在FDM管理的FTD上使用IP SLA配置ECMP

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简介

本文档介绍如何在由FDM管理的FTD上配置ECMP和IP SLA。

先决条件

要求

Cisco 建议您了解以下主题:

- 思科安全防火墙威胁防御(FTD)上的ECMP配置
- 思科安全防火墙威胁防御(FTD)上的IP SLA配置
- 思科安全防火墙设备管理器(FDM)

使用的组件

本文档中的信息基于以下软件和硬件版本:

• 思科FTD版本7.4.1(内部版本172)

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。

背景信息

本文档介绍如何在由Cisco FDM管理的Cisco FTD上配置等价多路径(ECMP)以及互联网协议服务级 别协议(IP SLA)。 ECMP允许您在FTD上将接口分组到一起,并在多个接口之间均衡流量负载。 IP SLA是一种通过交换常规数据包来监控端到端连接的机制。与ECMP一起,可以实施IP SLA以确保 下一跳的可用性。 在本例中,ECMP用于在两个Internet服务提供商(ISP)电路上平均分配数据包。 同时,IP SLA会跟踪连通性,确保在发生故障时无缝过渡至任何可用电路。

本文档的具体要求包括:

- 使用具有管理员权限的用户帐户访问设备
- 思科安全防火墙威胁防御7.1版或更高版本

配置

网络图

在本例中,Cisco FTD有两个外部接口:outside1和outside2。每个都连接到ISP网关,outside1和 outside2属于名为outside的同一个ECMP区域。

来自内部网络的流量通过FTD路由,并通过两个ISP实现到Internet的负载均衡。

同时,FTD使用IP SLA来监控与每个ISP网关的连接。如果任何ISP电路出现故障,FTD会故障切换 到另一个ISP网关以保持业务连续性。



网络图

配置

步骤 0预配置接口/对象

登录FDM Web GUI,单击Device,然后单击Interfaces摘要中的链接。 Interfaces 列表显示可用接口及其名称、地址和状态。



FDM设备接口



点击要编辑的物理接口的编辑图标(

)。 在本示例中,GigabitEthernet0/1。

| Firewall Device Manager Monitoring Po | icies Objects Devic | ce: firepower | ۵. | @ ? : ; | admin Administrator | SECURE |
|--|---------------------|---------------|-------------|-------------------|------------------------|---------|
| Device Summary Interfaces | | | | | | |
| Cisco Pirepower Threat Defense for KVM () 0/0 0/1 0/2 0/3 0/4 0/5 0/6 0/7 () () () () () () () () () () () () () (| a | | | | | |
| 9 Interfaces | | | 6 | Y Filter | | + |
| NAME | LOGICAL NAME STATU | IS MODE IPA | LDD RESS | STAND BY AD DRESS | MONITOR FOR HA | ACTIONS |
| > GlgabitEthernet0/0 | outside | Routed | | | Enabled | |
| > GigabitEthemet0/1 | outside 1 | Routed 10. | 1.1.1 State | | Enabled | Q. |

步骤0接口Gi0/1

在Edit Physical Interface窗口中:

1. 设置Interface Name,在本例中为outside1。



2. 将状态滑块设置为已启用设置(

)。

- 3. 单击IPv4 Address选项卡并配置IPv4地址(本例中为10.1.1.1/24)。
- 4. Click OK.

| GigabitEthernet0/1 Edit Physical Interface | | 0 × |
|---|----------|--------|
| | | |
| Interface Name | Mode | Status |
| outside1 | Routed ~ | |
| Most features work with named interfaces only, although some require unnamed interfaces. | | |
| Description | | |
| | | |
| | | li. |
| IPv4 Address IPv6 Address Advanced | | |
| Туре | | |
| Static 🗸 | | |
| | | |
| IP Address and Subnet Mask | | |
| 10.1.1.1 / 255.255.255.0 | | |
| e.g. 192.108.5.15/17 or 192.108.5.15/255.255.128.0 | | |
| Standby IP Address and Subnet Mask | | |
| 1 | | |
| e.g. 192.168.5.16 | | |
| | | |
| | CANCEL | OK |

步骤0编辑接口Gi0/1



注意:只有路由接口可以与ECMP区域关联。

重复类似步骤,为辅助ISP连接配置接口,本示例中物理接口为GigabitEthernet0/2。在Edit Physical Interface窗口中:

- 2. 将状态滑块设置为已启用设置(
- 1. 设置Interface Name,在本例中为outside2。

)。

- 3. 单击IPv4 Address 选项卡并配置IPv4地址,在本例中为10.1.2.1/24。
- 4. Click OK.

| GigabitEthernet0/2 Edit Physical Interface | | 0 × |
|---|------------------|--------|
| Interface Name outside2 Most features work with named interfaces only, although some require unnamed interfaces. | Mode Routed V | Status |
| Description | | |
| IPv4 Address IPv6 Address Advanced | | li. |
| Type Static V | | |
| IP Address and Subnet Mask 10.1.2.1 / 24 e.g. 192.168.5.15/17 or 192.168.5.15/255.255.128.0 | | |
| Standby IP Address and Subnet Mask / e.g. 192.168.5.16 | | |
| | CANCEL | СК |

步骤0编辑接口Gi0/2

重复类似步骤,为内部连接配置接口,在本示例中,物理接口为GigabitEthernet0/3。在Edit Physical Interface窗口中:

1. 设置Interface Name,在此示例中为inside。



- 2. 将状态滑块设置为已启用设置(
-)。 3. 点击IPv4 Address选项卡并配置IPv4地址,在本例中为10.1.3.1/24。
- 4. Click OK.

| GigabitEthernet0/3 Edit Physical Interface | | 0 × |
|--|----------|--------|
| Interface Name | Mode | Status |
| inside | Routed ~ | |
| Most features work with named interfaces only, although some require unnamed interfaces. | | |
| Description | | |
| | | |
| IPv4 Address IPv6 Address Advanced | | |
| Type Static IP Address and Subnet Mask 10.1.3.1 / 24 e.g. 192.168.5.15/17 or 192.168.5.15/255.255.128.0 | | |
| Standby IP Address and Subnet Mask | | |
| 1 | | |
| e.g. 192.168.5.16 | | |
| | CANCEL | ок |

步骤0编辑接口Gi0/3

导航到对象>对象类型>网络,点击添加图标(



)添加新对象。

| Firewall Device Mana | ager Monito | ring | Ø Policies | HE Objects | Device: firepow | ver | (| \sum | | ۲ | ? | : | admin Administrator | Ŷ | cisco SECURE |
|-----------------------|-------------|-------------|---------------|---------------|-----------------|------|------------------------------|---------------|-------------|--------------------|------------|-----------|------------------------|------|--------------|
| Object Types ← | Network | Objec | cts and | d Groups | | | | | | | | | | | |
| C Networks | 8 objects | | | | | | | | Ţ R | ter | | | | | + 🔍 |
| 🕁 Ports | | | | | | | | , | Preset filt | ers: Syst e | an defines | 1. Vaerus | boola | | |
| 🔒 Security Zones | # NAME | | | | туря | I | VALUE | | | | | | | | ACTIONS |
| 🐔 Application Filters | 1 IPv4-F | rivate-All- | -RFC1918 | | Gro | up | IPv4-Private- 192.168.0.0 | -10.0)-16 | .0.0-8, | Pv4-Pri | vate-172 | .16.0.0 |)-12, IPv4-Priv | ite- | |
| 🕫 URLs | 2 IPv4-P | rivate-10 | .0.0.8 | | NET | WORK | 10.0.0/8 | | | | | | | | |
| Geolocations | з IPv4-Р | rivate - 17 | 2.16.0.0- | 12 | NET | WORK | 172.16.0.0/ | 12 | | | | | | | |
| Svslog Servers | 4 IPv4-P | rivate-19 | 2.168.0.0 | -16 | NET | WORK | 192.168.0.0 |)/16 | | | | | | | |
| | s any-ip | v4 | | | NET | WORK | 0.0.0.0/0 | | | | | | | | |
| IKE POIICIES | s any-ip | vб | | | NET | WORK | ::/0 | | | | | | | | |

第0步对象1

在Add Network Object 窗口中,配置第一个ISP网关:

- 1. 设置对象的Name,在本例中为gw-outside1。
- 2. 选择对象的类型,在本例中为主机。
- 3. 设置主机的IP地址,在本例中为10.1.1.2。
- 4. Click OK.

Add Network Object

| Name gw-outside1 | |
|--|-----------|
| Description | |
| | |
| Type O Network O FQDN O R | lange |
| Host 10.1.1.2 | |
| e.g. 192.168.2.1 or 2001:DB8::0DB8:800:200C:417A | |
| | CANCEL OK |

第0步对象2

重复类似步骤,为第二个ISP网关配置另一个网络对象:

1. 设置对象的Name,在本例中为gw-outside2。

- 2. 选择对象的类型,在本例中为主机。
- 3. 设置主机的IP地址,在本例中为10.1.2.2。
- 4. Click OK.

Add Network Object

| Name gw-outside2 | |
|--|--|
| Description | |
| | |
| Type Network Host FQDN Range | |
| Host | |
| e.g. 192.168.2.1 or 2001:DB8::0DB8:800:200C:417A | |
| CANCEL | |

第0步对象3



注意:必须在FTD上配置访问控制策略才能允许该流量,本文档中不包含此部分。

步骤1:配置ECMP区域

导航到设备,然后点击路由摘要中的链接。



如果启用了虚拟路由器,请点击在其中配置静态路由的路由器的查看图标()。在这种情况下,虚拟路由器未启用。



第1步ECMP Zone1



点击ECMP Traffic Zones选项卡,然后点击添加图标()添加新区域。

| Firewall Device Manager | 500 Monitoring | Policies | ta± Objects | Device: firepower | 6 | | admin Administra | tor visition SECURE |
|------------------------------|----------------|-----------------|----------------|-------------------|---|-----------------|--------------------------|---------------------|
| Device Summary Routing | | | | | | | | |
| Add Multiple Virtual Routers | | | | | | * | >_ Commands \checkmark | BGP Global Settings |
| Static Routing BGP OSPF | EIGRP | CMP Traffic Zon | 62 | | | T Filter | | + |

第1步ECMP Zone2

在Add ECMP Traffic Zone窗口中:

1. 设置ECMP区域的名称和说明(可选)。



2. 点击添加图标(

)可选择最多8个接口以包含在区域中。在本示例中,ECMP名称为Outside,接口outside1和 outside2将添加到此区域。

3. Click OK.

Add ECMP Traffic Zone

Keep the member interfaces of a ECMP traffic zone in the same security zone to prevent different access rules being applied to those interfaces.

0 ×

| Name | | |
|------------------------------------|---------|---------------------|
| Outside | | |
| Description | | |
| | | |
| | | 11. |
| Interfaces | | |
| + | | |
| > Inside (GigabitEthernet0/3) | 0 | |
| > management (Management0/0) | O ANCEL | OK |
| > outside (GigabitEthernet0/0) | 0 | NETWORK |
| > is outside1 (GigabitEthernet0/1) | 0 | |
| Outside 2 (GigabitEthernet0/2) | 0 | |
| 2 literals) selected | | INSIDE HOST |
| | AD | D ECMP TRAFFIC ZONE |
| Greate dew Subioterface CANCEL | OK | |

第1步ECMP区域3

接口outside1和outside2均已成功添加到ECMP区域outside。

| Device Summary Routing | | | | |
|-----------------------------------|--|-----------------|---------------|---------------------|
| Add Multiple Virtual Routers | | ~ | >_ Commands v | BGP Global Settings |
| Static Routing BGP OSPF EIGRP ECM | P Traffic Zones | | | |
| 1 object | | T Filter | | + |
| # NAME | INTERFACES | | | ACTIONS |
| 1 Outside | outside1 (GigabitEthernet0/1) outside2 (GigabitEthernet0/2) | | | |
| | | | | |

第1步ECMP Zone4



注意:ECMP路由流量区域与安全区域无关。创建包含outside1和outside2接口的安全区域 不会为ECMP路由实现流量区域。

第二步:配置IP SLA对象

要定义用于监控到每个网关连接的SLA对象,请导航到对象>对象类型> SLA监控器,点击添加图标(



)为第一个ISP连接添加新的SLA监控器。

| Firewall Device Manager Monitoring Policies | Objects Device: firepower | admin Administrato | or Cisco SECURE |
|---|--------------------------------|--------------------|-----------------|
| Object Types - SLA Monitors | | | |
| C Networks | | T Filter | + |
| S Ports | MONITORED ADDRESS TA | NGET INTERFACE | ACTIONS |
| G Security Zones | | | |
| 🐬 Application Filters | There are no SLA Monit | ors yet. | |
| c ² URLs | Start by creating the first St | A Monitor. | |
| Geolocations | CREATE SLA MONITO | R | |
| 🚆 Syslog Servers | | | |
| 🔏 IKE Policies | | | |
| 🐴 IPSec Proposals | | | |
| Secure Client Profiles | | | |
| 🕰 Identity Sources | | | |
| L Users | | | |
| 🙊 Certificates | | | |
| 🔒 Secret Keys | | | |
| DNS Groups | | | |
| Vg Event List Filters | | | |
| (?) SLA Monitors | | | |

第2步IP SLA1

在Add SLA Monitor Object 窗口中:

- 1. 为SLA监控器对象设置Name,也可以设置说明(本例中为sla-outside1)。
- 2. 设置Monitor Address,在本例中为gw-outside1(第一个ISP网关)。
- 3. 设置用于到达监控器地址的目标接口,在本例中为outside1。
- 4. 此外,还可以调整超时和阈值。Click OK.

Add SLA Monitor Object

| Name | | | |
|-------------------------|-------------------------------|-----------------------------------|--------------|
| sla-outside1 | | | |
| Description | | | |
| | | | h. |
| Monitor Address | | | |
| gw-outside1 | | | ~ |
| Target Interface | hernet0/1) | | ~ |
| | | | |
| IP ICMP ECHO OPTIONS | | | |
| Following propertie | es have following correlation | n: Threshold ≤ Timeout ≤ Frequenc | av |
| Threshold | | Timeout | |
| 5000 | milliseconds | 5000 | milliseconds |
| 0 - 2147483647 | | 0 - 604800000 | |
| Frequency | | | |
| 60000 | milliseconds | | |
| 1000 - 604800000, multi | ple of 1000 | | |
| Type of Service | Number of Packets | Data Size | |
| 0 | 1 | 28 | bytes |
| 0 - 255 | 0 - 100 | 0 - 16384 | |
| | | | |
| | | CANCEL | ок |

0>

重复类似步骤,在Add SLA Monitor Object 窗口中为第二个ISP连接配置另一个SLA Monitor对象:

- 1. 为SLA监控器对象设置Name,也可以设置说明(本例中为sla-outside2)。
- 2. 设置Monitor Address,在本例中为gw-outside2(第二个ISP网关)。
- 3. 设置可到达监控器地址的目标接口,此例中为outside2。
- 4. 此外,还可以调整超时和阈值。Click OK.

Add SLA Monitor Object

| Name | | | |
|-------------------------|------------------------------|---------------------------------|--------------|
| sla-outside2 | | | |
| Description | | | |
| | | | 14. |
| Monitor Address | | | |
| gw-outside2 | | | ~ |
| Target Interface | | | |
| outside2 (GigabitEth | ernet0/2) | | ~ |
| IP ICMP ECHO OPTIONS | | | |
| Following propertie | s have following correlation | : Threshold ≤ Timeout ≤ Frequen | ay |
| Threshold | | Timeout | |
| 5000 | milliseconds | 5000 | milliseconds |
| 0 - 2147483647 | | 0 - 604800000 | |
| Frequency | | | |
| 60000 | milliseconds | | |
| 1000 - 604800000, multi | ple of 1000 | | |
| Type of Service | Number of Packets | Data Size | |
| 0 | 1 | 28 | bytes |
| 0 - 255 | 0 - 100 | 0 - 16384 | |
| | | | |
| | | CANCEL | ок |

0 X

第三步:使用路由跟踪配置静态路由

导航到设备,然后点击路由摘要中的链接。

如果启用了虚拟路由器,请点击在其中配置静态路由的路由器的查看图标()。在这种情况下,虚拟路由器未启用。

| Firewall Device Manag | jer 🕅 Monitoring | Policies Objects | Device: firepow | er (| | Administrator | SECURE |
|---|------------------------|---|--------------------------------------|---|--------------------------------------|---|--------|
| Model Cisco Firepo | ower Threat Defense fo | Software VDB rKVM 7.4.1-172 376.0 | Intrusion Rule Up 0 20231011-1536 | ate Cloud Service | IS High A tered Register Not Co | wailability O CONFIGURE | |
| | inside Netw | Cisco Firepower Threat D 0/0 0/1 0/2 0 00 000 000 | 0/3 0/4 0/5 0/6 0 | 17 MOMT | ISP/WAN/Gate way | Internet DNS Server ONTP Server | |
| Interfaces Management: Merged Enabled 4 of 9 View All Interfaces | > | Routing 2 static routes View Configuration | > | Updates Geolocation, Rule Security Intelligen View Configurati | o, VDB, System Upgrade, ce Feeds | System Settings Management Access Logging Settings DHCP Server / Relay DDNS Service DNS Server | |

第3步Route1

在静态路由页面上,点击添加图标(



)为第一个ISP链路添加新静态路由。

在Add Static Route 窗口中:

- 1. 设置路由的名称和说明(可选)。在本示例中,route_outside1。
- 2. 从Interface 下拉列表中,选择要通过其发送流量的接口,网关地址需要通过该接口可访问。 在本示例中,outside1 (GigabitEthernet0/1)。
- 3. 选择Networks 以标识使用此路由中网关的目标网络或主机。在本示例中,预定义any-ipv4。
- 4. 从Gateway 下拉列表中,选择用于识别网关IP地址的网络对象,Traffic is sent to this address。在本示例中,gw-outside1(第一个ISP网关)。
- 5. 设置路由的Metric,介于1和254之间。在本示例1中。
- 6. 从SLA Monitor下拉列表中选择SLA监控器对象。在本例中,sla-outside1。

| Add Static Route | 0 | × |
|--|----|-----|
| Name route_outside1 | | |
| Description | | 11. |
| Interface outside1 (GigabitEthernet0/1) | | ~ |
| Protocol OIPv4 OIPv6 | | |
| + D any-lpv4 | | |
| Gateway Metric gw-outside1 ~ 1 | | |
| SLA Monitor Applicate only for IPv4 Protocol type sla-outside1 | | ~ |
| CANCEL | oĸ | |

在Add Static Route 窗口中重复类似步骤,为第二个ISP连接配置另一个静态路由:

- 1. 设置路由的名称和说明(可选)。在本示例中,route_outside2。
- 2. 从Interface 下拉列表中,选择要通过其发送流量的接口,网关地址需要通过该接口可访问。 在本示例中,outside2 (GigabitEthernet0/2)。
- 3. 选择Networks 以标识使用此路由中网关的目标网络或主机。在本示例中,预定义any-ipv4。
- 4. 从Gateway 下拉列表中,选择识别网关IP地址的网络对象,流量将发送到此地址。在本示例 中,gw-outside2(第二个ISP网关)。
- 5. 设置路由的Metric,介于1和254之间。在本示例1中。
- 6. 从SLA Monitor下拉列表中选择SLA监控器对象。在本场景中,为sla-outside2。
- 7. Click OK.

Add Static Route



| Name | | |
|---|--------|--------|
| route_outside2 | | |
| Description | | |
| | | 1 |
| Interface | | 776 |
| outside2 (GigabitEthernet0/2) | | ~ |
| Protocol | | |
| ● IPv4 ○ IPv6 | | |
| Networks | | |
| T any-lpv4 | | |
| | | |
| Gateway | | Metric |
| gw-outside2 | ~ | 1 |
| SLA Monitor Applicatile only for IPv4 Protocol type | | |
| sla-outside2 | | ~ |
| | | |
| | CANCEL | ок |

您有2条通过具有路由路径的outside1和outside2接口的路由。

| Device Summary Routing | | | | | | | | |
|--|-----------|---------|----------|-----------|----------------|---------------|----------|-------------|
| Add Multiple Virtual Routers | | | | | ~ | >_ Commands ~ | BGP Glob | al Settings |
| Static Routing BGP OSPF EIGRP ECMP Traffic Zones | | | | | | | | |
| 2 routes | | | | | T Filte | r | | + |
| # NAME | INTERFACE | IP TYPE | NETWORKS | GATEWAYIP | | SLA MONITOR | METRIC | ACTIONS |
| 1 route_outside1 | outside1 | IPv4 | 0.0.0/0 | 10.1.1.2 | | sla-outside1 | 1 | |
| 2 route_outside2 | outside2 | IPv4 | 0.0.0/0 | 10.1.2.2 | | sla-outside2 | 1 | |

第3步Route4

将更改部署到FTD。

验证

登录FTD的CLI,运行命令 show zone 以检查有关ECMP流量区域的信息,包括作为每个区域一部分的接口。

<#root>

> show zone Zone:

Outside

ecmp Security-level: 0

Zone member(s): 2

outside2 GigabitEthernet0/2

outside1 GigabitEthernet0/1

运行 show running-config route 命令检查正在运行的路由配置是否正确,在这种情况下,有两条带路由跟踪的静态路由。

<#root>

> show running-config route

route outside1 0.0.0.0 0.0.0.0 10.1.1.2 1 track 1

运行 show route 命令检查路由表,如果有两个默认路由是通过接口outside1和outside2以等价方式路由,数据流可以在两个ISP电路之 间分配。

<#root>

> show route

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, V - VPN 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 SI - Static InterVRF, BI - BGP InterVRF Gateway of last resort is 10.1.2.2 to network 0.0.0

S* 0.0.0.0 0.0.0.0 [1/0] via 10.1.2.2, outside2

[1/0] via 10.1.1.2, outside1

C 10.1.1.0 255.255.255.0 is directly connected, outside1 L 10.1.1.1 255.255.255.255 is directly connected, outside1 C 10.1.2.0 255.255.255.0 is directly connected, outside2 L 10.1.2.1 255.255.255.255 is directly connected, outside2 C 10.1.3.0 255.255.255.0 is directly connected, inside L 10.1.3.1 255.255.255.255 is directly connected, inside

运行命令 show sla monitor configuration 以检查SLA监控器的配置。

<#root>

> show sla monitor configuration SA Agent, Infrastructure Engine-II Entry number: 1037119999 Owner: Tag:

Type of operation to perform: echo

Target address: 10.1.1.2

Interface: outside1

Number of packets: 1

Request size (ARR data portion): 28 Operation timeout (milliseconds): 5000 Type Of Service parameters: 0x0 Verify data: No Operation frequency (seconds): 60 Next Scheduled Start Time: Start Time already passed Group Scheduled : FALSE Life (seconds): Forever Entry Ageout (seconds): never Recurring (Starting Everyday): FALSE Status of entry (SNMP RowStatus): Active Enhanced History: Entry number: 1631063762 Owner: Tag: Type of operation to perform: echo Target address: 10.1.2.2 Interface: outside2 Number of packets: 1 Request size (ARR data portion): 28 Operation timeout (milliseconds): 5000 Type Of Service parameters: 0x0 Verify data: No Operation frequency (seconds): 60 Next Scheduled Start Time: Start Time already passed Group Scheduled : FALSE Life (seconds): Forever Entry Ageout (seconds): never Recurring (Starting Everyday): FALSE Status of entry (SNMP RowStatus): Active Enhanced History:

运行命令 show sla monitor operational-state 以确认SLA监控器的状态。在这种情况下,您可以在命令输出中找到"Timeout occurred : FALSE",它表示发往网关的ICMP回应正在应答,因此通过目标接口的默认路由处于活动状态并已安装在路由表中。

<#root>

> show sla monitor operational-state
Entry number: 1037119999
Modification time: 04:14:32.771 UTC Tue Jan 30 2024
Number of Octets Used by this Entry: 2056
Number of operations attempted: 79
Number of operations skipped: 0
Current seconds left in Life: Forever
Operational state of entry: Active
Last time this entry was reset: Never
Connection loss occurred: FALSE

Timeout occurred: FALSE

Over thresholds occurred: FALSE Latest RTT (milliseconds): 1 Latest operation start time: 05:32:32.791 UTC Tue Jan 30 2024 Latest operation return code: OK RTT Values: RTTAvg: 1 RTTMin: 1 RTTMax: 1 NumOfRTT: 1 RTTSum: 1 RTTSum2: 1

Entry number: 1631063762 Modification time: 04:14:32.771 UTC Tue Jan 30 2024 Number of Octets Used by this Entry: 2056 Number of operations attempted: 79 Number of operations skipped: 0 Current seconds left in Life: Forever Operational state of entry: Active Last time this entry was reset: Never Connection loss occurred: FALSE

Timeout occurred: FALSE

Over thresholds occurred: FALSE Latest RTT (milliseconds): 1 Latest operation start time: 05:32:32.791 UTC Tue Jan 30 2024 Latest operation return code: OK RTT Values: RTTAvg: 1 RTTMin: 1 RTTMax: 1 NumOfRTT: 1 RTTSum: 1 RTTSum2: 1

负载平衡

通过FTD的初始流量,用于检验ECMP是否在ECMP区域中的网关之间对流量进行负载均衡。在这种情况下,从Test-PC-1 (10.1.3.2)和 Test-PC-2 (10.1.3.4)到Internet主机(10.1.5.2)启动SSH连接,运行 show conn 命令确认流量在两个ISP链路之间实现负载均衡,Test-PC-1 (10.1.3.2)通过interface outside1, Test-PC-2 (10.1.3.4)通过interface outside2。

<#root>

> show conn 4 in use, 14 most used Inspect Snort: preserve-connection: 2 enabled, 0 in effect, 12 most enabled, 0 most in effect

TCP inside 10.1.3.4:41652 outside2 10.1.5.2:22, idle 0:02:10, bytes 5276, flags UIO N1

TCP inside 10.1.3.2:57484 outside1 10.1.5.2:22, idle 0:00:04, bytes 5276, flags UIO N1



注:根据散列源和目标IP地址、传入接口、协议、源和目标端口的算法,在指定网关之间对流量进行负载均衡。运行测试时,由于使用散列算法,可以模拟的流量路由到同一网关,这是预期的,更改6个元组(源IP、目标IP、传入接口、协议、源端口、目标端口)中的任何值,以更改散列结果。

丢失的路由

在这种情况下,如果通向第一个ISP网关的链路关闭,请关闭第一个网关路由器进行模拟。 如果FTD在SLA监控器对象中指定的阈值 计时器内没有收到来自第一个ISP网关的回应应答,则认为主机无法访问,并标记为关闭。通向第一个网关的跟踪路由也会从路由表 中删除。

运行命令 show sla monitor operational-state 以确认SLA监控器的当前状态。在这种情况下,您可以在命令输出中找到"Timeout occurred : True",这表示发往第一个ISP网关的ICMP回应没有响应。

<#root>

> show sla monitor operational-state
Entry number: 1037119999
Modification time: 04:14:32.771 UTC Tue Jan 30 2024
Number of Octets Used by this Entry: 2056
Number of operations attempted: 121
Number of operations skipped: 0
Current seconds left in Life: Forever
Operational state of entry: Active
Last time this entry was reset: Never
Connection loss occurred: FALSE

Timeout occurred: TRUE

Over thresholds occurred: FALSE Latest RTT (milliseconds): NoConnection/Busy/Timeout Latest operation start time: 06:14:32.801 UTC Tue Jan 30 2024 Latest operation return code: Timeout RTT Values: RTTAvg: 0 RTTMin: 0 RTTMax: 0 NumOfRTT: 0 RTTSum: 0 RTTSum2: 0

Entry number: 1631063762 Modification time: 04:14:32.771 UTC Tue Jan 30 2024 Number of Octets Used by this Entry: 2056 Number of operations attempted: 121 Number of operations skipped: 0 Current seconds left in Life: Forever Operational state of entry: Active Last time this entry was reset: Never Connection loss occurred: FALSE

Timeout occurred: FALSE

Over thresholds occurred: FALSE Latest RTT (milliseconds): 1 Latest operation start time: 06:14:32.802 UTC Tue Jan 30 2024 Latest operation return code: OK RTT Values: RTTAvg: 1 RTTMin: 1 RTTMax: 1 NumOfRTT: 1 RTTSum: 1 RTTSum2: 1

运行 show route 命令以检查当前路由表,通过接口outside1到第一个ISP网关的路由被删除,通过接口outside2到第二个ISP网关只有一 个活动默认路由。

<#root>

> show route

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, V - VPN 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 SI - Static InterVRF, BI - BGP InterVRF Gateway of last resort is 10.1.2.2 to network 0.0.00

S* 0.0.0.0 0.0.0.0 [1/0] via 10.1.2.2, outside2

C 10.1.1.0 255.255.255.0 is directly connected, outside1 L 10.1.1.1 255.255.255.255 is directly connected, outside1 C 10.1.2.0 255.255.255.0 is directly connected, outside2 L 10.1.2.1 255.255.255.255 is directly connected, outside2 C 10.1.3.0 255.255.255.0 is directly connected, inside L 10.1.3.1 255.255.255.255 is directly connected, inside

运行命令 show conn (PIM稀疏或PIM密集模式),您会发现两个连接仍为up状态。SSH会话在Test-PC-1 (10.1.3.2)和Test-PC-2 (10.1.3.4)上也处于活动状态,不会出现任何中断。

<#root>

> show conn
4 in use, 14 most used
Inspect Snort:
preserve-connection: 2 enabled, 0 in effect, 12 most enabled, 0 most in effect

TCP inside 10.1.3.4:41652 outside2 10.1.5.2:22, idle 0:19:29, bytes 5276, flags UIO N1

TCP inside 10.1.3.2:57484 outside1 10.1.5.2:22, idle 0:17:22, bytes 5276, flags UIO N1



注意:在show conn的输出中,您会注意到,虽然通过接口outside1的默认路由已从路由表中删除,但来自Test-PC-1 (10.1.3.2)的SSH会话仍通过接口outside1。这是预期的,而且根据设计,实际流量流经接口outside2。如果从Test-PC-1 (10.1.3.2)到Internet主机(10.1.5.2)发起新连接,则可以发现所有流量都通过接口outside2。

故障排除

要验证路由表更改,请运行命令 debug ip routing。

在本例中,当通向第一个ISP网关的链路断开时,通过接口outside1的路由将从路由表中删除。

<#root>

> debug ip routingIP routing debugging is on

RT:

ip_route_delete 0.0.0.0 0.0.0.0 via 10.1.1.2, outside1

ha_cluster_synced 0 routetype 0

RT: del 0.0.0.0 via 10.1.1.2, static metric [1/0]NP-route: Delete-Output 0.0.0.0/0 hop_count:1 , via 0.0

RT(mgmt-only):

NP-route: Update-Output 0.0.0.0/0 hop_count:1 , via 10.1.2.2, outside2

NP-route: Update-Input 0.0.0.0/0 hop_count:1 Distance:1 Flags:0X0 , via 10.1.2.2, outside2

运行 show route 命令以确认当前路由表。

<#root>

> show route

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, V - VPN 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 SI - Static InterVRF, BI - BGP InterVRF Gateway of last resort is 10.1.2.2 to network 0.0.0

S* 0.0.0.0 0.0.0.0 [1/0] via 10.1.2.2, outside2

C 10.1.1.0 255.255.255.0 is directly connected, outside1 L 10.1.1.1 255.255.255.255 is directly connected, outside1 C 10.1.2.0 255.255.255.0 is directly connected, outside2 L 10.1.2.1 255.255.255.255 is directly connected, outside2 C 10.1.3.0 255.255.255.0 is directly connected, inside L 10.1.3.1 255.255.255.255 is directly connected, inside

当通向第一个ISP网关的链路重新接通时,通过接口outside1的路由将添加回路由表。

> debug ip routingIP routing debugging is on

RT(mgmt-only):

NP-route: Update-Output 0.0.0.0/0 hop_count:1 , via 10.1.2.2, outside2

NP-route: Update-Output 0.0.0.0/0 hop_count:1 , via 10.1.1.2, outside2

NP-route: Update-Input 0.0.0.0/0 hop_count:2 Distance:1 Flags:0X0 , via 10.1.2.2, outside2 via 10.1.1.2, outside1

运行 show route 命令以确认当前路由表。

> show route

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, V - VPN 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 SI - Static InterVRF, BI - BGP InterVRF Gateway of last resort is 10.1.2.2 to network 0.0.0

S* 0.0.0 0.0.0 [1/0] via 10.1.2.2, outside2
[1/0] via 10.1.1.2, outside1
C 10.1.1.0 255.255.255.0 is directly connected, outside1
L 10.1.1.1 255.255.255.255 is directly connected, outside2
C 10.1.2.0 255.255.255.255 is directly connected, outside2
C 10.1.2.1 255.255.255.255 is directly connected, outside2
C 10.1.3.0 255.255.255.0 is directly connected, inside
L 10.1.3.1 255.255.255.255 is directly connected, inside

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