

对IOS-XR上路由策略不佳导致的BGP收敛缓慢问题进行故障排除

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简介

本文档介绍如何诊断Cisco IOS® XR路由器上由于非最佳路由策略而发生的缓慢BGP收敛问题。

背景

BGP收敛时间包括许多因素。其中之一是通过配置的路由策略处理入口或出口BGP更新的时间。可通过多种方式编写路由策略来执行特定任务。最佳方法有助于改进BGP融合、最小化潜在流量丢弃并避免临时路由环路。Cisco IOS® XR包含一个分析工具，该工具可测量特定路由策略花费的时间，从而估计其处理时间。

问题

BGP收敛缓慢有时是路由策略以非最佳方式写入的结果。

解决方案

有一个用于路由策略的策略分析工具，它可以在不影响性能的情况下使用，以测量路由策略在某个特定连接点上的每条语句所花费的时间。您可以检查路由策略在此特定连接点的运行时间。默认情况下，仅对汇聚路由策略统计启用分析。

```
router bgp 65000
neighbor 10.0.54.6
remote-as 65000
update-source Loopback0
address-family ipv4 unicast
route-policy INGRESS-ROUTE-POLICY in
!
neighbor 10.0.54.11
remote-as 65001
ebgp-multihop 255
```

```
update-source Loopback0
address-family ipv4 unicast
route-policy EGRESS-ROUTE-POLICY out
```

<#root>

```
RP/0/RSP1/CPU0:XR1#
```

```
show pc1 protocol bgp speaker-0 neighbor-in-dflt default-IPv4-Uni-10.0.54.6 policy profile
```

```
Policy profiling data
Policy : INGRESS-ROUTE-POLICY
Pass : 1440233
Drop : 0
# of executions : 1440233
Total execution time : 57095msec      <=====
```

```
RP/0/RSP1/CPU0:XR1#
```

```
show bgp ipv4 unicast neighbors 10.0.54.11 | i Update group
```

```
Update group: 0.3 Filter-group: 0.5 No Refresh request being processed
```

```
RP/0/RSP1/CPU0:XR1#
```

```
RP/0/RSP1/CPU0:XR1#
```

```
show pc1 protocol bgp speaker-0 neighbor-out-dflt default-IPv4-Uni-UpdGrp-0.3-Out policy profile
```

```
Policy profiling data
Policy : EGRESS-ROUTE-POLICY
Pass : 726751
Drop : 0
# of executions : 726751
Total execution time : 108099msec <=====
RP/0/RSP1/CPU0:XR1#
```

您可以看到处理INGRESS-ROUTE-POLICY和EGRESS-ROUTE-POLICY所花费的累计时间。

分析可以应用于任何连接点的入口或出口路由策略。

<#root>

```
RP/0/RSP1/CPU0:XR1#
```

```
show pc1 protocol bgp speaker-0 ?
```

debug-policy	Attachpoint name
permnet	Attachpoint name
import	Attachpoint name
export	Attachpoint name
interafi-import	Attachpoint name
source-rt	Attachpoint name
interafi-export	Attachpoint name
retain-rt	Attachpoint name

addpath	Attachpoint name
neighbor-in-dflt	Attachpoint name
neighbor-in-vrf	Attachpoint name
neighbor-out-dflt	Attachpoint name
neighbor-out-vrf	Attachpoint name
orf-dflt	Attachpoint name
orf-vrf	Attachpoint name
dampening-dflt	Attachpoint name
dampening-vrf	Attachpoint name
default-originate-dflt	Attachpoint name
default-originate-vrf	Attachpoint name
clear-policy	Attachpoint name
show-policy-node0_RSP1_CPU0	Attachpoint name
aggregation-dflt	Attachpoint name
aggregation-vrf	Attachpoint name
nexthop	Attachpoint name
allocate-label	Attachpoint name
label-mode	Attachpoint name
l2vpn-import	Attachpoint name
l2vpn-export	Attachpoint name
redistribution-dflt	Attachpoint name
redistribution-vrf	Attachpoint name
rib-install-dflt	Attachpoint name
rib-install-vrf	Attachpoint name
network-dflt	Attachpoint name
network-vrf	Attachpoint name
redistribution-dflt	Attachpoint name
redistribution-vrf	Attachpoint name
rib-install-dflt	Attachpoint name
rib-install-vrf	Attachpoint name
network-dflt	Attachpoint name
network-vrf	Attachpoint name
l2vpn-export-mp2mp	Attachpoint name
l2vpn-export-vfi	Attachpoint name
l2vpn-export-evi	Attachpoint name
l2vpn-export-mspw	Attachpoint name
l2vpn-export-instance	Attachpoint name
WORD	Attachpoint name

RP/0/RSP1/CPU0:XR1#

您可以根据需要清除统计信息。

<#root>

RP/0/RSP1/CPU0:XR1#

clear pcl protocol bgp speaker-0 neighbor-in-dflt default-IPv4-Uni-10.0.54.6 policy profile

RP/0/RSP1/CPU0:XR1#

clear pcl protocol bgp speaker-0 neighbor-out-dflt default-IPv4-Uni-UpdGrp-0.3-Out policy profile

如果启用debug pcl profile detail，则会获取每个路由策略条目的详细统计信息。

<#root>

RP/0/RSP1/CPU0:XR1#

debug pc1 profile detail

这些输出是在收到完整的Internet BGP表扩展后收集并进一步传播的。

<#root>

RP/0/RSP1/CPU0:XR1#

show pc1 protocol bgp speaker-0 neighbor-in-dflt default-IPv4-Uni-10.0.54.6 policy profile

Policy profiling data
Policy : INGRESS-ROUTE-POLICY
Pass : 720100
Drop : 0
of executions : 720100
Total execution time : 222788msec <===== about 3.7 minutes to process ingress updates

Node Id	Num visited	Exec time	Policy engine operation
PXL_0_1	720100	221796msec	if as-path aspath-match ... then <=====

PXL_0_3	3525	3msec	set local-preference 150
	3525	0msec	

PXL_0_2	716575	225msec	set local-preference 50
	716575	82msec	

RP/0/RSP1/CPU0:XR1#

show pc1 protocol bgp speaker-0 neighbor-out-dflt default-IPv4-Uni-UpdGrp-0.3-Out policy profile

Policy profiling data
Policy : EGRESS-ROUTE-POLICY
Pass : 720105
Drop : 0
of executions : 720105
Total execution time : 221975msec <===== about 3.7 minutes to process egress updates

Node Id	Num visited	Exec time	Policy engine operation	

PXL_0_1	720105	3005msec	if as-path aspath-match ... then	
PXL_0_5	0	0msec	set med 70	
	0	0msec		
PXL_0_2	720105	218008msec	if as-path aspath-match ... then	<=====
PXL_0_3	25	0msec	set med 80	
	25	0msec		
PXL_0_4	720080	145msec	set med 90	
	720080	76msec		

RP/0/RSP1/CPU0:XR1#

如您所见，INGRESS-ROUTE-POLICY的行PXL_0_1和EGRESS-ROUTE-POLICY的行PXL_0_2尤其耗时，而且会降低收敛速度。

如果将它们与路由策略相关联，您会发现INGRESS-ROUTE-POLICY中的AS-PATH-SET-11和EGRESS-ROUTE-POLICY中的AS-PATH-SET-22会导致问题。每个AS路径集由100个正则表达式行组成，这是编写策略的一种非常低效的方法，因为它不会利用任何可能的优化或正则表达式的强大功能。

```
route-policy INGRESS-ROUTE-POLICY
  if as-path in AS-PATH-SET-11 then
    set local-preference 150
  else
    set local-preference 50
  endif
end-policy
```

```
route-policy EGRESS-ROUTE-POLICY
  if as-path in AS-PATH-SET-21 then
    set med 70
  elseif as-path in AS-PATH-SET-22 then
    set med 80
  else
    set med 90
  endif
end-policy
```

```
as-path-set AS-PATH-SET-11
  ios-regex '^65101 65201_',
  ios-regex '^65102 65202_',
  ios-regex '^65103 65203_',
  ios-regex '^65104 65204_',
  ios-regex '^65105 65205_',
  --- removed 90 similar lines ---
  ios-regex '^65195 65295_',
  ios-regex '^65196 65296_',
  ios-regex '^65197 65297_',
  ios-regex '^65198 65298_',
  ios-regex '^65199 65299_'
end-set
```

```
as-path-set AS-PATH-SET-21
  ios-regex '^$'
end-set
```

```
as-path-set AS-PATH-SET-22
  ios-regex '^65169(_65169)*$',
  ios-regex '^65392(_65392)*$',
  ios-regex '^65133(_65133)*$',
  ios-regex '^65231(_65231)*$',
  ios-regex '^65161(_65161)*$',
  --- removed 90 similar lines ---
  ios-regex '^65281(_65281)*$',
  ios-regex '^65336(_65336)*$',
  ios-regex '^65238(_65238)*$',
  ios-regex '^65381(_65381)*$',
  ios-regex '^65103(_65103)*$'
end-set
```

为了提高策略性能，可以使用本地as-path匹配操作而不是正则表达式来评估AS路径集的配置。或者，可以在路由策略内以折叠方式使用正则表达式，从而减少使用的正则表达式行数。

此表列出了路由策略语言(RPL)提供的AS路径匹配条件。本机匹配函数使用二进制匹配算法，与正则表达式匹配引擎相比具有更好的性能。大多数常见的ios-regex匹配场景都可以与其一起编写（或其组合）。

命令	描述
is-local	确定路由器（或此自治系统或联盟中的另一台路由器）是否发起路由
长度	根据AS路径的长度执行条件检查
neighbor-is	根据一个或多个整数值或参数的序列，测试AS路径头部的一个或多个自主系统编号。
源自	从开始根据AS序列测试AS路径使用发起路由的AS编号。
直通	测试，以了解指定的整数或参数是否出现在AS路径中的任何位置，或是否出现整数和参数的序列。
unique-length	根据AS路径的长度执行特定检查，忽略重复项

确认

这些策略是借助本地匹配条件重新编排的路由策略。这显著地减少了处理时间。

```

route-policy INGRESS-ROUTE-POLICY
  if as-path in AS-PATH-SET-11 then
    set local-preference 150
  else
    set local-preference 50
  endif
end-policy

route-policy EGRESS-ROUTE-POLICY
  if as-path is-local then
    set med 70
  elseif as-path in AS-PATH-SET-22 and as-path unique-length is 1 then
    set med 80
  else
    set med 90
  endif
end-policy

as-path-set AS-PATH-SET-11
  neighbor-is '65101 65201',
  neighbor-is '65102 65202',
  neighbor-is '65103 65203',
  neighbor-is '65104 65204',
  neighbor-is '65105 65205',
  --- removed 90 similar lines ---
  neighbor-is '65195 65295',
  neighbor-is '65196 65296',
  neighbor-is '65197 65297',
  neighbor-is '65198 65298',
  neighbor-is '65199 65299'
end-set

as-path-set AS-PATH-SET-22
  originates-from '65169',
  originates-from '65392',
  originates-from '65133',
  originates-from '65231',
  originates-from '65161',
  --- removed 90 similar lines ---
  originates-from '65281',
  originates-from '65336',
  originates-from '65238',
  originates-from '65381',
  originates-from '65103'
end-set

```

这些输出是在收到完整的Internet BGP表扩展后收集并进一步传播的。

<#root>

RP/0/RSP1/CPU0:XR1#

show pcl protocol bgp speaker-0 neighbor-in-dflt default-IPv4-Uni-10.0.54.6 policy profile

```

Policy profiling data
Policy : INGRESS-ROUTE-POLICY
Pass : 720100

```

Drop : 0

of executions : 720100

Total execution time : 9612msec <===== about 10 seconds to process ingress updates

Node Id	Num visited	Exec time	Policy engine operation
PXL_0_1	720100	8540msec	if as-path aspath-match ... then

PXL_0_3	7128	2msec	set local-preference 150
	7128	1msec	

PXL_0_2	712972	276msec	set local-preference 50
	712972	80msec	

RP/0/RSP1/CPU0:XR1#

show pcl protocol bgp speaker-0 neighbor-out-dflt default-IPv4-Uni-UpdGrp-0.3-Out policy profile

Policy profiling data

Policy : EGRESS-ROUTE-POLICY

Pass : 720126

Drop : 0

of executions : 720126

Total execution time : 12399msec <===== about 12 seconds to process egress updates

Node Id	Num visited	Exec time	Policy engine operation
PXL_0_1	720126	190msec	if as-path is-local then

PXL_0_7	0	0msec	set med 70
---------	---	-------	------------

0	0msec
---	-------

PXL_0_2	720126	11190msec	if as-path aspath-match ... then
---------	--------	-----------	----------------------------------

PXL_0_4	262734	65msec	if as-path unique-length is 1 then
---------	--------	--------	------------------------------------

PXL_0_5	25	0msec	set med 80
	25	0msec	

PXL_0_6	720101	164msec	set med 90
	720101	57msec	

GOTO :

PXL_0_6

RP/0/RSP1/CPU0:XR1#

或者，可以折叠ios-regex行。这还有助于提高性能。

```
route-policy INGRESS-ROUTE-POLICY
  if as-path in (ios-regex '^((65101_65201|65102_65202|65103_65203|65104_65204|65105_65205|65106_65206|6
    set local-preference 150
  endif
  if as-path in (ios-regex '^((65111_65211|65112_65212|65113_65213|65114_65214|65115_65215|65116_65216|6
    set local-preference 150
  endif
  if as-path in (ios-regex '^((65121_65221|65122_65222|65123_65223|65124_65224|65125_65225|65126_65226|6
    set local-preference 150
  endif
  if as-path in (ios-regex '^((65131_65231|65132_65232|65133_65233|65134_65234|65135_65235|65136_65236|6
    set local-preference 150
  endif
  if as-path in (ios-regex '^((65141_65241|65142_65242|65143_65243|65144_65244|65145_65245|65146_65246|6
    set local-preference 150
  endif
  if as-path in (ios-regex '^((65151_65251|65152_65252|65153_65253|65154_65254|65155_65255|65156_65256|6
    set local-preference 150
  endif
  if as-path in (ios-regex '^((65161_65261|65162_65262|65163_65263|65164_65264|65165_65265|65166_65266|6
    set local-preference 150
  endif
  if as-path in (ios-regex '^((65171_65271|65172_65272|65173_65273|65174_65274|65175_65275|65176_65276|6
    set local-preference 150
  endif
  if as-path in (ios-regex '^((65181_65281|65182_65282|65183_65283|65184_65284|65185_65285|65186_65286|6
    set local-preference 150
  else
    set local-preference 50
  endif
```



```
endif
if as-path in (ios-regex '^65281(_65281)*$|^65336(_65336)*$|^65238(_65238)*$|^65381(_65381)*$|^65103(_65103)*$')
    set med 80
else
    set med 90
endif
end-policy
```

这些输出是在收到完整的Internet BGP表扩展后收集的，然后进一步传播。

<#root>

RP/0/RSP1/CPU0:XR1#

show pcl protocol bgp speaker-0 neighbor-in-dflt default-IPv4-Uni-10.0.54.6 policy profile

Policy profiling data
Policy : INGRESS-ROUTE-POLICY
Pass : 720100
Drop : 0
of executions : 720100
Total execution time : 30119msec <===== about 30 seconds to process ingress updates

Node Id	Num visited	Exec time	Policy engine operation

PXL_0_1	720100	4434msec	if as-path aspath-match ... then
PXL_0_2	361	0msec	set local-preference 150
PXL_0_3	720100	3039msec	if as-path aspath-match ... then

--- removed lines ---
GOTO : PXL_0_3

RP/0/RSP1/CPU0:XR1#

show pcl protocol bgp speaker-0 neighbor-out-dflt default-IPv4-Uni-UpdGrp-0.3-Out policy profile

Policy profiling data
Policy : EGRESS-ROUTE-POLICY

Pass : 720110

Drop : 0

of executions : 720110

Total execution time : 106566msec <===== about 1.8 minutes to process egress updates

Node Id	Num visited	Exec time	Policy engine operation
PXL_0_1	720110	2958msec	if as-path aspath-match ... then

PXL_0_2	0	0msec	set med 70
PXL_0_3	720110	5222msec	if as-path aspath-match ... then

PXL_0_4	3	0msec	set med 80
PXL_0_5	720110	4979msec	if as-path aspath-match ... then

PXL_0_6			set med 80
---------	--	--	------------

--- removed lines ---

GOTO : PXL_0_3

RP/0/RSP1/CPU0:XR1#

结论

使用本地as-path匹配或折叠正则表达式模式可以提高路由策略的性能。

关于此翻译

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