

ASA版本9.2.1 OSPF增强功能配置示例

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简介

本文档介绍自适应安全设备(ASA)软件版本9.2.1中引入的与开放最短路径优先(OSPF)协议相关的新功能和命令。

先决条件

要求

本文档没有任何特定的要求。

使用的组件

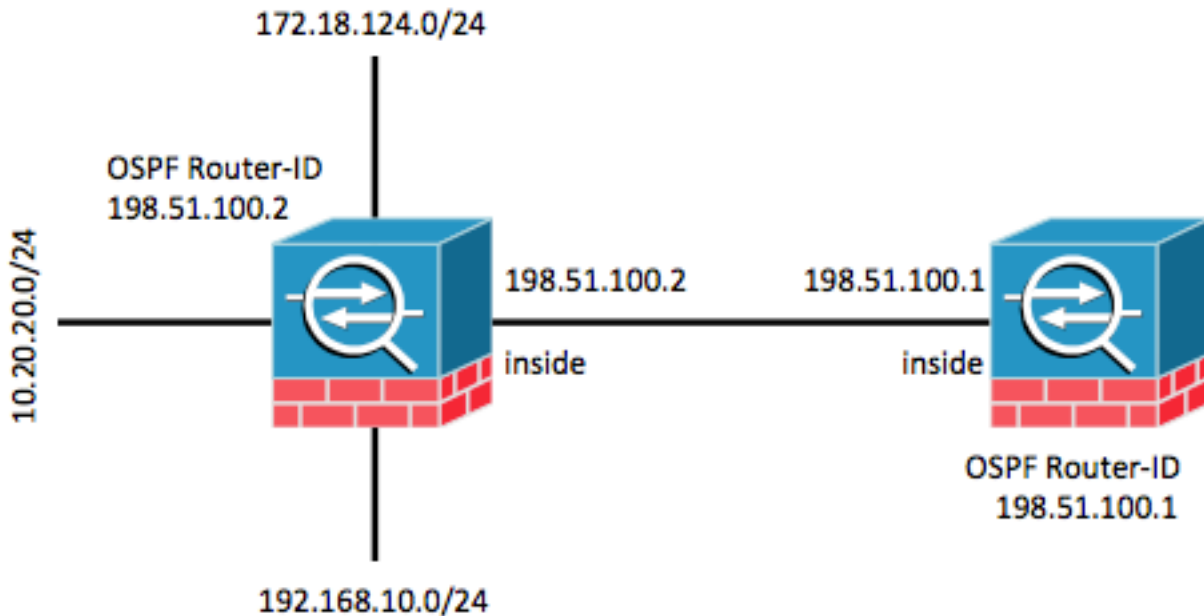
本文档中的信息基于运行Cisco ASA软件版本9.2.(1)及更高版本的Cisco ASA 5500-X系列防火墙。

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。

配置

注意：使用[命令查找工具](#)（仅限注册用户）可获取有关本部分所使用命令的详细信息。

网络图



配置

OSPF 支持快速 Hello 包

OSPF hello数据包是OSPF进程发送给其OSPF邻居以保持与这些邻居的连接的数据包。这些hello数据包以可配置的间隔（以秒为单位）发送。以太网链路的默认值为10秒，非广播链路的默认值为30秒。Hello数据包包括在Dead间隔内收到Hello数据包的所有邻居的列表。dead间隔也是可配置的间隔（以秒为单位），默认为hello间隔值的四倍。网络中所有hello间隔的值必须相同。同样，网络中所有停顿间隔的值必须相同。

OSPF快速Hello数据包是指以小于1秒的间隔发送的Hello数据包。要启用OSPF快速hello数据包，请输入`ospf dead-interval`命令。对于次秒Hello，Dead间隔设置为1秒或最小，Hello乘数值设置为要在该1秒内发送的Hello数据包数。例如，如果dead间隔设置为1秒，hello乘数设置为4，则每0.25秒发送一次hello。

当接口上配置了快速Hello数据包时，在从此接口发送的Hello数据包中通告的Hello间隔设置为0。忽略通过此接口接收的Hello数据包中的Hello间隔。必须注意的是，死区间必须在数据段上保持一致。无论是设置为1秒（对于快速hello数据包）还是设置为任何其他值，它都必须在该网段的邻居之间保持一致。只要在停顿间隔内发送至少一个hello数据包，整个网段的hello乘数就不必相同。

要启用4的倍数的快速问询，请在适当的接口配置下输入`ospf dead-interval minimal hello-multiplier 4`命令。

```
interface GigabitEthernet0/0
nameif inside
security-level 100
```

```
ip address 198.51.100.1 255.255.255.0
ospf dead-interval minimal hello-multiplier 4
```

```
router ospf 1
network 198.51.100.0 255.255.255.0 area 0
```

使用show ospf interface命令进行验证。

```
asa(config)# show ospf interface
```

```
inside is up, line protocol is up
Internet Address 198.51.100.1 mask 255.255.255.0, Area 0
Process ID 928, Router ID 198.51.100.1, Network Type BROADCAST, Cost: 10
Transmit Delay is 1 sec, State DR, Priority 1
Designated Router (ID) 198.51.100.1, Interface address 198.51.100.1
No backup designated router on this network
Timer intervals configured, Hello 250 msec, Dead 1, Wait 1, Retransmit 5
Hello due in 48 msec
Index 1/1, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 0, maximum is 0
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 0, Adjacent neighbor count is 0
Suppress hello for 0 neighbor(s)
```

用于链路状态通告和SPF限制的新OSPF计时器命令

ASA 9.2.1版及更高版本中引入了以下命令：作为OSPF路由器配置的一部分，timers lsa arrival、timers pacing、timers throttle lsa 和timers throttle spf。

```
asa(config-router)# timers ?
```

```
router mode commands/options:
lsa OSPF LSA timers
pacing OSPF pacing timers
throttle OSPF throttle timers
```

已删除以下命令：timers spf 和timers lsa-grouping-pacing。

有关链路状态通告(LSA)和最短路径优先(SPF)限制优势的详细信息，请参阅以下文档：

- [OSPF最短路径优先限制](#)
- [OSPF链路状态通告\(LSA\)](#)

使用ACL过滤OSPF路由

现在支持使用访问控制列表(ACL)进行路由过滤。这是通过使用distribute-list命令过滤路由实现的。

例如，为了过滤10.20.20.0/24的路由，配置如下所示：

```
access-list ospf standard deny host 10.20.20.0
access-list ospf standard permit any4
!
router ospf 1
network 198.51.100.0 255.255.255.0 area 0
log-adj-changes
```

distribute-list ospf in interface inside
当检查关联的ACL时，它表示其命中计数增加：

```
asa(config)# show access-list ospf
access-list ospf; 2 elements; name hash: 0xb5dd06eb
access-list ospf line 1 standard deny host 10.20.20.0 (hitcnt=1) 0xe29503b8
access-list ospf line 2 standard permit any4 (hitcnt=2) 0x51ff4e67
```

此外，您还可以检查ASA上的路由信息库(RIB)以进一步验证功能。输入**show ospf rib detail**命令，以便向后报告OSPF路由器进程的完整路由信息数据库。与每条路由关联的“标志”表示它是否已安装在RIB中。

```
asa(config)# show ospf rib detail

          OSPF Router with ID (198.51.100.10) (Process ID 1)
OSPF local RIB
Codes: * - Best, > - Installed in global RIB

*> 172.18.124.0/32, Intra, cost 11, area 0
   SPF Instance 13, age 0:13:59
   Flags: RIB, HiPrio
     via 198.51.100.2, inside, flags: RIB
     LSA: 1/198.51.100.2/198.51.100.2
* 10.20.20.0/32, Intra, cost 11, area 0
   SPF Instance 13, age 0:13:59
   Flags: HiPrio
     via 198.51.100.2, inside, flags: none
     LSA: 1/198.51.100.2/198.51.100.2
*> 192.168.10.0/32, Intra, cost 11, area 0
   SPF Instance 13, age 0:13:59
   Flags: RIB, HiPrio
     via 198.51.100.2, inside, flags: RIB
     LSA: 1/198.51.100.2/198.51.100.2
* 198.51.100.0/24, Intra, cost 10, area 0
   SPF Instance 13, age 0:52:52
   Flags: Connected
     via 198.51.100.10, inside, flags: Connected
     LSA: 2/198.51.100.2/192.151.100.10
```

在上述输出中，已安装带有标志“RIB”的路由器，但尚未安装带有标志“none”的路由。这也应反映在全局路由表中。使用**show route**命令检查。

```
asa(config)# 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
       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 10.106.44.1 to network 0.0.0.0

S* 0.0.0.0 0.0.0.0 [1/0] via 10.106.44.1, tftp
O 172.18.124.0 255.255.255.0 [110/11] via 198.51.100.2, 00:00:03, inside
O 192.168.10.0 255.255.255.0 [110/11] via 198.51.100.2, 00:00:03, inside
O 10.20.20.0 255.255.255.0 [110/11] via 198.51.100.2, 00:00:03, inside
S 10.76.76.160 255.255.255.255 [1/0] via 10.106.44.1, tftp
C 10.86.195.0 255.255.255.0 is directly connected, management
```

L 10.86.195.1 255.255.255.255 is directly connected, management

OSPF监控增强功能

引入这些命令是为了帮助监控和观察OSPF路由器进程。这些命令的输出示例可供参考。

show ospf interface brief

输入show ospf interface brief命令，以快速获取此ASA上存在的邻接关系的快照。

```
asa(config)# show ospf interface brief
```

```
Interface PID Area IP Address/Mask Cost State Nbrs F/C
inside 1 0 198.51.100.2/255.255.255.0 10 DR 1/1
```

show ospf statistics [Detail]

show ospf statistics detail命令提供有关SPF上次运行时间和运行次数的简要说明。它还指示有多少个新LSA添加到数据库。

```
asa(config)# show ospf statistics detail
```

```
OSPF Router with ID (198.51.100.10) (Process ID 1)
```

```
Area 0: SPF algorithm executed 12 times
```

```
SPF 3 executed 00:32:56 ago, SPF type Full
```

```
SPF calculation time (in msec):
```

SPT	Intra	D-Intr	Summ	D-Summ	Ext7	D-Ext7	Total
0	0	0	0	0	0	0	00

```
LSIDs processed R:2 N:1 Stub:1 SN:0 SA:0 X7:0
```

```
Change record 0x0
```

```
LSIDs changed 1
```

```
Changed LSAs. Recorded is LS ID and LS type:
```

```
198.51.100.2(R)
```

```
SPF 4 executed 00:28:16 ago, SPF type Full
```

```
SPF calculation time (in msec):
```

SPT	Intra	D-Intr	Summ	D-Summ	Ext7	D-Ext7	Total
0	0	0	0	0	0	0	00

```
LSIDs processed R:1 N:1 Stub:0 SN:0 SA:0 X7:0
```

```
Change record 0x0
```

```
LSIDs changed 2
```

```
Changed LSAs. Recorded is LS ID and LS type:
```

```
198.51.100.2(R) 198.51.100.10(R)
```

```
SPF 5 executed 00:28:06 ago, SPF type Full
```

```
SPF calculation time (in msec):
```

SPT	Intra	D-Intr	Summ	D-Summ	Ext7	D-Ext7	Total
0	0	0	0	0	0	0	00

```
LSIDs processed R:2 N:1 Stub:1 SN:0 SA:0 X7:0
```

```
Change record 0x0
```

```
LSIDs changed 1
```

```
Changed LSAs. Recorded is LS ID and LS type:
```

```
198.51.100.2(R)
```

```
SPF 6 executed 00:26:40 ago, SPF type Full
```

```
SPF calculation time (in msec):
```

```
SPT      Intra  D-Intr Summ   D-Summ Ext7   D-Ext7 Total
        0      0      0      0      0      0      00
LSIDs processed R:1 N:1 Stub:0 SN:0 SA:0 X7:0
Change record 0x0
LSIDs changed 2
Changed LSAs. Recorded is LS ID and LS type:
198.51.100.2(R) 198.51.100.10(R)
```

show ospf events neighbor

这是检查OSPF邻居状态的有用命令，特别是在OSPF抖动时。它提供每个邻居的事件和状态转换列表以及这些事件的时间戳。在本示例中，邻居10.10.40.1通过状态从DOWN转换为FULL。

```
asa(config)# show ospf events neighbor
```

```
OSPF Router with ID (198.51.100.10) (Process ID 1)

279 May 15 13:07:31.737: Neighbor 198.51.100.2, Interface inside state changes from
LOADING to FULL
280 May 15 13:07:31.737: Neighbor 198.51.100.2, Interface inside state changes from
EXCHANGE to LOADING
281 May 15 13:07:31.737: Neighbor 198.51.100.2, Interface inside state changes from
EXSTART to EXCHANGE
290 May 15 13:07:31.737: Neighbor 198.51.100.2, Interface inside state changes from
2WAY to EXSTART
296 May 15 13:07:31.738: Neighbor 198.51.100.2, Interface inside state changes from
INIT to 2WAY
297 May 15 13:07:31.728: Neighbor 198.51.100.2, Interface inside state changes from
DOWN to INIT
```

show ospf events lsa

此命令可用于检查已生成和接收的所有LSA。在链路抖动和LSA泛洪时，这些功能非常有用。

```
asa(config)# show ospf events lsa
```

```
OSPF Router with ID (198.51.100.10) (Process ID 1)

253 May 15 13:07:49.167: Rcv Changed Type-1 LSA, LSID 198.51.100.2,
Adv-Rtr 198.51.100.2, Seq# 80000002, Age 1, Area 0
271 May 15 13:07:32.237: Generate New Type-2 LSA, LSID 198.51.100.1,
Seq# 80000001, Age 0, Area 0
275 May 15 13:07:32.238: Generate Changed Type-1 LSA, LSID 198.51.100.10,
Seq# 80000002, Age 0, Area 0
276 May 15 13:07:32.228: Rcv New Type-1 LSA, LSID 198.51.100.2,
Adv-Rtr 198.51.100.2, Seq# 80000001, Age 1, Area 0
```

show ospf events neighbor rib

此命令提供有关添加到RIB中的路由和安装的路由类型(Intra/Inter)的信息。

```
asa(config)# show ospf events neighbor rib
```

```
255 May 15 13:07:54.168: RIB Update, dest 172.18.124.0, mask 255.255.255.255,
gw 198.51.100.2, via inside, source 198.51.100.2, type Intra
287 May 15 13:07:31.738: Neighbor 198.51.100.2, Interface inside state changes from
LOADING to FULL
288 May 15 13:07:31.738: Neighbor 198.51.100.2, Interface inside state changes from
```

EXCHANGE to LOADING

289 May 15 13:07:31.738: Neighbor 198.51.100.2, Interface inside state changes from EXSTART to EXCHANGE

298 May 15 13:07:31.738: Neighbor 198.51.100.2, Interface inside state changes from 2WAY to EXSTART

304 May 15 13:07:31.738: Neighbor 198.51.100.2, Interface inside state changes from INIT to 2WAY

305 May 15 13:07:31.728: Neighbor 198.51.100.2, Interface inside state changes from DOWN to INIT

show ospf events spf

运行SPF计算时，生成的运行时间和LSA机会记录在SPF事件列表中。

```
asa(config)# show ospf events spf
235 May 15 13:07:54.167: End of SPF, SPF time 0ms, next wait-interval 10000ms
240 May 15 13:07:54.167: Starting External processing in area 0
241 May 15 13:07:54.167: Starting External processing
244 May 15 13:07:54.167: Starting summary processing, Area 0
250 May 15 13:07:54.167: Starting Intra-Area SPF, Area 0, spf_type Full
251 May 15 13:07:54.167: Starting SPF, wait-interval 5000ms
254 May 15 13:07:49.167: Schedule SPF, Area 0, spf-type Full, Change in LSA
Type RLSID 198.51.100.2, Adv-Rtr 198.51.100.2
255 May 15 13:07:37.227: End of SPF, SPF time 0ms, next wait-interval 10000ms
260 May 15 13:07:37.228: Starting External processing in area 0
261 May 15 13:07:37.228: Starting External processing
264 May 15 13:07:37.228: Starting summary processing, Area 0
268 May 15 13:07:37.228: Starting Intra-Area SPF, Area 0, spf_type Full
269 May 15 13:07:37.228: Starting SPF, wait-interval 5000ms
272 May 15 13:07:32.238: Schedule SPF, Area 0, spf-type Full, Change in LSA
Type NLSID 198.51.100.1, Adv-Rtr 198.51.100.10
274 May 15 13:07:32.238: Schedule SPF, Area 0, spf-type Full, Change in LSA
Type RLSID 198.51.100.10, Adv-Rtr 198.51.100.10
277 May 15 13:07:32.228: Schedule SPF, Area 0, spf-type Full, Change in LSA
Type RLSID 198.51.100.2, Adv-Rtr 198.51.100.2
```

show ospf events generic

此输出包含一般的进程范围事件，如指定路由器(DR)选举和邻接关系更改。

```
asa(config)# show ospf events generic
236 May 15 13:07:54.167: Generic: ospf_external_route_sync0x0
237 May 15 13:07:54.167: Generic: ospf_external_route_sync0x0
238 May 15 13:07:54.167: Generic: ospf_external_route_sync0x0
239 May 15 13:07:54.168: Generic: ospf_external_route_sync0x0
242 May 15 13:07:54.168: Generic: ospf_inter_route_sync0x0
243 May 15 13:07:54.168: Generic: ospf_inter_route_sync0x0
245 May 15 13:07:54.168: Generic: post_spf_intra0x0
246 May 15 13:07:54.168: Generic: ospf_intra_route_sync0x0
248 May 15 13:07:54.168: Generic: ospf_intra_route_sync0x0
249 May 15 13:07:54.168: DB add: 172.18.124.00x987668 204
252 May 15 13:07:51.668: Timer Exp: if_ack_delayed0xcb97dfe0
256 May 15 13:07:37.228: Generic: ospf_external_route_sync0x0
257 May 15 13:07:37.228: Generic: ospf_external_route_sync0x0
258 May 15 13:07:37.228: Generic: ospf_external_route_sync0x0
259 May 15 13:07:37.228: Generic: ospf_external_route_sync0x0
262 May 15 13:07:37.228: Generic: ospf_inter_route_sync0x0
263 May 15 13:07:37.228: Generic: ospf_inter_route_sync0x0
265 May 15 13:07:37.228: Generic: post_spf_intra0x0
```

```

266 May 15 13:07:37.228: Generic:  ospf_intra_route_sync0x0
267 May 15 13:07:37.228: Generic:  ospf_intra_route_sync0x0
270 May 15 13:07:34.728: Timer Exp:  if_ack_delayed0xcb97dfe0
273 May 15 13:07:32.238: DB add:   198.51.100.100x987848 206
278 May 15 13:07:32.228: DB add:   198.51.100.20x987938 205
283 May 15 13:07:31.738: Elect DR:  inside198.51.100.10
284 May 15 13:07:31.738: Elect BDR: inside198.51.100.2
285 May 15 13:07:31.736: i/f state nbr chg:  inside0x5
287 May 15 13:07:31.736: Elect DR:  inside198.51.100.10
288 May 15 13:07:31.736: Elect BDR: inside198.51.100.2
289 May 15 13:07:31.736: i/f state nbr chg:  inside0x5
291 May 15 13:07:31.736: nbr state adjok: 198.51.100.20x3
293 May 15 13:07:31.736: Elect DR:  inside198.51.100.10
294 May 15 13:07:31.736: Elect BDR: inside198.51.100.2
295 May 15 13:07:31.736: i/f state nbr chg:  inside0x5

```

show ospf rib detail

如前所述，此命令允许管理员查看从对等体获知的路由以及这些路由是否已安装到RIB中。由于路由过滤（以前列出），路由可能未安装在RIB中。

```
asa(config)# show ospf rib detail
```

```

                OSPF Router with ID (198.51.100.1) (Process ID 1)
OSPF local RIB
Codes: * - Best, > - Installed in global RIB

*> 172.18.124.0/32, Intra, cost 11, area 0
   SPF Instance 13, age 0:13:59
   Flags: RIB, HiPrio
   via 198.51.100.2, inside, flags: RIB
   LSA: 1/198.51.100.2/198.51.100.2
* 10.20.20.0/32, Intra, cost 11, area 0
   SPF Instance 13, age 0:13:59
   Flags: HiPrio
   via 198.51.100.2, inside, flags: none
   LSA: 1/198.51.100.2/198.51.100.2
*> 192.168.10.0/32, Intra, cost 11, area 0
   SPF Instance 13, age 0:13:59
   Flags: RIB, HiPrio
   via 198.51.100.2, inside, flags: RIB
   LSA: 1/198.51.100.2/198.51.100.2
* 198.51.100.0/24, Intra, cost 10, area 0
   SPF Instance 13, age 0:52:52
   Flags: Connected
   via 198.51.100.10, inside, flags: Connected
   LSA: 2/198.51.100.2/192.151.100.10

```

show ospf neighbor detail

show ospf neighbor detail命令可用于详细说明OSPF邻接关系的状态。

```
asa(config)# show ospf neighbor detail
```

```

Neighbor 198.51.100.2, interface address 198.51.100.2
In the area 0 via interface ISP
Neighbor priority is 1, State is FULL, 6 state changes
DR is 198.51.100.10 BDR is 198.51.100.2
Options is 0x12 in Hello (E-bit, L-bit)
Options is 0x52 in DBD (E-bit, L-bit, O-bit)
Dead timer due in 0:00:16

```



```
Neighbor is up for 00:02:45  
Index 1/1, retransmission queue length 0, number of retransmission 0  
First 0x0(0)/0x0(0) Next 0x0(0)/0x0(0)  
Last retransmission scan length is 0, maximum is 0  
Last retransmission scan time is 0 msec, maximum is 0 msec
```

OSPF重分布BGP

为了支持边界网关协议(BGP)在其他路由协议中和从其他路由协议中重分发，**redistribute bgp**命令已引入到OSPF路由器配置中。输入此命令以将通过BGP获知的路由重分发到运行的OSPF进程。

```
asa(config)# router ospf 1  
asa(config-router)# redistribute bgp ?  
router mode commands/options:  
100 Autonomous system number  
ASA-1(config-router)# redistribute bgp 100
```

验证

当前没有可用于此配置的验证过程。

故障排除

目前没有针对此配置的故障排除信息。