

# L2TP负载均衡和故障切换

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## 简介

本文档介绍L2TP接入集中器(LAC)的功能，该集中器对多个L2TP网络服务器(LNS)执行负载均衡和故障切换功能。

## 先决条件

### 要求

本文档没有任何特定的要求。

### 使用的组件

本文档不限于特定的软件和硬件版本。

### 规则

有关文档规则的详细信息，请参阅 [Cisco 技术提示规则](#)。

## LNS负载均衡

当使用RADIUS将虚拟专用拨号网络(VPDN)隧道信息传送到LAC时，可以将同一拨号号码标识服务(DNIS)或域的用户转发到多个LNS。当需要跨多个LNS共享传入隧道和会话以帮助进行负载分配并提供更高级别的冗余时，这是一项要求。要启用负载均衡功能，作为隧道终端可用的每个LNS的IP地址必须在思科供应商特定属性(VSA)属性/值对中提供。

```
Cisco:Avpair = "vpdn:ip-addresses=10.51.6.82,10.51.6.59"
```

“，”用作分隔符，表示LAC有多个可用端点（您还可以使用空格作为分隔符，以表示隧道端点的等优先级）。LAC根据传送的第一个非活动IP地址的随机选择来选择要使用的终端。如果此地址繁忙（LAC无法连接到IP地址），则选择下一个IP地址。如果没有非活动IP地址可用，则下一个选择基于处于“打开隧道状态”的IP地址，最后基于处于“挂起隧道状态”的IP地址。

## [LNS故障转移](#)

当使用多个LNS时，Cisco IOS®软件最多允许六个优先级。使用“/”作为分隔符，可以将不同的优先级组分配给下载到LAC的LNS。这允许某些LNS作为主LNS运行，而其他LNS则作为备份运行。与以前一样，隧道终端在Cisco VSA属性/值对中传送。

```
Cisco:Avpair = "vpdn:ip-addresses=10.51.6.82/10.51.6.59"
```

“/”分隔符表示10.51.6.82在优先级组1中，10.51.6.59在优先级组2中。

## [LNS负载均衡和故障转移](#)

可以在同一配置文件中同时使用负载均衡和故障切换。这是通过使用Cisco VSA属性/值对“vpdn:ip-addresses”下所示：

```
Cisco:Avpair = "vpdn:ip-addresses=
1.1.1.1,2.2.2.2/3.3.3.3,4.4.4.4/5.5.5.5,6.6.6.6"
```

这解释为：

- 隧道终端1.1.1.1和2.2.2.2位于优先级组1中
- 隧道终端3.3.3.3和4.4.4.4位于优先级组2中
- 隧道终端5.5.5.5和6.6.6.6位于优先级组3中

负载均衡功能在优先级组1上执行 — 非活动/非忙、打开、挂起。如果此优先级上没有可用，请转到下一个优先级，然后继续选择逻辑。

## [实验室测试](#)

本节中的测试显示使用负载均衡和故障切换功能的三种不同方案：

- 使用思科供应商特定属性/值对的LNS负载均衡
- 使用思科供应商特定属性/值对的LNS故障转移
- 使用思科供应商特定属性/值对的LNS负载平衡和故障切换

## [使用思科供应商特定属性/值对的LNS负载均衡](#)

### [RADIUS配置文件](#)

## Merit RADIUS服务器3.6B上的RADIUS用户和隧道配置文件：

```
2500-1 Password = "cisco"  
Service-Type = Framed,  
Framed-Protocol = PPP,  
Framed-IP-Address = 255.255.255.255
```

```
dnis:614629 Password = "cisco"  
Service-Type = Outbound,  
Cisco:Avpair = "vpdn:tunnel-type=l2tp",  
Cisco:Avpair = "vpdn:tunnel-id=hgw",  
Cisco:Avpair = "vpdn:ip-addresses=10.51.6.82,10.51.6.59",  
Cisco:Avpair = "vpdn:l2tp-tunnel-password=hello"
```

## LAC — 配置

```
aaa new-model  
!--- Enables Authentication, Authorization and Accounting functionality. aaa group server radius  
NSA_LAB server 10.51.6.3 auth-port 1645 acct-port 0 non-standard ! aaa authentication login  
default local aaa authentication ppp default local group NSA_LAB aaa authentication ppp DIAL  
group NSA_LAB local aaa authorization network default group NSA_LAB local aaa authorization  
network DIAL group NSA_LAB local !--- Authentication and Authorization will be implemented !---  
in sequence by the methods configured. vpdn enable !--- Enables the VPDN feature. no vpdn  
logging vpdn search-order dnis !--- Once LCP state is open, the dialed number is checked !--- to  
see if the remote is a VPDN user. interface Serial0:15 no ip address encapsulation ppp no  
logging event link-status dialer rotary-group 1 dialer-group 1 autodetect encapsulation ppp v120  
no snmp trap link-status isdn switch-type primary-net5 isdn incoming-voice modem compress stac !  
interface Dialer1 ip unnumbered Loopback0 encapsulation ppp no ip mroute-cache dialer-group 1  
autodetect encapsulation ppp v120 !--- Allows the encapsulation type to be dynamically set if  
the call !--- type is not identified in the ISDN Q.931 Lower Layer Compatibility. peer default  
ip address pool default compress stac ppp authentication chap pap DIAL ppp authorization DIAL !-  
- The list-name DIAL is configured, that PPP Authentication and !--- Authorization will use.  
ppp chap hostname 5300-1 !--- The name 5300-1 is used for all CHAP challenge and response on !-  
- this interface. ppp multilink ! radius-server host 10.51.6.3 auth-port 1645 acct-port 1646  
non-standard !--- 'non-standard' indicates that the RADIUS Server will use !--- non standard  
RADIUS attributes.
```

## LNS — 配置

```
aaa new-model  
!--- Enables Authentication, Authorization and Accounting functionality. aaa authentication  
login default local aaa authentication enable default group radius enable aaa authentication ppp  
default local aaa authentication ppp vpdn group radius none aaa authorization network default  
local none aaa authorization network vpdn group radius local !--- Authentication and  
Authorization will be implemented !--- in sequence by the methods configured. vpdn enable !---  
Enables the VPDN feature. vpdn-group 1 accept-dialin protocol l2tp virtual-template 1 local name  
l2tp-gw l2tp tunnel password 7 1211001B1E04 !--- The LNS will accept connections from the LAC  
using L2TP !--- using All Virtual-Access Interfaces that are created will be cloned from !---  
Virtual-Template 1. The name 'l2tp-gw' is used to identify the password, !--- that will  
authenticate the tunnel, is encrypted. interface Ethernet5/0 ip address 10.51.6.59 255.255.252.0  
! interface Virtual-Template1 ip unnumbered Ethernet5/0 no ip route-cache cef peer default ip  
address pool default ppp authentication chap vpdn ppp authorization vpdn ! radius-server host  
10.51.6.3 auth-port 1645 acct-port 1646 non-standard !--- 'non-standard' identifies the RADIUS  
Server will be !--- using nonstandard RADIUS attributes.
```

## 从LAC获取的调试

```
Jan 1 00:32:54.847: %LINK-3-UPDOWN: Interface Serial0:0, changed state to up
```

```
Jan 1 00:32:55.027: Se0:0 PPP: Treating connection as a callin
Jan 1 00:32:55.027: Se0:0 PPP: Phase is ESTABLISHING, Passive Open
Jan 1 00:32:55.027: Se0:0 CHAP: Using alternate hostname 5300-1
Jan 1 00:32:55.027: Se0:0 LCP: State is Listen
Jan 1 00:32:55.027: Se0:0 LCP: I CONFREQ [Listen] id 112 len 10
- snip -
Jan 1 00:32:55.063: Se0:0 LCP: State is Open
Jan 1 00:32:55.063: Se0:0 PPP: Phase is AUTHENTICATING, by this end
Jan 1 00:32:55.063: Se0:0 CHAP: Using alternate hostname 5300-1
Jan 1 00:32:55.063: Se0:0 CHAP: O CHALLENGE id 14 len 27 from "5300-1"
Jan 1 00:32:55.083: Se0:0 CHAP: I RESPONSE id 14 len 27 from "2500-1"
Jan 1 00:32:55.083: Se0:0 PPP: Phase is FORWARDING
Jan 1 00:32:55.083: Se0:0 VPDN: Got DNIS string 614629
Jan 1 00:32:55.083: Se0:0 VPDN: Looking for tunnel -- dnis:614629 --
Jan 1 00:32:55.083: Serial0:0 AAA/AUTHOR/VPDN (480033158):
Port='Serial0:0' list='default' service=NET
Jan 1 00:32:55.083: AAA/AUTHOR/VPDN: Serial0:0 (480033158) user='dnis:614629'
Jan 1 00:32:55.087: Serial0:0 AAA/AUTHOR/VPDN (480033158): send AV service=ppp
Jan 1 00:32:55.087: Serial0:0 AAA/AUTHOR/VPDN (480033158): send AV protocol=vpdn
Jan 1 00:32:55.087: Serial0:0 AAA/AUTHOR/VPDN (480033158): found list "default"
Jan 1 00:32:55.087: Serial0:0 AAA/AUTHOR/VPDN (480033158): Method=NSA_LAB (radius)
Jan 1 00:32:55.087: RADIUS: Initial Transmit Serial0:0 id 50 10.51.6.3:1645,
Access-Request, len 100
Jan 1 00:32:55.087: Attribute 4 6 0A330644
Jan 1 00:32:55.087: Attribute 5 6 00000000
Jan 1 00:32:55.087: Attribute 26 17 000000009020B5365
Jan 1 00:32:55.087: Attribute 61 6 00000002
Jan 1 00:32:55.087: Attribute 1 13 646E6973
Jan 1 00:32:55.087: Attribute 30 8 36313436
Jan 1 00:32:55.087: Attribute 2 18 F0AF3BC4
Jan 1 00:32:55.087: Attribute 6 6 00000005
Jan 1 00:32:55.091: RADIUS: Received from id 50 10.51.6.3:1645,
Access-Accept, len 167
Jan 1 00:32:55.091: Attribute 6 6 00000005
Jan 1 00:32:55.091: Attribute 26 29 00000000901177670
Jan 1 00:32:55.091: Attribute 26 26 00000000901147670
Jan 1 00:32:55.091: Attribute 26 47 00000000901297670
Jan 1 00:32:55.091: Attribute 26 39 00000000901217670
!--- LAC receives a call, negotiates PPP, LCP is declared Open, !--- the dialed number is
queried to ascertain if this is a VPDN customer. !--- VPDN attempts to find an existing tunnel
for the user, queries RADIUS for !--- the tunnel information.
Jan 1 00:32:55.091: RADIUS: saved
authorization data for user 61F40024 at 61F9813C
Jan 1 00:32:55.091: RADIUS: cisco AVPair
"vpdn:tunnel-type=l2tp"
Jan 1 00:32:55.091: RADIUS: cisco AVPair "vpdn:tunnel-id=hgw"
Jan 1
00:32:55.091: RADIUS: cisco AVPair "vpdn:ip-addresses=10.51.6.82,10.51.6.59"
Jan 1 00:32:55.095:
RADIUS: cisco AVPair "vpdn:l2tp-tunnel-password=hello"
Jan 1 00:32:55.095: AAA/AUTHOR
(480033158): Post authorization status = PASS_ADD
Jan 1 00:32:55.095: AAA/AUTHOR/VPDN:
Processing AV service=ppp
Jan 1 00:32:55.095: AAA/AUTHOR/VPDN: Processing AV protocol=vpdn
Jan 1
00:32:55.095: AAA/AUTHOR/VPDN: Processing AV tunnel-type=l2tp
Jan 1 00:32:55.095:
AAA/AUTHOR/VPDN: Processing AV tunnel-id=hgw
Jan 1 00:32:55.095: AAA/AUTHOR/VPDN: Processing AV
ip-addresses=
10.51.6.82,10.51.6.59
Jan 1 00:32:55.095: AAA/AUTHOR/VPDN: Processing AV l2tp-tunnel-password=hello
Jan 1 00:32:55.095: Se0:0 VPDN/RPMS/: Got tunnel info for dnis:614629
Jan 1 00:32:55.095: Se0:0 VPDN/RPMS/: LAC hgw
Jan 1 00:32:55.095: Se0:0 VPDN/RPMS/: l2tp-busy-disconnect yes
Jan 1 00:32:55.095: Se0:0 VPDN/RPMS/: l2tp-tunnel-password xxxxxx
Jan 1 00:32:55.095: Se0:0 VPDN/RPMS/: 2 IP addresses
Jan 1 00:32:55.095: Se0:0 VPDN/RPMS/: IP 10.51.6.82 Priority 1
Jan 1 00:32:55.095: Se0:0 VPDN/RPMS/: IP 10.51.6.59 Priority 1
Jan 1 00:32:55.095: Se0:0 VPDN/: curlvl 1 Address 0: 10.51.6.82, priority 1
Jan 1 00:32:55.095: Se0:0 VPDN/: Select non-active address 10.51.6.82, priority 1
!--- The tunnel information is downloaded, using Cisco VSA. Two LNS IP !--- Addresses are used
with a ',' as the delimiter, indicating that both !--- have equal priority. In this case
10.51.6.82 is selected as the tunnel !--- endpoint.
Jan 1 00:32:55.095: Se0:0 VPDN: Find LNS
```

```
process created Jan 1 00:32:55.095: Tnl 49467 L2TP: SM State idle Jan 1 00:32:55.095: Tnl 49467
L2TP: O SCCRQ Jan 1 00:32:55.099: Tnl 49467 L2TP: Tunnel state change from idle to wait-ctl-
reply Jan 1 00:32:55.099: Tnl 49467 L2TP: SM State wait-ctl-reply Jan 1 00:32:55.099: Se0:0
VPDN: Forward to address 10.51.6.82
Jan 1 00:32:55.099: Se0:0 VPDN: Pending
Jan 1 00:32:55.099: Se0:0 VPDN: Process created
Jan 1 00:32:55.191: Tnl 49467 L2TP: I SCCRP from l2tp-gw
Jan 1 00:32:55.191: Tnl 49467 L2TP: Got a challenge from remote peer, l2tp-gw
Jan 1 00:32:55.191: Tnl 49467 L2TP: Got a response from remote peer, l2tp-gw
Jan 1 00:32:55.191: Tnl 49467 L2TP: Tunnel Authentication success
Jan 1 00:32:55.191: Tnl 49467 L2TP: Tunnel state change from
wait-ctl-reply to established
Jan 1 00:32:55.191: Tnl 49467 L2TP: O SCCCN to l2tp-gw tnlid 62193
Jan 1 00:32:55.195: Tnl 49467 L2TP: SM State established
Jan 1 00:32:55.195: Tnl/Cl 49467/16 L2TP: Session FS enabled
Jan 1 00:32:55.195: Tnl/Cl 49467/16 L2TP: Session state change
from idle to wait-for-tunnel
Jan 1 00:32:55.195: Se0:0 Tnl/Cl 49467/16 L2TP: Create session
Jan 1 00:32:55.195: Tnl 49467 L2TP: SM State established
Jan 1 00:32:55.195: Se0:0 Tnl/Cl 49467/16 L2TP: O ICRQ to l2tp-gw 62193/0
Jan 1 00:32:55.195: Se0:0 Tnl/Cl 49467/16 L2TP: Session state change
from wait-for-tunnel to wait-reply
Jan 1 00:32:55.195: Se0:0 VPDN: 2500-1 is forwarded
Jan 1 00:32:55.327: Se0:0 Tnl/Cl 49467/16 L2TP: O ICCN to l2tp-gw 62193/17
Jan 1 00:32:55.327: Se0:0 Tnl/Cl 49467/16 L2TP: Session state change
from wait-reply to established
Jan 1 00:32:56.195: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0:0,
changed state to up
Jan 1 00:33:00.851: %ISDN-6-CONNECT:Interface Serial0:0 is now connected to 2500-1
Jan 1 00:33:06.111: %ISDN-6-CONNECT:
Interface Serial0:1 is now connected to N/A N/A
!--- Second call is received by the LAC, !--- the dialed number is a VPDN customer. Jan 1
00:33:35.027: As1 LCP: I CONFREQ [Closed] id 1 len 23 - snip - Jan 1 00:33:39.275: As1 LCP:
State is Open
Jan 1 00:33:39.275: As1 PPP: Phase is AUTHENTICATING, by this end
Jan 1 00:33:39.275: As1 CHAP: Using alternate hostname 5300-1
Jan 1 00:33:39.275: As1 CHAP: O CHALLENGE id 2 len 27 from "5300-1"
Jan 1 00:33:39.383: As1 CHAP: I RESPONSE id 2 len 25 from "paul"
Jan 1 00:33:39.383: As1 PPP: Phase is FORWARDING
Jan 1 00:33:39.383: As1 VPDN: Got DNIS string 614629
Jan 1 00:33:39.383: As1 VPDN: Looking for tunnel -- dnis:614629 --
Jan 1 00:33:39.387: Async1 AAA/AUTHOR/VPDN (3019717950):
Port='Async1' list='default' service=NET
Jan 1 00:33:39.387: AAA/AUTHOR/VPDN: Async1 (3019717950) user='dnis:614629'
Jan 1 00:33:39.387: Async1 AAA/AUTHOR/VPDN (3019717950): send AV service=ppp
Jan 1 00:33:39.387: Async1 AAA/AUTHOR/VPDN (3019717950): send AV protocol=vpdn
Jan 1 00:33:39.387: Async1 AAA/AUTHOR/VPDN (3019717950): found list "default"
Jan 1 00:33:39.387: Async1 AAA/AUTHOR/VPDN (3019717950): Method=NSA_LAB (radius)
Jan 1 00:33:39.387: RADIUS: Initial Transmit Async1 id 52 10.51.6.3:1645,
Access-Request, len 97
Jan 1 00:33:39.387: Attribute 4 6 0A330644
Jan 1 00:33:39.387: Attribute 5 6 00000001
Jan 1 00:33:39.387: Attribute 26 14 0000000902084173
Jan 1 00:33:39.387: Attribute 61 6 00000000
Jan 1 00:33:39.387: Attribute 1 13 646E6973
Jan 1 00:33:39.387: Attribute 30 8 36313436
Jan 1 00:33:39.387: Attribute 2 18 E9164E4C
Jan 1 00:33:39.387: Attribute 6 6 00000005
Jan 1 00:33:39.391: RADIUS: Received from id 52 10.51.6.3:1645,
Access-Accept, len 167
Jan 1 00:33:39.391: Attribute 6 6 00000005
Jan 1 00:33:39.391: Attribute 26 29 0000000901177670
Jan 1 00:33:39.391: Attribute 26 26 0000000901147670
Jan 1 00:33:39.391: Attribute 26 47 0000000901297670
```

Jan 1 00:33:39.391: Attribute 26 39 0000000901217670  
Jan 1 00:33:39.391: RADIUS: saved authorization data for user  
621904CC at 61FAB9EC  
Jan 1 00:33:39.391: RADIUS: cisco AVPair "vpdn:tunnel-type=l2tp"  
Jan 1 00:33:39.391: RADIUS: cisco AVPair "vpdn:tunnel-id=hgw"  
Jan 1 00:33:39.391: RADIUS: cisco AVPair "vpdn:ip-addresses=10.51.6.82,10.51.6.59"  
Jan 1 00:33:39.391: RADIUS: cisco AVPair "vpdn:l2tp-tunnel-password=hello"  
Jan 1 00:33:39.395: AAA/AUTHOR (3019717950): Post authorization status = PASS\_ADD  
Jan 1 00:33:39.395: AAA/AUTHOR/VPDN: Processing AV service=ppp  
Jan 1 00:33:39.395: AAA/AUTHOR/VPDN: Processing AV protocol=vpdn  
Jan 1 00:33:39.395: AAA/AUTHOR/VPDN: Processing AV tunnel-type=l2tp  
Jan 1 00:33:39.395: AAA/AUTHOR/VPDN: Processing AV tunnel-id=hgw  
Jan 1 00:33:39.395: AAA/AUTHOR/VPDN:  
Processing AV ip-addresses=10.51.6.82,10.51.6.59  
Jan 1 00:33:39.395: AAA/AUTHOR/VPDN:  
Processing AV l2tp-tunnel-password=hello  
Jan 1 00:33:39.395: As1 VPDN/RPMS/: Got tunnel info for dnis:614629  
Jan 1 00:33:39.395: As1 VPDN/RPMS/: LAC hgw  
Jan 1 00:33:39.395: As1 VPDN/RPMS/: l2tp-busy-disconnect yes  
Jan 1 00:33:39.395: As1 VPDN/RPMS/: l2tp-tunnel-password xxxxxx  
Jan 1 00:33:39.395: As1 VPDN/RPMS/: 2 IP addresses  
Jan 1 00:33:39.395: As1 VPDN/RPMS/: IP 10.51.6.82 Priority 1  
Jan 1 00:33:39.395: As1 VPDN/RPMS/: IP 10.51.6.59 Priority 1  
Jan 1 00:33:39.395: As1 VPDN/: curlvl 1 Address 1: 10.51.6.59, priority 1  
**Jan 1 00:33:39.395: As1 VPDN/: Select non-active address 10.51.6.59, priority 1**  
*!--- The second non-active endpoint is selected 10.51.6.59 !--- and the control connection is established.*  
Jan 1 00:33:39.395: As1 VPDN: Find LNS process created Jan 1 00:33:39.395: Tnl  
20770 L2TP: SM State idle Jan 1 00:33:39.395: Tnl 20770 L2TP: O SCCRQ Jan 1 00:33:39.399: Tnl  
20770 L2TP: Tunnel state change from idle to wait-ctl-reply Jan 1 00:33:39.399: Tnl 20770 L2TP:  
SM State wait-ctl-reply **Jan 1 00:33:39.399: As1 VPDN: Forward to address 10.51.6.59**  
Jan 1 00:33:39.399: As1 VPDN: Pending  
Jan 1 00:33:39.399: As1 VPDN: Process created  
Jan 1 00:33:39.399: Tnl 20770 L2TP: I SCCRQ from l2tp-gw  
Jan 1 00:33:39.399: Tnl 20770 L2TP: Got a challenge from remote peer, l2tp-gw  
Jan 1 00:33:39.399: Tnl 20770 L2TP: Got a response from remote peer, l2tp-gw  
Jan 1 00:33:39.399: Tnl 20770 L2TP: Tunnel Authentication success  
Jan 1 00:33:39.399: Tnl 20770 L2TP: Tunnel state change from  
wait-ctl-reply to established  
Jan 1 00:33:39.403: Tnl 20770 L2TP: O SCCCN to l2tp-gw tnlid 42921  
Jan 1 00:33:39.403: Tnl 20770 L2TP: SM State established  
Jan 1 00:33:39.403: As1 VPDN: Forwarding...  
Jan 1 00:33:39.403: Tnl/Cl 20770/17 L2TP: Session FS enabled  
Jan 1 00:33:39.403: Tnl/Cl 20770/17 L2TP: Session state change from  
idle to wait-for-tunnel  
Jan 1 00:33:39.403: As1 Tnl/Cl 20770/17 L2TP: Create session  
Jan 1 00:33:39.403: Tnl 20770 L2TP: SM State established  
Jan 1 00:33:39.403: As1 Tnl/Cl 20770/17 L2TP: O ICRQ to l2tp-gw 42921/0  
Jan 1 00:33:39.403: As1 Tnl/Cl 20770/17 L2TP: Session state change from  
wait-for-tunnel to wait-reply  
Jan 1 00:33:39.403: As1 VPDN: paul is forwarded  
Jan 1 00:33:39.407: As1 Tnl/Cl 20770/17 L2TP: O ICCN to l2tp-gw 42921/16  
**Jan 1 00:33:39.407: As1 Tnl/Cl 20770/17 L2TP: Session state change from  
wait-reply to established**

