

负载分配与在单宿主和多宿主环境的BGP

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Introduction

本文描述负载分配，允许路由器分发在多条路径中的流出和流入的数据流。路径以静态方式或采用动态协议进行派生，如：

- 路由信息协议(RIP)
- 增强的内部网关路由选择协议(EIGRP)

- 开放最短路径优先(OSPF)协议
- 增强型内部网关路由协议(EIGRP)

默认情况下，边界网关协议(BGP)选择仅单个最佳路径，并且不执行负载均衡。本文档说明如何使用 BGP 在不同情况下执行负载共享。有关负载均衡的其他信息，请参阅[负载均衡的工作原理](#)。

Prerequisites

Requirements

尝试进行此配置之前，请确保满足以下要求：

- [BGP 最佳路径选择算法](#)的知识
- [配置 BGP](#) 的知识

Components Used

This document is not restricted to specific software and hardware versions.

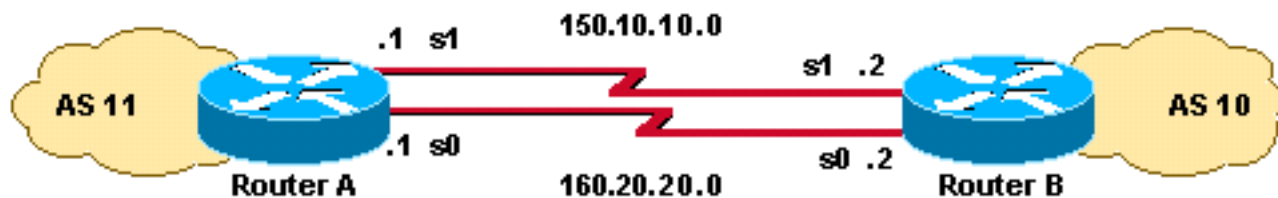
The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

使用环回地址作为 BGP 邻居的负载共享

此方案显示有多个（最多六个）等成本链路时如何实现负载共享。链路被终止在本地自治系统 (AS) 的一个路由器和在远程 AS 的另一个路由器在一个单址的 BGP 环境里。以[网络图](#)为例。

Network Diagram

此部分使用此网络建立：



配置

本部分使用以下配置：

- [RouterA](#)
- [RouterB](#)

RouterA

```

interface loopback 0
 ip address 1.1.1.1 255.255.255.0

interface serial 0
 ip address 160.20.20.1 255.255.255.0
 no ip route-cache

interface serial 1
 ip address 150.10.10.1 255.255.255.0
 no ip route-cache

router bgp 11
 neighbor 2.2.2.2 remote-as 10
 neighbor 2.2.2.2 update-source loopback 0

!--- Use the IP address of the loopback interface for TCP connections.>

neighbor 2.2.2.2 ebgp-multihop

!--- You must configure ebgp-multihop whenever the external BGP (eBGP)
!--- connections are not on the same network address.

router eigrp 12
 network 1.0.0.0
 network 150.10.0.0
 network 160.20.0.0

no auto-summary

```

RouterB

```

interface loopback 0
 ip address 2.2.2.2 255.255.255.0

interface serial 0
 ip address 160.20.20.2 255.255.255.0
 no ip route-cache

interface serial 1
 ip address 150.10.10.2 255.255.255.0
 no ip route-cache

router bgp 10
 neighbor 1.1.1.1 remote-as 11
 neighbor 1.1.1.1 update-source loopback 0

!--- Use the IP address of the loopback interface for TCP connections.

neighbor 1.1.1.1 ebgp-multihop

!--- You must configure ebgp-multihop whenever the eBGP connections
!--- are not on the same network address.

router eigrp 12
 network 2.0.0.0
 network 150.10.0.0
 network 160.20.0.0

no auto-summary

```

Note: 可以使用静态路由代替路由协议，以便引入两个等成本路径以到达目标。在这种情况下

, 路由协议为 EIGRP。

Verify

Use this section to confirm that your configuration works properly.

确定[Cisco CLI分析器\(仅限注册用户\)](#)技术支持显示命令。请使用Cisco CLI分析器查看show命令输出分析。

show ip route 命令的输出表示，指向 2.2.2.0 网络的两个路径都是通过 EIGRP 获知的。输出的 **traceroute**命令表明负荷被分配在两个串行链路之间。在此方案中，负载共享是针对每个数据包逐一进行的。可以在串行接口发出 **ip route-cache** 命令，针对每个目标逐一执行负载共享。您能用 Cisco快速转发也配置每个信息包和单个目标文件的负载均衡。关于如何配置Cisco快速转发的更多信息，请参见[配置Cisco快速转发](#)。

```
RouterA# show ip route
```

```
!--- Output suppressed.
```

```
Gateway of last resort is not set
```

```
1.0.0.0/24 is subnetted, 1 subnets
```

```
C 1.1.1.0 is directly connected, Loopback0
```

```
2.0.0.0/24 is subnetted, 1 subnets
```

```
D 2.2.2.0 [90/2297856] via 150.10.10.2, 00:00:45, Serial1
```

```
[90/2297856] via 160.20.20.2, 00:00:45, Serial0
```

```
160.20.0.0/24 is subnetted, 1 subnets
```

```
C 160.20.20.0 is directly connected, Serial0
```

```
150.10.0.0/24 is subnetted, 1 subnets
```

```
C 150.10.10.0 is directly connected, Serial1
```

```
RouterA# traceroute 2.2.2.2
```

```
Type escape sequence to abort.
```

```
Tracing the route to 2.2.2.2
```

```
1 160.20.20.2 16 msec
```

```
150.10.10.2 8 msec *
```

Troubleshoot

目前没有针对此配置的故障排除信息。

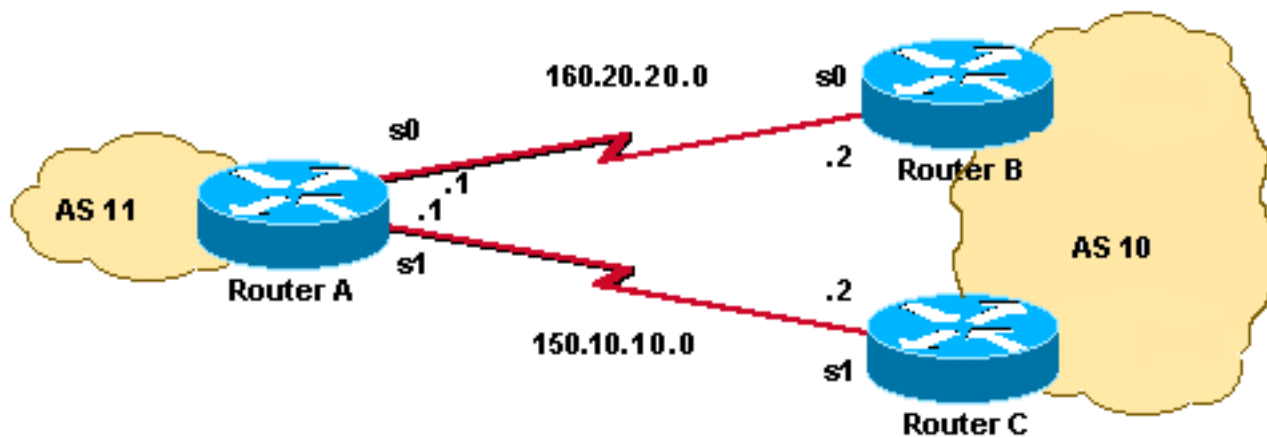
负载分配，当双重归属对一个互联网服务提供商(ISP)通过单个本地路由器

此方案显示当远程 AS 与本地 AS 之间存在多条链路时，如何实现负载共享。这些链路在本地 AS 的一个路由器中终止，并在单宿主 BGP 环境中远程 AS 的多个路由器中终止。[网络图](#)是这样网络示例。

此配置示例使用**maximum-paths**命令。默认情况下，BGP 在通过一个 AS 获知的可能的等成本路径中选择一个最佳路径。但是，您可以更改允许的并行等成本路径的最大数量。为进行此更改，请在 BGP 配置中包括 **maximum-paths paths** 命令。对于 *paths* 参数，可使用 1 和 6 之间的数字。

Network Diagram

此部分使用此网络建立：



配置

本部分使用以下配置：

- [RouterA](#)
- [RouterB](#)
- [RouterC](#)

RouterA

```
RouterA# show ip route
```

```
!--- Output suppressed.
```

```
Gateway of last resort is not set
```

```
1.0.0.0/24 is subnetted, 1 subnets
```

```
C 1.1.1.0 is directly connected, Loopback0
```

```
2.0.0.0/24 is subnetted, 1 subnets
```

```
D 2.2.2.0 [90/2297856] via 150.10.10.2, 00:00:45, Serial1
```

```
[90/2297856] via 160.20.20.2, 00:00:45, Serial0
```

```
160.20.0.0/24 is subnetted, 1 subnets
```

```
C 160.20.20.0 is directly connected, Serial0
```

```
150.10.0.0/24 is subnetted, 1 subnets
```

```
C 150.10.10.0 is directly connected, Serial1
```

```
RouterA# traceroute 2.2.2.2
```

```
Type escape sequence to abort.
```

```
Tracing the route to 2.2.2.2
```

```
1 160.20.20.2 16 msec
```

```
150.10.10.2 8 msec *
```

RouterB

```
RouterA# show ip route
```

```
!--- Output suppressed.
```

```
Gateway of last resort is not set
```

```
1.0.0.0/24 is subnetted, 1 subnets
```

```
C 1.1.1.0 is directly connected, Loopback0
```

```
2.0.0.0/24 is subnetted, 1 subnets
```

```
D 2.2.2.0 [90/2297856] via 150.10.10.2, 00:00:45, Serial1  
[90/2297856] via 160.20.20.2, 00:00:45, Serial0
```

```
160.20.0.0/24 is subnetted, 1 subnets
```

```
C 160.20.20.0 is directly connected, Serial0
```

```
150.10.0.0/24 is subnetted, 1 subnets
```

```
C 150.10.10.0 is directly connected, Serial1
```

```
RouterA# traceroute 2.2.2.2
```

```
Type escape sequence to abort.
```

```
Tracing the route to 2.2.2.2
```

```
1 160.20.20.2 16 msec  
 150.10.10.2 8 msec *
```

RouterC

```
RouterA# show ip route
```

```
!--- Output suppressed.
```

```
Gateway of last resort is not set
```

```
1.0.0.0/24 is subnetted, 1 subnets
```

```
C 1.1.1.0 is directly connected, Loopback0
```

```
2.0.0.0/24 is subnetted, 1 subnets
```

```
D 2.2.2.0 [90/2297856] via 150.10.10.2, 00:00:45, Serial1  
[90/2297856] via 160.20.20.2, 00:00:45, Serial0
```

```
160.20.0.0/24 is subnetted, 1 subnets
```

```
C 160.20.20.0 is directly connected, Serial0
```

```
150.10.0.0/24 is subnetted, 1 subnets
```

```
C 150.10.10.0 is directly connected, Serial1
```

```
RouterA# traceroute 2.2.2.2
```

```
Type escape sequence to abort.
```

```
Tracing the route to 2.2.2.2
```

```
1 160.20.20.2 16 msec  
 150.10.10.2 8 msec *
```

Verify

Use this section to confirm that your configuration works properly.

确定[Cisco CLI分析器\(仅限注册用户\)](#)技术支持显示命令。请使用Cisco CLI分析器查看show命令输出分析。

`show ip route` 命令的输出表示，指向 2.2.2.0 网络的两个路径都是通过 BGP 获知的。输出的 `traceroute` 命令表明负荷被分配在两个串行链路之间。在此方案中，负载共享是针对每个目标逐一进行的。`show ip bgp` 命令可生成用于 2.0.0.0 网络的有效条目。

```
RouterA# show ip route
```

```
!--- Output suppressed
```

```
Gateway of last resort is not set
```

```
1.0.0.0/24 is subnetted, 1 subnets
```

```
C 1.1.1.0 is directly connected, Loopback0
```

```
B 2.0.0.0/8 [20/0] via 150.10.10.2, 00:04:23  
 [20/0] via 160.20.20.2, 00:04:01
```

```
160.20.0.0/24 is subnetted, 1 subnets C 160.20.20.0 is directly connected, Serial0  
150.10.0.0/24 is subnetted, 1 subnets C 150.10.10.0 is directly connected, Serial1 RouterA# traceroute 2.2.2.2
```

```
Type escape sequence to abort.
```

```
Tracing the route to 2.2.2.2
```

```
1 160.20.20.2 16 msec  
 150.10.10.2 8 msec *
```

```
RouterA# show ip bgp
```

```
BGP table version is 3, local router ID is 1.1.1.1
```

```
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
```

```
Origin codes: i - IGP, e - EGP, ? - incomplete
```

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 1.0.0.0	0.0.0.0			0	32768 i
*> 2.0.0.0	160.20.20.2	0		0	10 i
*	150.10.10.2	0		0	10 i

Troubleshoot

目前没有针对此配置的故障排除信息。

负载分配，当双重归属对一个ISP通过多个本地路由器

当有与同样ISP的多个连接通过多个本地路由器时，此方案显示如何达到负载分配。两个 eBGP 对等体在两个单独的本地路由器终止。不可能实现这两条链路的负载均衡，因为 BGP 将在通过 eBGP 和内部 BGP (iBGP) 获知的网络中选择单一最佳路径。在指向 AS 10 的多个路径中进行负载共享是次佳选项。采用这种类型的负载共享，流向特定网络的流量将根据预定义的策略通过两条链路进行传输。此外，如果一条链路发生故障，另一条将充当其备份。

为简单起见，假定 AS 11 的 BGP 路由策略如下：

- AS 11 与互联网路由的其余的一个默认值一起接受从 AS 10 的本地路由。
- outbound 数据流策略是：所有从 R101 发往 Internet 的流量都经过 R101-R103 链路。如果 R101-R103 链路发生故障，则对互联网的所有数据流从 R101 通过 R102 AS 10。同样，所有从 R102 发往 Internet 的流量都经过 R102-R104 链路。如果 R102-R104 链路发生故障，则对互联网的所有数据流从 R102 通过 R101 AS 10。
- 入站数据流策略是：从 Internet 发往网络 192.168.11.0/24 的流量应出自 R103-R101 链路。从

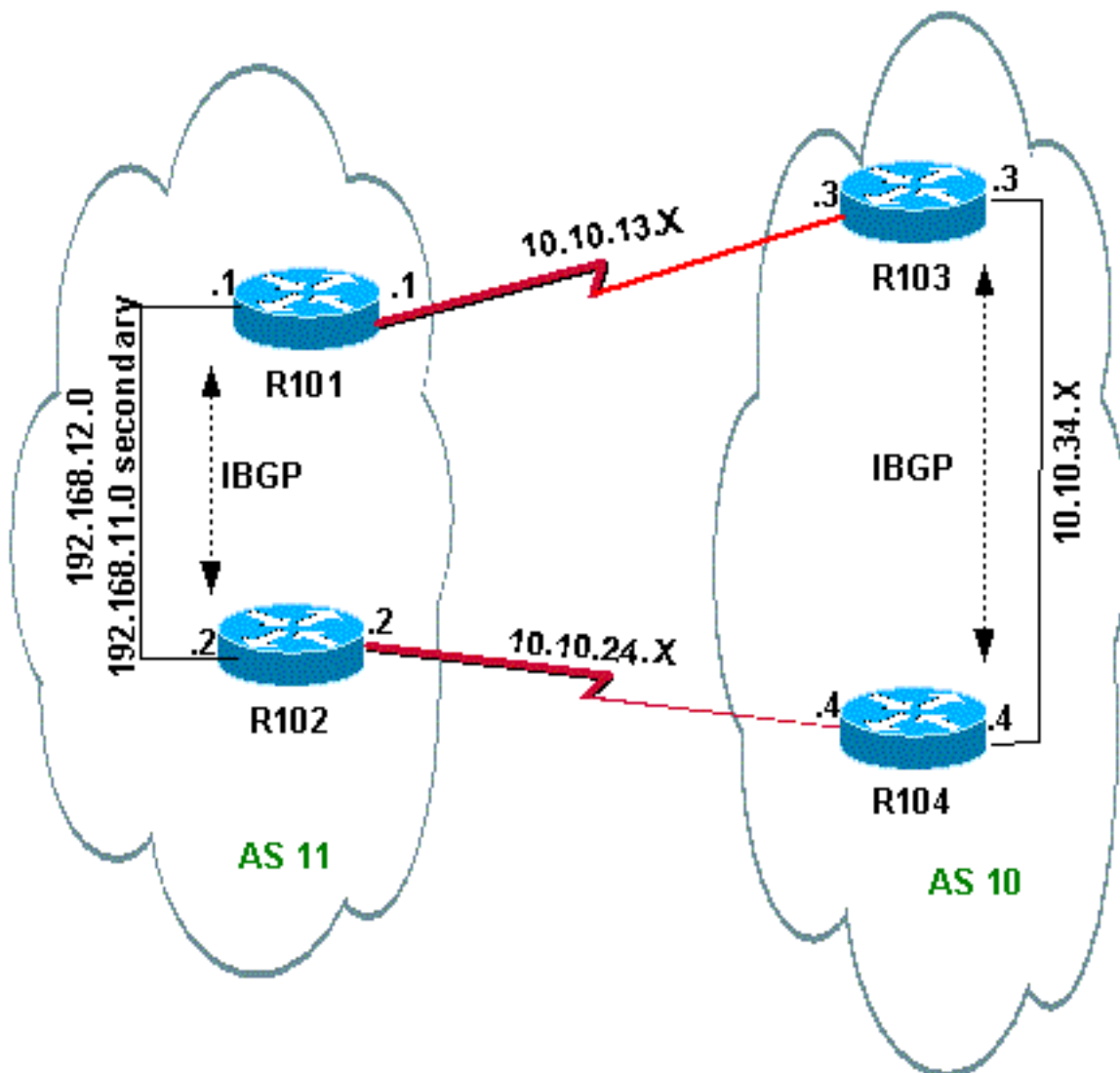
Internet 发往网络 192.168.12.0/24 的流量应出自 R104-R102 链路。如果指向 AS 10 的一条链路发生故障，另一条链路应将发往所有网络的流量从 Internet 路由回 AS 11。

为实现这一点，192.168.11.0 从 R101 到 R103 宣布的 AS_PATH 比从 R102 到 R104 宣布的更短。AS 10 找到了通过 R103-R101 链路的最佳路径。同样，192.168.12.0 通过 R102-R104 链路宣布的路径较短。对于绑定到 AS 11 中 192.168.12.0 的流量，AS 10 首选 R104-R102 链路。

对于出站流量，BGP 根据通过 eBGP 获知的路由确定最佳路径。与通过 iBGP 获知的路由相比，这些路由更为可取。因此，R101 通过 eBGP 从 R103 获知 10.10.34.0，通过 iBGP 从 R102 获知 10.10.34.0。选择外部路径而不是内部路径。因此，如果查看 [R101](#) 配置中的 BGP 表，指向 10.10.34.0 的路由将通过 R101-R103 链路，下一跳为 10.10.13.3。在 [R102](#) 中，指向 10.10.34.0 的路由将通过 R102-R104 链路，下一跳为 10.10.24.4。这样便可以实现发往 10.10.34.0 的流量的负载共享。类似的推论也适用于 R101 和 R102 的默认路由。有关 BGP 路径选择标准的详细信息，请参阅 [BGP 最佳路径选择算法](#)。

Network Diagram

此部分使用此网络建立：



配置

本部分使用以下配置：

- [R101](#)
- [R102](#)
- [R103](#)
- [R104](#)

R101

RouterA# **show ip route**

!--- Output suppressed

Gateway of last resort is not set

1.0.0.0/24 is subnetted, 1 subnets

C 1.1.1.0 is directly connected, Loopback0

B 2.0.0.0/8 [20/0] via 150.10.10.2, 00:04:23
[20/0] via 160.20.20.2, 00:04:01

160.20.0.0/24 is subnetted, 1 subnets C 160.20.20.0 is directly connected, Serial0 150.10.0.0/24 is subnetted, 1 subnets C 150.10.10.0 is directly connected, Serial1 RouterA# **traceroute 2.2.2.2**

Type escape sequence to abort.

Tracing the route to 2.2.2.2

1 160.20.20.2 16 msec
150.10.10.2 8 msec *

RouterA# **show ip bgp**

BGP table version is 3, local router ID is 1.1.1.1

Status codes: s suppressed, d damped, h history, * valid, > best, i - internal

Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 1.0.0.0	0.0.0.0			0	32768 i
*> 2.0.0.0	160.20.20.2	0		0	10 i
*	150.10.10.2	0		0	10 i

R102

RouterA# **show ip route**

!--- Output suppressed

Gateway of last resort is not set

1.0.0.0/24 is subnetted, 1 subnets

C 1.1.1.0 is directly connected, Loopback0

B 2.0.0.0/8 [20/0] via 150.10.10.2, 00:04:23
[20/0] via 160.20.20.2, 00:04:01

160.20.0.0/24 is subnetted, 1 subnets C 160.20.20.0 is directly connected, Serial0 150.10.0.0/24 is subnetted, 1 subnets C 150.10.10.0 is directly connected, Serial1 RouterA# **traceroute 2.2.2.2**

Type escape sequence to abort.

Tracing the route to 2.2.2.2

1 160.20.20.2 16 msec
150.10.10.2 8 msec *

```
RouterA# show ip bgp
```

```
BGP table version is 3, local router ID is 1.1.1.1  
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal  
Origin codes: i - IGP, e - EGP, ? - incomplete
```

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 1.0.0.0	0.0.0.0			0	32768 i
*> 2.0.0.0	160.20.20.2	0		0	10 i
*	150.10.10.2	0		0	10 i

R103

```
RouterA# show ip route
```

```
!--- Output suppressed
```

```
Gateway of last resort is not set
```

```
1.0.0.0/24 is subnetted, 1 subnets
```

```
C 1.1.1.0 is directly connected, Loopback0
```

```
B 2.0.0.0/8 [20/0] via 150.10.10.2, 00:04:23  
[20/0] via 160.20.20.2, 00:04:01
```

```
160.20.0.0/24 is subnetted, 1 subnets C 160.20.20.0 is directly connected, Serial0 150.10.0.0/24  
is subnetted, 1 subnets C 150.10.10.0 is directly connected, Serial1 RouterA# traceroute 2.2.2.2
```

```
Type escape sequence to abort.
```

```
Tracing the route to 2.2.2.2
```

```
1 160.20.20.2 16 msec  
150.10.10.2 8 msec *
```

```
RouterA# show ip bgp
```

```
BGP table version is 3, local router ID is 1.1.1.1  
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal  
Origin codes: i - IGP, e - EGP, ? - incomplete
```

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 1.0.0.0	0.0.0.0			0	32768 i
*> 2.0.0.0	160.20.20.2	0		0	10 i
*	150.10.10.2	0		0	10 i

R104

```
RouterA# show ip route
```

```
!--- Output suppressed
```

```
Gateway of last resort is not set
```

```
1.0.0.0/24 is subnetted, 1 subnets
```

```
C 1.1.1.0 is directly connected, Loopback0
```

```
B 2.0.0.0/8 [20/0] via 150.10.10.2, 00:04:23  
[20/0] via 160.20.20.2, 00:04:01
```

```
160.20.0.0/24 is subnetted, 1 subnets C 160.20.20.0 is directly connected, Serial0 150.10.0.0/24  
is subnetted, 1 subnets C 150.10.10.0 is directly connected, Serial1 RouterA# traceroute 2.2.2.2
```

Type escape sequence to abort.

Tracing the route to 2.2.2.2

```
1 160.20.20.2 16 msec
   150.10.10.2 8 msec *
```

RouterA# **show ip bgp**

BGP table version is 3, local router ID is 1.1.1.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 1.0.0.0	0.0.0.0			0	32768 i
*> 2.0.0.0	160.20.20.2	0		0	10 i
*	150.10.10.2	0		0	10 i

Verify

本部分所提供的信息可用于确认您的配置是否正常工作。

确定请显示[Cisco CLI分析器](#)支持命令([仅限注册用户](#))，允许您查看show命令输出分析。

验证，当之间链路AS 11和AS 10是UP

出站流量验证

Note: [show ip bgp command output](#) 中的大于号 (>) 表示可能的路径中用于该网络的最佳路径。
。参考[BGP最佳路径选择算法](#)欲知更多信息。

[R101](#) 中的 BGP 表显示发往 Internet 的所有传出流量的最佳路径是通过 R101-R103 链路。 [show ip route](#) 命令输出将确认路由表中的路由。

R101# **show ip bgp**

BGP table version is 5, local router ID is 192.168.12.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
* i0.0.0.0	192.168.12.2		100	0	10 i
*>	10.10.13.3			0	10 i
!--- This is the next hop of R103.	* i10.10.34.0/24	192.168.12.2	100	0	10 i *>
10.10.13.3	0	0	10	i	
!--- This is the next hop of R103.	* i192.168.11.0	192.168.12.2	0	100	0 i *>
i192.168.12.0	192.168.12.2	0	100	0 i *>	0.0.0.0 0 32768 i

R101# **show ip route**

!--- Output suppressed.

Gateway of last resort is 10.10.13.3 to network 0.0.0.0 C 192.168.12.0/24 is directly connected,
Ethernet0/0 C 192.168.11.0/24 is directly connected, Ethernet0/0 10.0.0.0/24 is subnetted, 2
subnets C 10.10.13.0 is directly connected, Serial8/0 B 10.10.34.0 [20/0] via 10.10.13.3,
00:08:53

!--- This is the next hop of R103.

```
B* 0.0.0.0/0 [20/0] via 10.10.13.3, 00:08:53
```

```
!--- This is the next hop of R103.
```

这是BGP和路由表R102的。根据策略，R102 应通过 R102-R104 链路将所有流量路由到 AS 10：

```
R102# show ip bgp
```

```
BGP table version is 7, local router ID is 192.168.12.2
```

```
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
```

```
Origin codes: i - IGP, e - EGP, ? - incomplete
```

```
Network          Next Hop          Metric LocPrf Weight Path
*> 0.0.0.0        10.10.24.4              0 10 i
```

```
!--- This is the next hop of R104.
```

```
* i 192.168.12.1 100 0 10 i *> 10.10.34.0/24    10.10.24.4              0 10 i
```

```
!--- This is the next hop of R104.
```

```
* i 192.168.12.1 0 100 0 10 i * i192.168.11.0 192.168.12.1 0 100 0 i *> 0.0.0.0 0 32768 i *
i192.168.12.0 192.168.12.1 0 100 0 i *> 0.0.0.0 0 32768 i R102# show ip route
```

```
!--- Output suppressed.
```

```
Gateway of last resort is 10.10.24.4 to network 0.0.0.0 C 192.168.12.0/24 is directly connected,
Ethernet0/0 C 192.168.11.0/24 is directly connected, Ethernet0/0 10.0.0.0/24 is subnetted, 2
subnets C 10.10.24.0 is directly connected, Serial8/0 B      10.10.34.0 [20/0] via 10.10.24.4,
00:11:21
```

```
!--- This is the next hop of R104.
```

```
B* 0.0.0.0/0 [20/0] via 10.10.24.4, 00:11:21
```

```
!--- This is the next hop of R104.
```

Inbound数据流的验证从AS 10的对AS 11

网络 192.168.11.0 和 192.168.12.0 都属于 AS 11。根据策略，对于发往网络 192.168.11.0 的流量，AS 11 应首选 R103-R101 链路，对于发往网络 192.168.12.0 的流量，则首选 R104-R102 链路。

。

```
R103# show ip bgp
```

```
BGP table version is 4, local router ID is 10.10.34.3
```

```
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
```

```
Origin codes: i - IGP, e - EGP, ? - incomplete
```

```
Network          Next Hop          Metric LocPrf Weight Path
*> 10.10.34.0/24   0.0.0.0              0          32768 i
```

```
*> 192.168.11.0   10.10.13.1          0          0 11 i
```

```
!--- The next hop is R101. * 192.168.12.0 10.10.13.1 0 0 11 11 11 11 i *>i
```

```
10.10.34.4        0    100    0 11 i
```

```
!--- The next hop is R104. R103# show ip route
```

```
!--- Output suppressed. Gateway of last resort is not set B      192.168.12.0/24 [200/0] via
10.10.34.4, 00:04:46
```

```
!--- The next hop is R104. B      192.168.11.0/24 [20/0] via 10.10.13.1, 00:04:46
```

```
!--- The next hop is R101. 10.0.0.0/24 is subnetted, 2 subnets C 10.10.13.0 is directly
connected, Serial8/0 C 10.10.34.0 is directly connected, Ethernet0/0
```

网络的192.168.11.0最佳路径在R103是通过R103-R101链路，并且网络的192.168.12.0最佳路径在这种情况下是通过R104对AS 11.，最短路径长度确定最佳路径。

同样，在 R104 中，BGP 和路由表与此类似：

```
R104# show ip bgp
```

```
BGP table version is 13, local router ID is 10.10.34.4  
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal  
Origin codes: i - IGP, e - EGP, ? - incomplete
```

Network	Next Hop	Metric	LocPrf	Weight	Path
*>i10.10.34.0/24	10.10.34.3	0	100	0	i
*>i192.168.11.0	10.10.34.3	0	100	0	11 i
*	10.10.24.2	0			0 11 11 11 11 i
*> 192.168.12.0	10.10.24.2	0			0 11 i

```
R104# show ip route
```

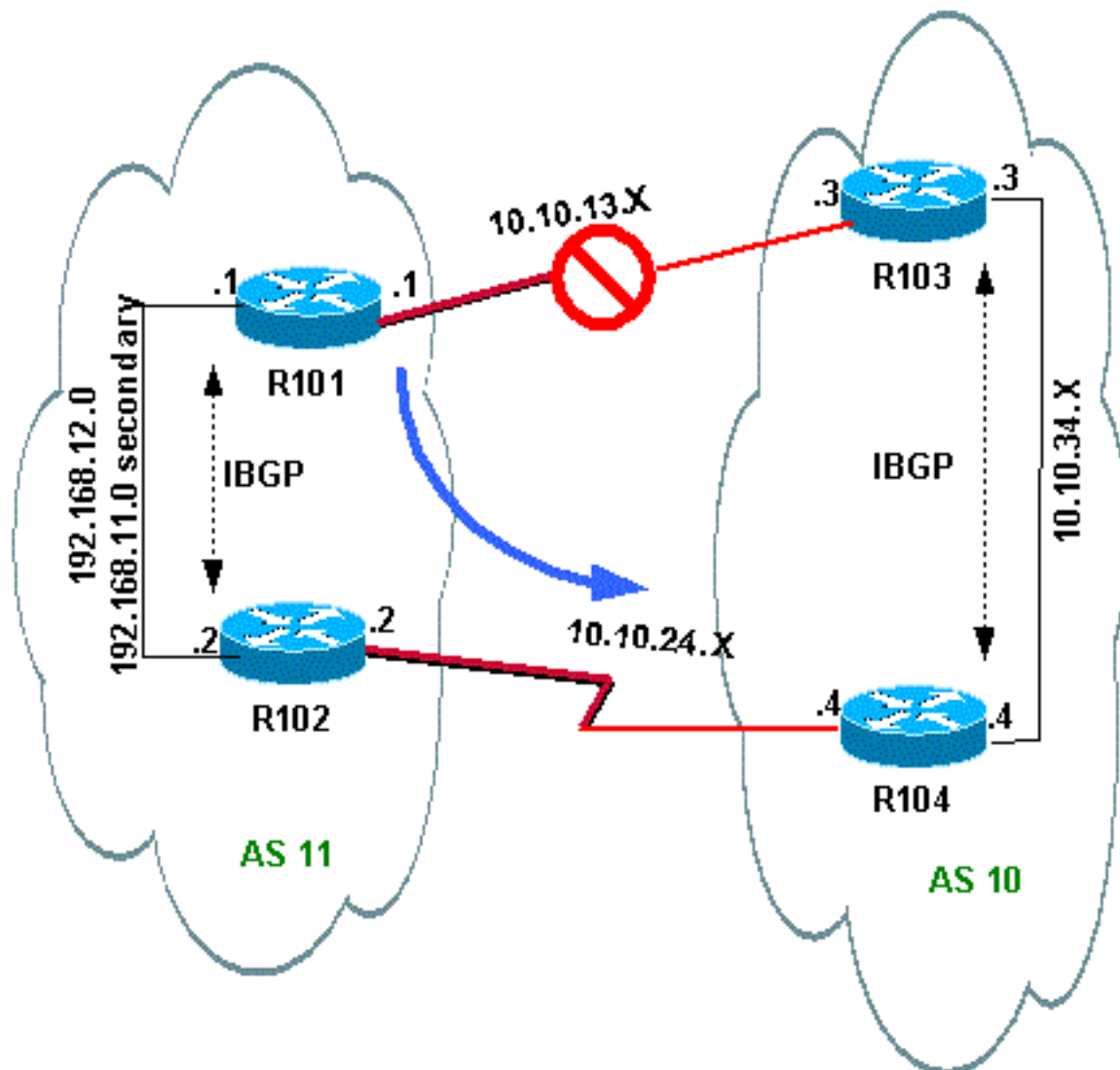
```
!--- Output suppressed. Gateway of last resort is not set B 192.168.12.0/24 [20/0] via  
10.10.24.2, 00:49:06
```

```
!--- The next hop is R102. B 192.168.11.0/24 [200/0] via 10.10.34.3, 00:07:36
```

```
!--- The next hop is R103. 10.0.0.0/24 is subnetted, 2 subnets C 10.10.24.0 is directly  
connected, Serial8/0 C 10.10.34.0 is directly connected, Ethernet0/0
```

验证，当R101-R103链路发生故障

当R101-R103链路发生故障时，所有数据流应该通过R102重路由。下图说明了这一更改：



关闭 R103 上的 R103-R101 链路以模拟这种情况。

```
R103(config)# interface serial 8/0
R103(config-if)# shutdown
```

```
*May 1 00:52:33.379: %BGP-5-ADJCHANGE: neighbor 10.10.13.1 Down Interface flap
*May 1 00:52:35.311: %LINK-5-CHANGED: Interface Serial8/0, changed state to
administratively down
*May 1 00:52:36.127: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial8/0, changed
state to down
```

验证出局路由对AS 10。

```
R101# show ip bgp
```

```
BGP table version is 17, local router ID is 192.168.12.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete
```

```
Network          Next Hop          Metric LocPrf Weight Path
*>i0.0.0.0        192.168.12.2          100      0 10 i
!--- This is the next hop of R102.
*>i10.10.34.0/24  192.168.12.2 100 0 10 i
!--- This is the next hop of R102.

* i192.168.11.0 192.168.12.2 0 100 0 i
*> 0.0.0.0 0 32768 i
* i192.168.12.0 192.168.12.2 0 100 0 i
*> 0.0.0.0 0 32768 i
```

```
R101# show ip route
```

```
!--- Output suppressed.
```

```
Gateway of last resort is 192.168.12.2 to network 0.0.0.0
```

```
C 192.168.12.0/24 is directly connected, Ethernet0/0
C 192.168.11.0/24 is directly connected, Ethernet0/0
10.0.0.0/24 is subnetted, 1 subnets
B 10.10.34.0 [200/0] via 192.168.12.2, 00:01:34
B* 0.0.0.0/0 [200/0] via 192.168.12.2, 00:01:34
!--- All outbound traffic goes through R102.
```

```
R102# show ip route
```

```
!--- Output suppressed.
```

```
Gateway of last resort is 10.10.24.4 to network 0.0.0.0
```

```
C 192.168.12.0/24 is directly connected, Ethernet0/0
C 192.168.11.0/24 is directly connected, Ethernet0/0
10.0.0.0/24 is subnetted, 2 subnets
C 10.10.24.0 is directly connected, Serial8/0
B 10.10.34.0 [20/0] via 10.10.24.4, 00:13:22
B* 0.0.0.0/0 [20/0] via 10.10.24.4, 00:55:22
!--- All outbound traffic on R102 goes through R104.
```

当R101-R103发生故障时，请验证Inbound数据流路由。

```
R103# show ip bgp
```

```
BGP table version is 6, local router ID is 10.10.34.3
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
```

Origin codes: i - IGP, e - EGP, ? - incomplete

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 10.10.34.0/24	0.0.0.0	0		32768	i
*>i192.168.11.0	10.10.34.4	0	100	0	11 11 11 11 i
*>i192.168.12.0	10.10.34.4	0	100	0	11 i

R103# **show ip route**

!--- Output suppressed.

Gateway of last resort is not set

B 192.168.12.0/24 [200/0] via 10.10.34.4, 00:14:55

!--- The next hop is R104.

B 192.168.11.0/24 [200/0] via 10.10.34.4, 00:05:46

!--- The next hop is R104.

10.0.0.0/24 is subnetted, 1 subnets

C 10.10.34.0 is directly connected, Ethernet0/0

在R104，192.168.11.0的数据流和192.168.12.0通过R104-R102链路。

R104# **show ip route**

!--- Output suppressed.

Gateway of last resort is not set

B 192.168.12.0/24 [20/0] via 10.10.24.2, 00:58:35

!--- The next hop is R102.

B 192.168.11.0/24 [20/0] via 10.10.24.2, 00:07:57

!--- The next hop is R102.

10.0.0.0/24 is subnetted, 2 subnets

C 10.10.24.0 is directly connected, Serial8/0

C 10.10.34.0 is directly connected, Ethernet0/0

Troubleshoot

目前没有针对此配置的故障排除信息。

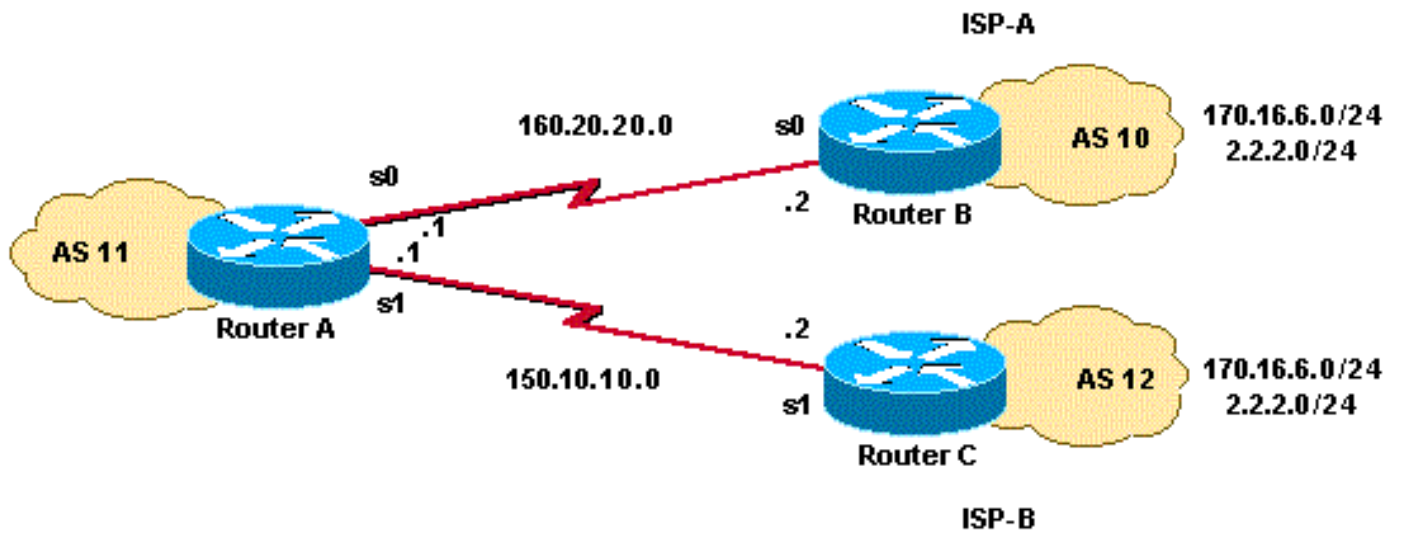
负载分配，当多址对两ISP通过单个本地路由器

在此方案中，负载均衡不适用于多宿主环境，因此只能进行负载共享。您不能进行负载均衡，因为在从不同 AS 获知的 BGP 路由中，BGP 仅选择一个指向目标的最佳路径。基本思想是为通过 ISP(A) 获知的范围从 1.0.0.0 到 128.0.0.0 的路由和通过 ISP(B) 获知的其余路由设置更好的度量标准。[网络图](#)是示例。

有关其他信息，请参阅[两个不同服务提供商（多宿主）间的 BGP 的配置示例](#)。

Network Diagram

此部分使用此网络建立：



配置

本部分使用以下配置：

- [RouterA](#)
- [RouterB](#)
- [RouterC](#)

RouterA

```
R104# show ip route
```

```
!--- Output suppressed.
```

```
Gateway of last resort is not set
```

```
B 192.168.12.0/24 [20/0] via 10.10.24.2, 00:58:35
!--- The next hop is R102.
```

```
B 192.168.11.0/24 [20/0] via 10.10.24.2, 00:07:57
!--- The next hop is R102.
```

```
10.0.0.0/24 is subnetted, 2 subnets
C 10.10.24.0 is directly connected, Serial8/0
C 10.10.34.0 is directly connected, Ethernet0/0
```

RouterB

```
R104# show ip route
```

```
!--- Output suppressed.
```

```
Gateway of last resort is not set
```

```
B 192.168.12.0/24 [20/0] via 10.10.24.2, 00:58:35
!--- The next hop is R102.
```

```
B 192.168.11.0/24 [20/0] via 10.10.24.2, 00:07:57
```


!--- The next hop is R102.

```
10.0.0.0/24 is subnetted, 2 subnets
C 10.10.24.0 is directly connected, Serial8/0
C 10.10.34.0 is directly connected, Ethernet0/0
```

RouterC

```
R104# show ip route
```

!--- Output suppressed.

Gateway of last resort is not set

```
B 192.168.12.0/24 [20/0] via 10.10.24.2, 00:58:35
```

!--- The next hop is R102.

```
B 192.168.11.0/24 [20/0] via 10.10.24.2, 00:07:57
```

!--- The next hop is R102.

```
10.0.0.0/24 is subnetted, 2 subnets
C 10.10.24.0 is directly connected, Serial8/0
C 10.10.34.0 is directly connected, Ethernet0/0
```

Verify

Use this section to confirm that your configuration works properly.

确定[Cisco CLI分析器\(仅限注册用户\)](#)技术支持显示命令。请使用Cisco CLI分析器查看show命令输出分析。

[show ip route](#) 命令和 [traceroute](#) 命令的输出显示，低于 128.0.0.0 的所有网络均通过 160.20.20.2 退出 RouterA。此路由是跳出 serial 0 接口的下一跳。其余网络通过 150.10.10.2 退出，这是跳出 serial 1 接口的下一跳。

```
RouterA# show ip route
```

!--- Output suppressed.

Gateway of last resort is not set

```
B 170.16.0.0/16 [20/0] via 150.10.10.2, 00:43:43
```

!--- This is the next hop out through serial 1.

```
B 2.0.0.0/8 [20/0] via 160.20.20.2, 00:43:43
```

!--- This is the next hop out through serial 0.

```
160.20.0.0/24 is subnetted, 1 subnets
C 160.20.20.0 is directly connected, Serial0
150.10.0.0/24 is subnetted, 1 subnets
C 150.10.10.0 is directly connected, Serial1
```

```
RouterA# show ip bgp
```

```
BGP table version is 3, local router ID is 160.20.20.1 Status codes: s suppressed, d damped, h
history, * valid, > best, i - internal Origin codes: i - IGP, e - EGP, ? - incomplete Network
Next Hop Metric LocPrf Weight Path Network Next Hop Metric LocPrf Weight Path * 2.0.0.0
150.10.10.2 0 0 12 i *> 160.20.20.2 0 100 10 i * 170.16.0.0 160.20.20.2 0 0 10 i *> 150.10.10.2
0 100 12 i RouterA# traceroute 2.2.2.2
```

```
Type escape sequence to abort.  
Tracing the route to 2.2.2.2  
  
1  160.20.20.2 16 msec * 16 msec  
  
RouterA# traceroute 170.16.6.6  
  
Type escape sequence to abort.  
Tracing the route to 170.16.6.6  
  
1  150.10.10.2 4 msec * 4 msec
```

Troubleshoot

目前没有针对此配置的故障排除信息。

负载分配，当多址对两ISP通过多个本地路由器

在具有两个 ISP 的多宿主环境中，不可能实现负载均衡。在通过不同 AS 获知的 BGP 路径中，BGP 仅选择一个指向目标的最佳路径，因此不可能实现负载均衡。但是，负载分配是可能的在这样多址BGP网络。根据预先确定的策略，使用不同的 BGP 属性控制流量。

本部分讨论最常用的多宿主配置。配置显示如何实现负载共享。请参阅[网络图](#)，其中 AS 100 的多宿主实现了可靠性和负载共享。

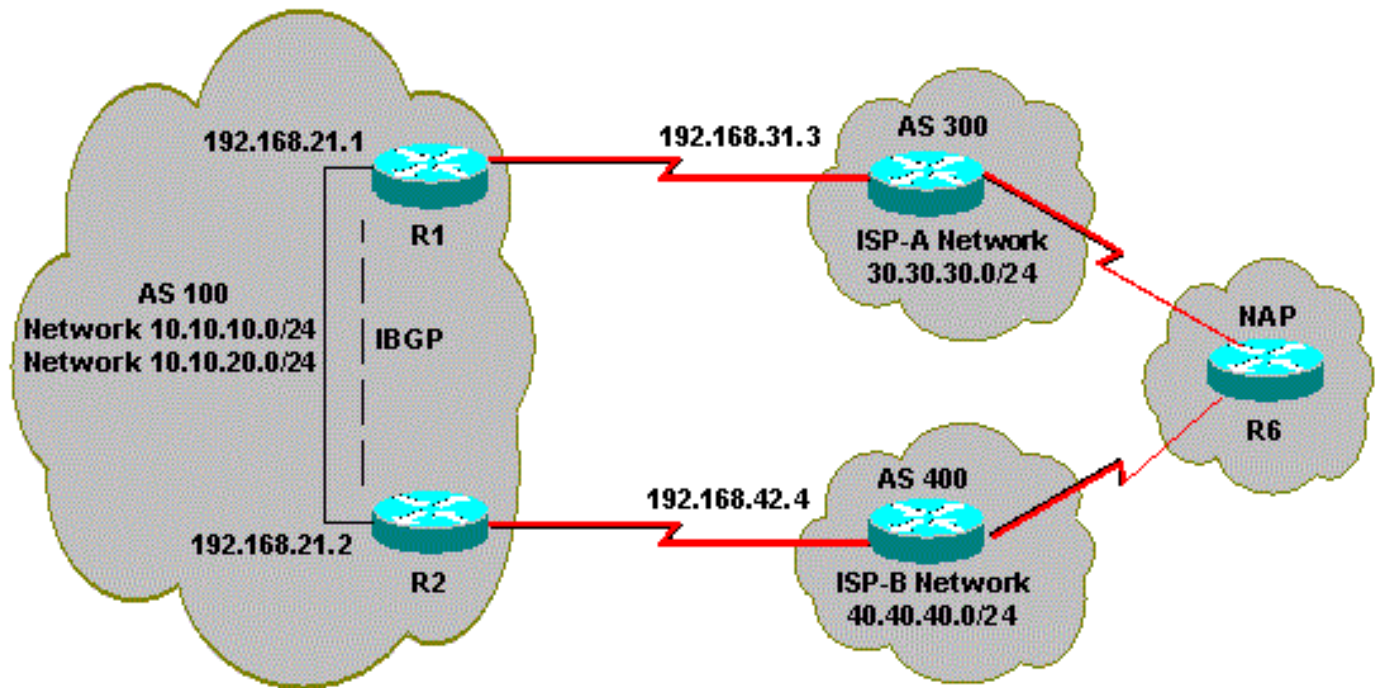
Note:在本例中，IP 地址遵循私有地址空间的 [RFC 1918](#) 标准，在 Internet 中不可路由。

为简单起见，假定 AS 100 的 BGP 路由策略如下：

- AS 100与互联网路由的其余的一个默认值一起接受从两个供应商的本地路由。
- outbound数据流策略是：发往 AS 300 的流量通过 R1-ISP(A) 链路。发往 AS 400 的流量通过 R2-ISP(B) 链路。其他数据流应该通过R1-ISP(A)链路更喜欢默认路由0.0.0.0。如果R1-ISP(A)链路发生故障，所有数据流应该通过R2-ISP(B)链路。
- 入站数据流策略是：从 Internet 发往网络 10.10.10.0/24 的流量应出自 ISP(A)-R1 链路。从 Internet 发往网络 10.10.20.0/24 的流量应出自 ISP(B)-R2 链路。如果一个 ISP 发生故障，另一个 ISP 应针对所有网络将流量从 Internet 路由回 AS 100。

Network Diagram

此部分使用此网络建立：



配置

本部分使用以下配置：

- [R2](#)
- [R1](#)

R2

```
RouterA# show ip route
```

```
!--- Output suppressed.
```

```
Gateway of last resort is not set
```

```
B 170.16.0.0/16 [20/0] via 150.10.10.2, 00:43:43
```

```
!--- This is the next hop out through serial 1.
```

```
B 2.0.0.0/8 [20/0] via 160.20.20.2, 00:43:43
```

```
!--- This is the next hop out through serial 0.
```

```
160.20.0.0/24 is subnetted, 1 subnets
```

```
C 160.20.20.0 is directly connected, Serial0
```

```
150.10.0.0/24 is subnetted, 1 subnets
```

```
C 150.10.10.0 is directly connected, Serial1
```

```
RouterA# show ip bgp
```

```
BGP table version is 3, local router ID is 160.20.20.1 Status codes: s suppressed, d damped, h
```

```
history, * valid, > best, i - internal Origin codes: i - IGP, e - EGP, ? - incomplete Network
```

```
Next Hop Metric LocPrf Weight Path Network Next Hop Metric LocPrf Weight Path * 2.0.0.0
```

```
150.10.10.2 0 0 12 i * > 160.20.20.2 0 100 10 i * 170.16.0.0 160.20.20.2 0 0 10 i * > 150.10.10.2
```

```
0 100 12 i RouterA# traceroute 2.2.2.2
```

```
Type escape sequence to abort.
```

```
Tracing the route to 2.2.2.2
```

```
1 160.20.20.2 16 msec * 16 msec
```

```
RouterA# traceroute 170.16.6.6
```

```
Type escape sequence to abort.  
Tracing the route to 170.16.6.6
```

```
1 150.10.10.2 4 msec * 4 msec
```

R1

```
RouterA# show ip route
```

```
!--- Output suppressed.  
Gateway of last resort is not set  
B 170.16.0.0/16 [20/0] via 150.10.10.2, 00:43:43  
!--- This is the next hop out through serial 1.  
  
B 2.0.0.0/8 [20/0] via 160.20.20.2, 00:43:43  
!--- This is the next hop out through serial 0.
```

```
160.20.0.0/24 is subnetted, 1 subnets  
C 160.20.20.0 is directly connected, Serial0  
150.10.0.0/24 is subnetted, 1 subnets  
C 150.10.10.0 is directly connected, Serial1
```

```
RouterA# show ip bgp
```

```
BGP table version is 3, local router ID is 160.20.20.1 Status codes: s suppressed, d damped, h  
history, * valid, > best, i - internal Origin codes: i - IGP, e - EGP, ? - incomplete Network  
Next Hop Metric LocPrf Weight Path Network Next Hop Metric LocPrf Weight Path * 2.0.0.0  
150.10.10.2 0 0 12 i *> 160.20.20.2 0 100 10 i * 170.16.0.0 160.20.20.2 0 0 10 i *> 150.10.10.2  
0 100 12 i RouterA# traceroute 2.2.2.2
```

```
Type escape sequence to abort.  
Tracing the route to 2.2.2.2
```

```
1 160.20.20.2 16 msec * 16 msec
```

```
RouterA# traceroute 170.16.6.6
```

```
Type escape sequence to abort.  
Tracing the route to 170.16.6.6
```

```
1 150.10.10.2 4 msec * 4 msec
```

Verify

Use this section to confirm that your configuration works properly.

确定[Cisco CLI分析器](#)([仅限注册用户](#))技术支持显示命令。请使用Cisco CLI分析器查看show命令输出分析。

发出 [show ip bgp](#) 命令以验证出站/入站策略是否有效。

Note:[show ip bgp output](#) 中的大于号 (>) 表示可能的路径中用于该网络的最佳路径。参考

[BGP最佳路径选择算法](#)欲知更多信息。

```
R1# show ip bgp
```

```
BGP table version is 6, local router ID is 192.168.31.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete
```

```
BGP table version is 6, local router ID is 192.168.31.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete
```

Network	Next Hop	Metric	LocPrf	Weight	Path
*> 0.0.0.0	192.168.31.3			200	0 300 i

```
!--- This line shows that the default route 0.0.0.0/0 is preferred
!--- through AS 300, ISP(A).
```

```
* i10.10.10.0/24 192.168.21.2 0 100 0 i
*> 0.0.0.0 0 32768 i
* i10.10.20.0/24 192.168.21.2 0 100 0 i
*> 0.0.0.0 0 32768 i
*> 30.30.30.0/24 192.168.31.3 0 200 0 300 i
*>i40.40.40.0/24 192.168.21.2 0 150 0 400 i
```

```
!--- The route to network 30.30.30.0/24 (AS 300) is preferred
!--- through the R1-ISP(A) link.
!--- The route to network 40.40.40.0/24 (AS 400) is preferred
!--- through the R2-ISP(B) link.
```

现在，请看 R2 上的 [show ip bgp output](#)：

```
R2# show ip bgp
```

```
BGP table version is 8, local router ID is 192.168.42.2
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete
```

Network	Next Hop	Metric	LocPrf	Weight	Path
* 0.0.0.0	192.168.42.4			150	0 400 i
*>i	192.168.21.1			200	0 300 i

```
!--- This line shows that the default route 0.0.0.0/0 is preferred
!--- through AS 300, through the R2-ISP(B) link.
```

```
*> 10.10.10.0/24 0.0.0.0 0 32768 i
* i 192.168.21.1 0 100 0 i
*> 10.10.20.0/24 0.0.0.0 0 32768 i
* i 192.168.21.1 0 100 0 i
*>i30.30.30.0/24 192.168.21.1 0 200 0 300 i
*> 40.40.40.0/24 192.168.42.4 0 150 0 400 i
```

```
!--- The route to network 30.30.30.0/24 (AS 300) is preferred
!--- through the R1-ISP(A) link.
!--- The route to network 40.40.40.0/24 (AS 400) is preferred
!--- through the R2-ISP(B) link.
```

在 Router 6 上发出 [show ip bgp](#) 命令，以观察网络 10.10.10.0/24 和 10.10.20.0/24 的入站策略：

```
R6# show ip bgp
```

```
BGP table version is 15, local router ID is 192.168.64.6
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete
```

```
Network          Next Hop          Metric LocPrf Weight Path
*> 10.10.10.0/24  192.168.63.3          0 300 100 100 i
```

```
!--- This line shows that network 10.10.10.0/24 is routed through AS 300
!--- with the ISP(A)-R1 link.
```

```
* 192.168.64.4 0 400 100 100 100 i
* 10.10.20.0/24 192.168.63.3 0 300 100 100 i
*>                192.168.64.4                0 400 100 i
```

```
!--- This line shows that network 10.10.20.0/24 is routed through AS 400
!--- with the ISP(B)-R2 link.
```

```
*> 30.30.30.0/24 192.168.63.3 0 0 300 i
*> 40.40.40.0/24 192.168.64.4 0 0 400 i
```

关闭 R1 上的 R1-ISP(A) 链路并观察 BGP 表。发往 Internet 的所有流量均应通过 R2-ISP(B) 链路进行路由：

```
R1(config)# interface serial 0/0
R1(config-if)# shutdown
```

```
*May  2 19:00:47.377: %BGP-5-ADJCHANGE: neighbor 192.168.31.3 Down Interface flap
*May  2 19:00:48.277: %LINK-5-CHANGED: Interface Serial0/0, changed state to
administratively down
*May 23 12:00:51.255: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0, changed
state to down
```

```
R1# show ip bgp
```

```
BGP table version is 12, local router ID is 192.168.31.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete
```

```
Network          Next Hop          Metric LocPrf Weight Path
*>i0.0.0.0        192.168.21.2          150      0 400 i
```

```
!--- The best default path is now through the R2-ISP(B) link.
```

```
* i10.10.10.0/24 192.168.21.2 0 100 0 i
*> 0.0.0.0 0 32768 i
* i10.10.20.0/24 192.168.21.2 0 100 0 i
*> 0.0.0.0 0 32768 i
*>i40.40.40.0/24 192.168.21.2 0 150 0 400 i
```

```
R2# show ip bgp
```

```
BGP table version is 14, local router ID is 192.168.42.2 Status codes: s suppressed, d damped, h
history, * valid, > best, i - internal Origin codes: i - IGP, e - EGP, ? - incomplete Network
Next Hop Metric LocPrf Weight Path *> 0.0.0.0 192.168.42.4 150 0 400 i !--- The best default
route is now through ISP(B) with a
!--- local preference of 150.
```

```
* i10.10.10.0/24 192.168.21.1 0 100 0 i
*> 0.0.0.0 0 32768 i
* i10.10.20.0/24 192.168.21.1 0 100 0 i
*> 0.0.0.0 0 32768 i
*> 40.40.40.0/24 192.168.42.4 0 150 0 400 i
```

请看 Router 6 中网络 10.10.10.0/24 的路由：

```
R6# show ip bgp
```

```
BGP table version is 14, local router ID is 192.168.64.6  
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal  
Origin codes: i - IGP, e - EGP, ? - incomplete
```

```
Network          Next Hop          Metric LocPrf Weight Path  
*> 10.10.10.0/24  192.168.64.4          0 400 100 100 i
```

```
!--- Network 10.10.10.0 is reachable through ISP(B), which announced  
!--- the network with AS path prepend.
```

```
*> 10.10.20.0/24 192.168.64.4 0 400 100 i
```

```
*> 30.30.30.0/24 192.168.63.3 0 0 300 i
```

```
*> 40.40.40.0/24 192.168.64.4 0 0 400 i
```

Troubleshoot

目前没有针对此配置的故障排除信息。

Related Information

- [BGP 多宿主：设计和故障排除 - 网络直播视频](#)
- [BGP 多宿主：设计和排除故障-问题和解答从实际Webcast](#)
- [负载均衡如何工作？](#)
- [两个不同服务提供商（多宿）间的 BGP 的示例配置](#)
- [BGP路由器如何使用多出口分辨器最佳路径选择](#)
- [IP路由技术支持页](#)
- [Technical Support & Documentation - Cisco Systems](#)