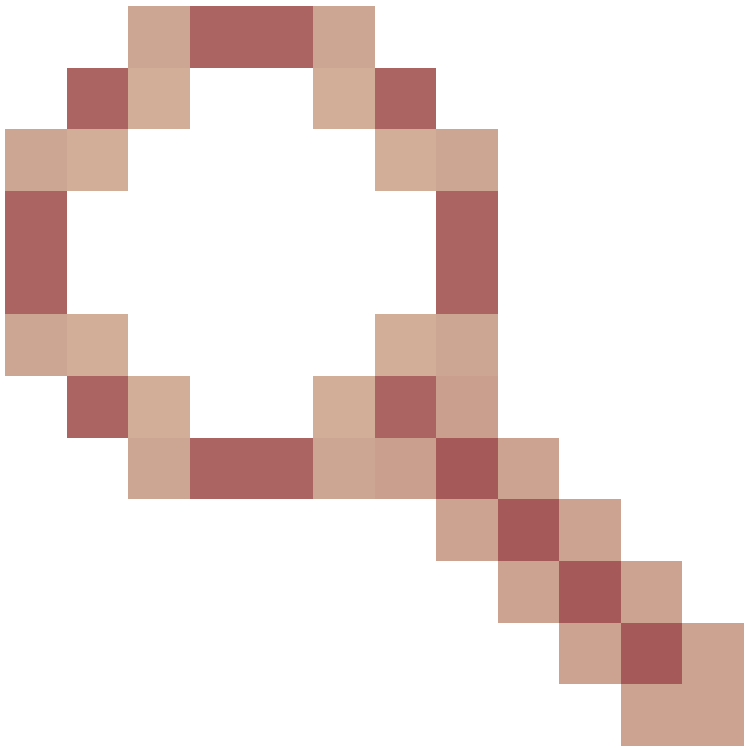
要检查IGMP限制和活动联接，请运行命令show igmp interface nameif:

```
<#root>

asa#

show igmp interface inside

inside is up, line protocol is up
  Internet address is 10.10.10.1/24
  IGMP is enabled on interface
  Current IGMP version is 2
  IGMP query interval is 125 seconds
  IGMP querier timeout is 255 seconds
  IGMP max query response time is 10 seconds
  Last member query response interval is 1 seconds
  Inbound IGMP access group is:

  IGMP limit is 500, currently active joins: 500

  Cumulative IGMP activity: 0 joins, 0 leaves
  IGMP querying router is 10.10.10.1 (this system)
```

IGMP debug命令debug igmp显示以下输出：

```
<#root>

asa#

debug igmp
```

```
Apr 20 2023 09:37:10: %ASA-7-711001: IGMP: Group 230.1.2.3 limit denied on inside
```



软件版本中修复了Cisco Bug ID CSCvw60976
允许用户为每个接口配置最多5000个组。

防火墙忽略232.x.x.x/8地址范围的IGMP报告

232.x.x.x/8地址范围用于源特定组播(SSM)。防火墙不支持PIM源特定组播(SSM)功能和相关配置。

IGMP debug命令debug igmp显示以下输出：

<#root>

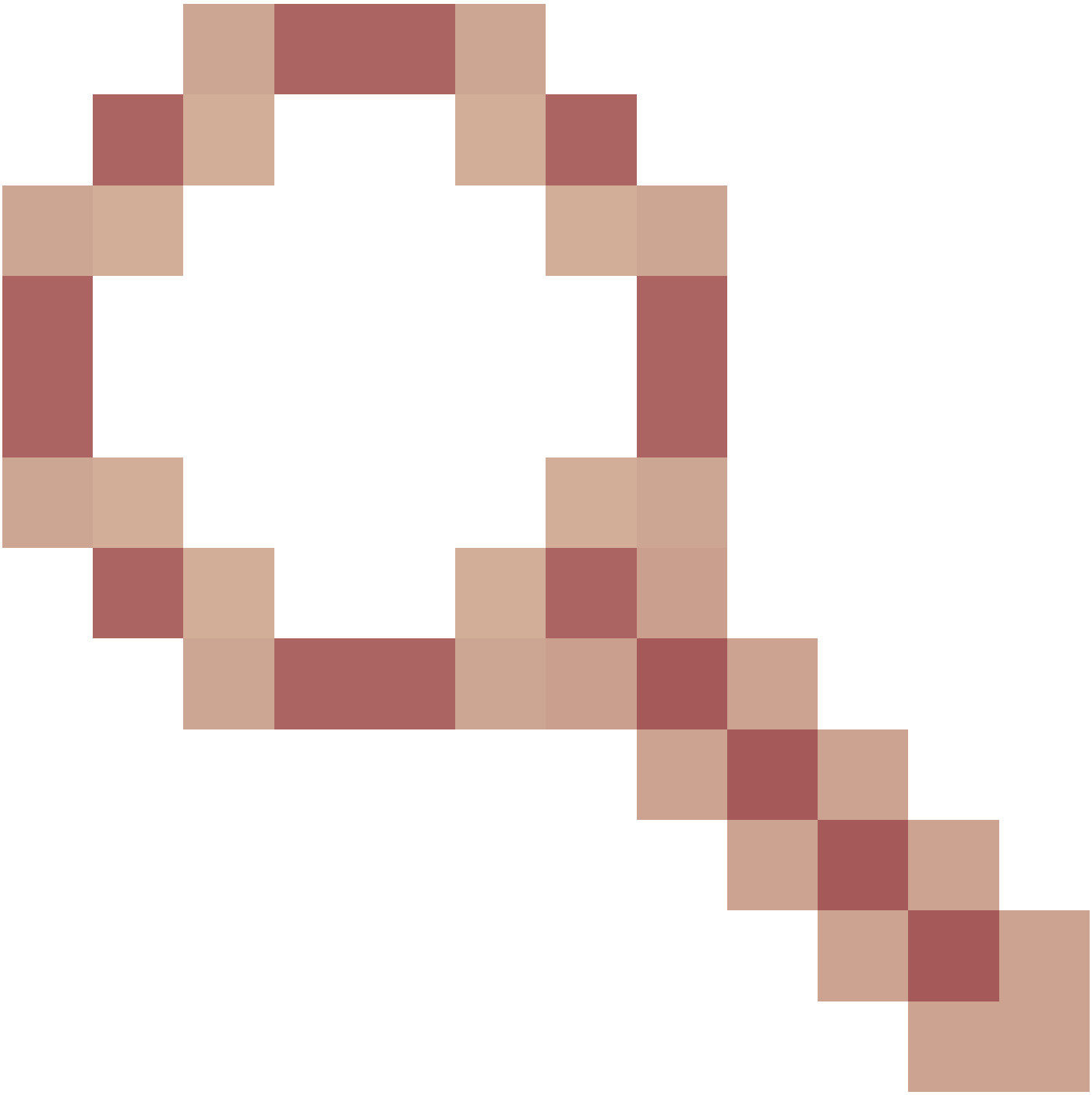
asa#

debug igmp

```
Apr 20 2023 09:37:10: %ASA-7-711001: IGMP: Received v2 Report on inside from 10.10.10.11 for 232.179.89
Apr 20 2023 09:37:10: %ASA-7-711001: IGMP: group_db: add new group 232.179.89.253 on inside
```

Apr 20 2023 09:37:10: %ASA-7-711001: IGMP: Exclude report on inside ignored for SSM group 232.179.89.253

Cisco Bug ID CSCsr53916



跟踪增强功能以支持SSM范围。

相关信息

- 用于Firepower威胁防御的组播路由
- 排除Firepower威胁防御和ASA组播PIM故障

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