Catalyst 9000系列交换机端口抖动故障排除

目录

简介

本文档介绍如何识别、收集有用的日志，以及对Catalyst 9000交换机上端口抖动可能发生的问题进行故障排除。

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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所有Catalyst 9000系列交换机。

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

端口摆动（通常称为链路摆动）是指交换机上的物理接口连续上下移动的情况。常见原因通常与电缆不良、不受支持或非标准、小型封装热插拔(SFP)或其他链路同步问题有关。链路抖动的原因可能是间歇性的或永久性的。

由于链路抖动通常是物理干扰，本文档说明了诊断、收集有用日志以及排除Catalyst 9000交换机上端口抖动可能发生的问题的步骤。

故障排除

您可以检查以下事项：如果您对交换机有物理访问权限，可以确保正确安装网络模块、电缆和SFP:

网络模块安装

下表介绍在Catalyst 9000系列交换机中安装网络模块的最佳实践：

Platform	URL
Catalyst 9200 系列交换机	Catalyst 9200系列交换机硬件安装指南
Catalyst 9300 系列交换机	Catalyst 9300系列交换机硬件安装指南
Catalyst 9400 系列交换机	Catalyst 9400系列交换机硬件安装指南
Catalyst 9500 系列交换机	Catalyst 9500系列交换机硬件安装指南
Catalyst 9600 系列交换机	Catalyst 9600系列交换机硬件安装指南

检验电缆和连接的两端

下表介绍了可能导致链路抖动的一些电缆问题。

原因	恢复操作
电缆损坏	使用已知正常的电缆替换可能有问题的电缆。查找连接器上的针脚损坏或丢失
连接松动	检查连接是否松动。有时，电缆似乎已正确固定，但并非如此。拔下电缆并重新入
配线面板	排除配线面板连接故障。如果可能，绕过配线面板以排除故障
SFP错误或错误（特定于光纤）	将可疑的SFP交换为已知良好的SFP。验证此类SFP的硬件和软件支持
错误的端口或模块端口	将电缆移至确认工作正常的端口，对可疑端口或模块进行故障排除
错误的或旧的终端设备	将电话、扬声器、其他终端与确认工作正常的设备或更新设备交换
设备睡眠模式	这是一个“预期的折翼”。请注意端口抖动的时间戳，以确定它是否快速或间歇性，以及是否是由睡眠设置导致的

验证SFP和SFP+兼容性

Cisco 热插拔接口组合在速度、协议、到达和支持的传输介质方面提供了丰富的选择。

您可以使用Catalyst 9000系列交换机设备支持的SFP或SFP+收发器模块的任意组合。唯一的限制是，每个端口必须与电缆另一端的波长规格相匹配，并且电缆不得超过规定的电缆长度，以实现可靠

通信。

在思科设备上仅使用思科SFP收发器模块。每个SFP或SFP+收发器模块均支持思科质量标识(ID)功能，允许思科交换机或路由器识别和验证收发器模块是否经过思科认证和测试。

> **提示**：请参阅此链接以验证Cisco光纤到设备兼容性矩阵

确定端口摆动

请使用 show logging命令来识别链路抖动事件。此示例显示带有接口TenGigabitEthernet1/0/40的链路抖动事件的部分交换机系统日志消息：

```
Switch#show logging | include changed
Aug 17 21:06:08.431 UTC: %LINEPROTO-5-UPDOWN: Line protocol on Interface
TenGigabitEthernet1/0/40, changed state to down
Aug 17 21:06:39.058 UTC: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/0/40, changed state to
down
Aug 17 21:06:41.968 UTC: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/0/40, changed state to up
Aug 17 21:06:42.969 UTC: %LINEPROTO-5-UPDOWN: Line protocol on Interface
TenGigabitEthernet1/0/40, changed state to up
Aug 17 21:07:20.041 UTC: %LINEPROTO-5-UPDOWN: Line protocol on Interface
TenGigabitEthernet1/0/40, changed state to down
Aug 17 21:07:21.041 UTC: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/0/40, changed state to
down
Aug 17 21:07:36.534 UTC: %LINEPROTO-5-UPDOWN: Line protocol on Interface
TenGigabitEthernet1/0/40, changed state to up
Aug 17 21:08:06.598 UTC: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/0/40, changed state to up
Aug 17 21:08:07.628 UTC: %LINEPROTO-5-UPDOWN: Line protocol on Interface
TenGigabitEthernet1/0/40, changed state to down
Aug 17 21:08:08.628 UTC: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/0/40, changed state to
down
Aug 17 21:08:10.943 UTC: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/0/40, changed state to up
Aug 17 21:08:11.944 UTC: %LINEPROTO-5-UPDOWN: Line protocol on Interface
TenGigabitEthernet1/0/40, changed state to up
```

> **提示**：如果分析系统消息日志，您必须注意端口抖动的时间戳，因为它允许您比较该特定端口上的同时事件，并验证链路抖动是否应该出现（例如：睡眠设置或其他“正常”原因不一定有问题）。

接口Show命令

show interface命令为您提供大量信息，有助于识别可能导致链路抖动事件的第1层问题：

```
Switch#show interfaces tenGigabitEthernet 1/0/40
TenGigabitEthernet1/0/40 is up, line protocol is up (connected)
Hardware is Ten Gigabit Ethernet, address is 00a5.bf9c.29a8 (bia 00a5.bf9c.29a8)
  MTU 1500 bytes, BW 10000000 Kbit/sec, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not set
  Full-duplex, 10Gb/s, link type is auto, media type is SFP-10GBase-SR   <-- SFP plugged into
the port
  input flow-control is on, output flow-control is unsupported
  ARP type: ARPA, ARP Timeout 04:00:00
```

```
  Last input 00:00:03, output 00:00:00, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/2000/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     670 packets input, 78317 bytes, 0 no buffer
     Received 540 broadcasts (540 multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog, 540 multicast, 0 pause input
     0 input packets with dribble condition detected
     1766 packets output, 146082 bytes, 0 underruns
0 Output 0 broadcasts (0 multicasts) 0 output errors, 0 collisions, 0 interface resets 0 unknown
protocol drops 0 babbles, 0 late collision, 0 deferred 0 lost carrier, 0 no carrier, 0 pause
output 0 output buffer failures, 0 output buffers swapped out
```

下表列出了**show interface**命令的一些计数器：

计数器	增加错误计数器的问题和常见原因
CRC	大量的CRC通常是冲突的结果，但也可能表示物理问题（如布线、SFP、接口或网卡）或 工不匹配。
输入错误	这包括残帧、巨型帧、无缓冲区、CRC、帧、溢出和忽略的计数。其他与输入相关的错 会导致输入错误计数增加。
输出错误	此问题是由于输出队列大小过小或存在超订用造成的。
总输出丢弃数	输出丢弃通常是由多对一或10Gbps到1Gps传输引起的接口超订用造成的。接口缓冲区是 的资源，只能吸收数据包开始丢弃之前的突发。缓冲区可以调整为提供一些缓冲，但它不 保证输出丢弃情况为零。
未知协议丢弃	未知协议丢弃通常会被丢弃，因为接收这些数据包的接口未针对此类协议进行配置，或者 可能是交换机无法识别的任何协议。 例如，如果连接两台交换机，并且在一个交换机接 禁用CDP，则会在该接口上导致未知协议丢弃。CDP数据包不再被识别，将被丢弃。

history命令允许接口以与CPU历史记录类似的图形格式维护使用率历史记录。 此历史记录可以保持为每秒比特(bps)或每秒数据包(pps)，如本示例所示：

```
Switch(config-if)#history ?
```

```
 bps Maintain history in bits/second
pps Maintain history in packets/second
```

除速率外，用户可以监控各种接口计数器：

```
Switch(config-if)#history [bps|pps] ?
  all                                Include all counters
babbles Include ethernet output babbles - Babbl
crcs Include CRCs - CRCs
deferred Include ethernet output deferred - Defer
dribbles Include dribbles - Dribl
excessive-collisions Include ethernet excessive output collisions -
ExCol
flushes Include flushes - Flush
frame-errors Include frame errors - FrErr
giants Include giants - Giant
ignored Include ignored - Ignor
input-broadcasts Include input broadcasts - iBcst
input-drops Include input drops - iDrop
input-errors Include input errors - iErr
interface-resets Include interface resets - IRset
late-collisions Include ethernet late output collisions - LtCol
lost-carrier Include ethernet output lost carrier - LstCr
multi-collisions Include ethernet multiple output collisions -
MlCol
multicast Include ethernet input multicast - MlCst
no-carrier Include ethernet output no-carrier - NoCarr
output-broadcasts Include output broadcasts - oBcst
output-buffer-failures Include output buffer failures - oBufF
output-buffers-swapped-out Include output buffers swapped out - oBSwO
output-drops Include output drops - oDrop
output-errors Include output errors - oErr
output-no-buffer Include output no buffer - oNoBf
overruns Include overruns - OvrRn
pause-input Include ethernet input pause - PsIn
pause-output Include ethernet output pause - PsOut
runts Include runts - Runts
single-collisions Include ethernet single output collisions - SnCol
throttles Include throttles - Thrtl
underruns Include underruns - UndRn
unknown-protocol-drops Include unknown protocol drops - Unkno
watchdog Include ethernet output watchdog - Wtchdg
<cr> <cr>
SW_1(config-if)#
```

与CPU历史记录一样，也有过去60秒、过去60分钟和过去72小时的图表。输入和输出直方图会维护单独的图表：

```
Switch#sh interfaces gigabitEthernet 1/0/2 history ?
 60min    Display 60 minute histograms only
60sec Display 60 second histograms only
72hour Display 72 hour histograms only
all Display all three histogram intervals
both Display both input and output histograms
input Display input histograms only
output Display output histograms only
| Output modifiers
```

```
show interfaces tenGigabitEthernet 1/0/9 history 60sec
```

```
10
9
8
7
6
5
4
3
2
1
0....5....1....1....2....2....3....3....4....4....5....5....6
0 5 0 5 0 5 0 5 0 5 0
TenGigabitEthernet1/0/9 input rate(mbits/sec) (last 60 seconds)
```

```
10
9
8
7
6
5
4
3
2
1
0....5....1....1....2....2....3....3....4....4....5....5....6
0 5 0 5 0 5 0 5 0 5 0
TenGigabitEthernet1/0/9 output rate(mbits/sec) (last 60 seconds)
```

使用show controllers ethernet-controller{interface{*interface-number*}} 显示从硬件读取的每个接口(Transmit和Receive)流量计数器和错误计数器统计信息。使用phy关键字显示接口内部寄存器，或使用port-info关键字显示有关端口ASIC的信息。

以下是show controllers ethernet-controller 针对特定接口的输出示例：

```
Switch#show controllers ethernet-controller tenGigabitEthernet 2/0/1
Transmit                  TenGigabitEthernet2/0/1               Receive
        61572 Total bytes                       282909 Total bytes
            0 Unicast frames                       600 Unicast frames
            0 Unicast bytes                      38400 Unicast bytes
          308 Multicast frames                    3163 Multicast frames
        61572 Multicast bytes                   244509 Multicast bytes
            0 Broadcast frames                       0 Broadcast frames
            0 Broadcast bytes                        0 Broadcast bytes
            0 System FCS error frames                0 IpgViolation frames
            0 MacUnderrun frames                     0 MacOverrun frames
            0 Pause frames                           0 Pause frames
            0 Cos 0 Pause frames                     0 Cos 0 Pause frames
```

```
            0 Cos 1 Pause frames                    0 Cos 1 Pause frames
            0 Cos 2 Pause frames                    0 Cos 2 Pause frames
            0 Cos 3 Pause frames                    0 Cos 3 Pause frames
            0 Cos 4 Pause frames                    0 Cos 4 Pause frames
            0 Cos 5 Pause frames                    0 Cos 5 Pause frames
            0 Cos 6 Pause frames                    0 Cos 6 Pause frames
            0 Cos 7 Pause frames                    0 Cos 7 Pause frames
            0 Oam frames                            0 OamProcessed frames
            0 Oam frames                            0 OamDropped frames
          193 Minimum size frames                3646 Minimum size frames
            0 65 to 127 byte frames                 1 65 to 127 byte frames
            0 128 to 255 byte frames                0 128 to 255 byte frames
          115 256 to 511 byte frames              116 256 to 511 byte frames
            0 512 to 1023 byte frames               0 512 to 1023 byte frames
            0 1024 to 1518 byte frames              0 1024 to 1518 byte frames
            0 1519 to 2047 byte frames              0 1519 to 2047 byte frames
            0 2048 to 4095 byte frames              0 2048 to 4095 byte frames
            0 4096 to 8191 byte frames              0 4096 to 8191 byte frames
            0 8192 to 16383 byte frames             0 8192 to 16383 byte frames
            0 16384 to 32767 byte frame             0 16384 to 32767 byte frame
            0 > 32768 byte frames                   0 > 32768 byte frames
            0 Late collision frames                 0 SymbolErr frames         <-- Usually
indicates Layer 1 issues. Large amounts of symbol errors can indicate a bad device, cable, or
hardware.
            0 Excess Defer frames                   0 Collision fragments      <-- If this
counter increments, this is an indication that the ports are configured at half-duplex.
            0 Good (1 coll) frames                  0 ValidUnderSize frames
            0 Good (>1 coll) frames                 0 InvalidOverSize frames
            0 Deferred frames                       0 ValidOverSize frames
            0 Gold frames dropped                   0 FcsErr frames           <-- Are the result
of collisions at half-duplex, a duplex mismatch, bad hardware (NIC, cable, or port)
            0 Gold frames truncated
            0 Gold frames successful
            0 1 collision frames
            0 2 collision frames
            0 3 collision frames
            0 4 collision frames
            0 5 collision frames
            0 6 collision frames
            0 7 collision frames
            0 8 collision frames
            0 9 collision frames
            0 10 collision frames
            0 11 collision frames
            0 12 collision frames
            0 13 collision frames
            0 14 collision frames
            0 15 collision frames
            0 Excess collision frames

LAST UPDATE 22622 msecs AGO
```

> 提示：您还可以使用**show interfaces {interface{*interface-number*}} controller命令显示从硬件读取的每个接口的Transmit和Receive*统计信息。***

使用**show platform pm interface-flaps{interface{*interface-number*}}** 要显示接口关闭的次数，请执行以下操作：

这是**show platform pm interface-flaps**的输出示例**{interface{*interface-number*}}**对于特定接口：

```
Switch#show platform pm interface-flaps tenGigabitEthernet 2/0/1

  Field                      AdminFields          OperFields
================================================================
  Access Mode                Static               Static
  Access Vlan Id             1                    0
  Voice Vlan Id              4096                 0
  VLAN Unassigned                                 0
  ExAccess Vlan Id           32767
  Native Vlan Id             1
  Port Mode                  dynamic              access
  Encapsulation              802.1Q               Native
  disl                       auto
  Media                      unknown
  DTP Nonegotiate            0                    0
  Port Protected             0                    0
  Unknown Unicast Blocked    0                    0
  Unknown Multicast Blocked  0                    0
  Vepa Enabled               0                    0
  App interface              0                    0
  Span Destination           0

  Duplex                     auto                 full
  Default Duplex             auto
  Speed                      auto                 1000
  Auto Speed Capable         1                    1
  No Negotiate               0                    0
  No Negotiate Capable       1024                 1024
  Flow Control Receive       ON                   ON
  Flow Control Send          Off                  Off
  Jumbo                      0                    0
  saved_holdqueue_out        0
  saved_input_defqcount      2000
  Jumbo Size                 1500

  Forwarding Vlans : none
  Current Pruned Vlans : none
  Previous Pruned Vlans : none


  Sw LinkNeg State : LinkStateUp
  No.of LinkDownEvents :     12                          <--  Number of times the interface
flapped
  XgxsResetOnLinkDown(10GE):
  Time Stamp Last Link Flapped(U) : Aug 19 14:58:00.154   <-- Last time the interface flapped
  LastLinkDownDuration(sec) 192                           <-- Time in seconds the interface
stayed down during the last flap event
  LastLinkUpDuration(sec):  2277                          <-- Time in seconds the interface
stayed up before the last flap event
```

使用**show idprom{interface{*interface-number*}}** 命令（不带关键字），以显示特定接口的IDPROM信息。与**detail**关键字一起使用可显示详细的十六进制IDPROM信息。

这是**show idprom**的输出示例**{interface{*interface-number*}}** 用于特定接口。此命令输出中列出的**High**和**Low Warning|Alarm** 阈值是正常运行的光纤收发器参数。这些值可以从特定光学器件的数据表中进行验证。请参阅思科光纤数据表

```
Switch#show idprom interface Twe1/0/1
```

```
IDPROM for transceiver TwentyFiveGigE1/0/1 :
  Description                            = SFP or SFP+ optics (type 3)
  Transceiver Type:                      = GE CWDM 1550 (107)
  Product Identifier (PID)               = CWDM-SFP-1550  <--
  Vendor Revision                        = A
  Serial Number (SN)                     = XXXXXXXXXX   <-- Cisco Serial Number
  Vendor Name                            = CISCO-FINISAR
  Vendor OUI (IEEE company ID)           = 00.90.65 (36965)
  CLEI code                              = CNTRV14FAB
  Cisco part number                      = 10-1879-03
  Device State                           = Enabled.
  Date code (yy/mm/dd)                   = 14/12/22
  Connector type                         = LC.
  Encoding                               = 8B10B (1)
  Nominal bitrate                        = OTU-1 (2700 Mbits/s)
  Minimum bit rate as % of nominal bit rate = not specified
  Maximum bit rate as % of nominal bit rate = not specified
  The transceiver type is 107
  Link reach for 9u fiber (km)           = LR-2(80km) (80)
                                           LR-3(80km) (80)
                                           ZX(80km) (80)
  Link reach for 9u fiber (m)            = IR-2(40km) (255)
                                           LR-1(40km) (255)
                                           LR-2(80km) (255)
                                           LR-3(80km) (255)
                                           DX(40KM) (255)
                                           HX(40km) (255)
                                           ZX(80km) (255)
                                           VX(100km) (255)
  Link reach for 50u fiber (m)           = SR(2km) (0)
                                           IR-1(15km) (0)
                                           IR-2(40km) (0)
                                           LR-1(40km) (0)
                                           LR-2(80km) (0)
                                           LR-3(80km) (0)
                                           DX(40KM) (0)
                                           HX(40km) (0)
                                           ZX(80km) (0)
                                           VX(100km) (0)
                                           1xFC, 2xFC-SM(10km) (0)
                                           ESCON-SM(20km) (0)
  Link reach for 62.5u fiber (m)         = SR(2km) (0)
                                           IR-1(15km) (0)
                                           IR-2(40km) (0)
                                           LR-1(40km) (0)
                                           LR-2(80km) (0)
                                           LR-3(80km) (0)
                                           DX(40KM) (0)
                                           HX(40km) (0)
                                           ZX(80km) (0)
                                           VX(100km) (0)
                                           1xFC, 2xFC-SM(10km) (0)
                                           ESCON-SM(20km) (0)
  Nominal laser wavelength               = 1550 nm.
  DWDM wavelength fraction               = 1550.0  nm.
  Supported options                      = Tx disable
                                           Tx fault signal
                                           Loss of signal (standard implementation)
  Supported enhanced options             = Alarms for monitored parameters
  Diagnostic monitoring                  = Digital diagnostics supported
                                           Diagnostics are externally calibrated
                                           Rx power measured is "Average power"
  Transceiver temperature operating range  = -5 C to 75 C (commercial)
  Minimum operating temperature          = 0 C
```

```
Maximum operating temperature             = 70 C
High temperature alarm threshold          = +90.000 C
High temperature warning threshold        = +85.000 C
Low temperature warning threshold         = +0.000 C
Low temperature alarm threshold           =  -4.000 C
High voltage alarm threshold              = 3600.0 mVolts
High voltage warning threshold            = 3500.0 mVolts
Low voltage warning threshold             = 3100.0 mVolts
Low voltage alarm threshold               = 3000.0 mVolts
High laser bias current alarm threshold   = 84.000 mAmps
High laser bias current warning threshold = 70.000 mAmps
Low laser bias current warning threshold  = 4.000 mAmps
Low laser bias current alarm threshold    = 2.000 mAmps
High transmit power alarm threshold       =  7.4 dBm
High transmit power warning threshold     =  4.0 dBm
Low transmit power warning threshold      = -1.7 dBm
Low transmit power alarm threshold        = -8.2 dBm
High receive power alarm threshold        = -3.0 dBm
Low receive power alarm threshold        = -33.0 dBm
High receive power warning threshold       = -7.0 dBm
Low receive power warning threshold       = -28.2 dBm
External Calibration: bias current slope  = 1.000
External Calibration: bias current offset = 0
```

提示：确保设备的硬件和软件版本与已安装的SFP/SFP+思科光纤到设备兼容性列表兼容

下表列出了可用于排除链路抖动故障的各种命令：

命令	目的
show interfaces counters error	显示接口错误计数器
show interfaces capabilities	显示特定接口的功能
show interface收发器（**特定于光纤/SFP**）	显示启用数字光纤监控(DOM)的光收发器的信息
show interface link	显示链路级别信息
show interface {interface{*interface-number*}}平台	显示接口平台信息
show controllers ethernet-controller {interface{*interface-number*}} port-info	显示其他端口信息
show controllers ethernet-controller {interface{*interface-number*}}链路状态详细信息	显示链路状态
show errdisable flap-values	显示允许在errdisable状态之前出现的摆动数
clear counters	使用此命令将流量和错误计数器清零，以便看问题是否只是暂时的，或者计数器是否继加。
clear controllers ethernet-controller	使用此命令可清除硬件发送和接收计数器。

使用时域反射器(TDR)验证电缆状态

时域反射计(TDR)功能允许您确定电缆出现故障时是打开还是短路。 使用TDR，您可以检查Catalyst 9000系列交换机上端口的铜缆状态。TDR使用通过电缆发送的信号检测电缆故障，并读取反射回的信号。由于电缆存在缺陷，信号的所有或部分都可以反射回来

使用test cable-diagnostics tdr {interface{***interface-number***} }启动TDR测试，然后使用**show cable-diagnostics tdr**{interfaceinterface-number***}。***

提示：有关详细信息，请参阅检查端口状态和连接性

示例显示了接口Tw2/0/10的TDR测试结果：

```
Switch#show cable-diagnostics tdr interface tw2/0/10
TDR test last run on: November 05 02:28:43
Interface Speed Local pair Pair length Remote pair Pair status
--------- ----- ---------- ----------------- ---------- --------------------
Tw2/0/10 1000M Pair A 1 +/- 5 meters Pair A Impedance Mismatch
Pair B 1 +/- 5 meters Pair B Impedance Mismatch
Pair C 1 +/- 5 meters Pair C Open
Pair D 3 +/- 5 meters Pair D Open
```

> **提示**：在Catalyst 9300系列交换机上，仅检测到以下电缆故障类型 — **OPEN、SHORT和IMPEDANCE MISMATCH。**如果电缆端接正确，则会显示**Normal**状态，此过程出于说明目的。

TDR准则

本指南适用于TDR的使用：

- 在TDR测试运行时，请勿更改端口配置。
- 如果在TDR测试期间将端口连接到启用了Auto-MDIX的端口，则TDR结果可能无效。
- 如果在TDR测试期间将端口连接到100BASE-T端口（例如设备上的端口），则未使用的对（4-5和7-8）将报告为故障，因为远程终端不会终止这些对。
- 由于电缆的特征，您必须多次运行TDR测试才能得到准确的结果。
- 请勿更改端口状态（例如，拔下近端或远端的电缆），因为结果可能不准确。
- 如果测试电缆从远程端口断开，则TDR的工作效果最佳。否则，您就很难正确解释结果。
- TDR在四根电线之间运行。根据电缆状况，状态可显示一个线对为OPEN或SHORT，而其他所有线对显示为故障。此操作是可接受的，因为只要一对电线开或短，您就可以断定电缆有故障。
- TDR的目的是确定电缆的运行情况如何，而不是定位有故障的电缆。
- 当TDR找到有故障的电缆时，您仍然可以使用离线电缆诊断工具来更好地诊断问题。
- 由于TDR实施的分辨率不同，Catalyst 9300系列交换机不同交换机型号上的TDR结果可能不同。发生这种情况时，必须参考离线电缆诊断工具。

数字光纤监控(DOM)

数字光纤监控(DOM)是行业标准，旨在定义访问实时参数的数字接口，例如：

- 温度
- 收发器电源电压
- 激光偏置电流
- 光发射功率
- 光Rx功率

如何启用DOM

下表列出了可用于为系统中所有类型的收发器打开/关闭DOM的命令：

步骤	命令或操作	目的

第 1 步	**enable** **示例：** switch>enable	启用物理执行模式 根据提示输入密码
步骤 2	**configure terminal** **示例：** switch#configure terminal 收发器类型all	进入全局配置模式
步骤 3	**示例：** switch(config)#transceiver type all 监控	进入收发器类型配置模式
步骤 4	**示例：** switch(config)#monitoring	启用对所有光纤收发器的监控。

使用**show interfaces** {interface{interface-number}} transceiver detail命令显示收发器信息：

```
Switch#show interfaces hundredGigE 1/0/25 transceiver detail
ITU Channel not available (Wavelength not available),
Transceiver is internally calibrated.
mA: milliamperes, dBm: decibels (milliwatts), NA or N/A: not applicable.
++ : high alarm, + : high warning, - : low warning, -- : low alarm.
A2D readouts (if they differ), are reported in parentheses.
The threshold values are calibrated.

High Alarm  High Warn  Low Warn   Low Alarm
              Temperature        Threshold   Threshold  Threshold  Threshold
Port (Celsius) (Celsius) (Celsius) (Celsius) (Celsius)
--------- ---------------- ---------- --------- --------- ---------
Hu1/0/25 28.8 75.0 70.0 0.0 -5.0

             High Alarm   High Warn  Low Warn   Low Alarm
             Voltage           Threshold    Threshold  Threshold  Threshold
Port (Volts) (Volts) (Volts) (Volts) (Volts)
--------- ---------------- ---------- --------- --------- ---------
Hu1/0/25 3.28 3.63 3.46 3.13 2.97

                High Alarm   High Warn  Low Warn   Low Alarm
               Current          Threshold    Threshold  Threshold  Threshold
Port Lane (milliamperes) (mA) (mA) (mA) (mA)
--------- ---- -------------- ---------- --------- --------- ---------
Hu1/0/25 N/A 6.2 10.0 8.5 3.0 2.6

 Optical         High Alarm   High Warn  Low Warn   Low Alarm
                 Transmit Power  Threshold    Threshold  Threshold  Threshold
Port Lane (dBm) (dBm) (dBm) (dBm) (dBm)
--------- ---- -------------- ---------- --------- --------- ---------
Hu1/0/25 N/A -2.2 1.7 -1.3 -7.3 -11.3

  Optical          High Alarm  High Warn   Low Warn   Low Alarm
                 Receive Power    Threshold   Threshold   Threshold  Threshold
Port Lane (dBm) (dBm) (dBm) (dBm) (dBm)
--------- ---- -------------- ---------- --------- --------- ---------
Hu1/0/25 N/A -16.7 2.0 -1.0 -9.9 -13.9
```

提示：要确定光收发器是否以适当的信号电平运行，请参阅Cisco Optics Datasheet

数字光纤监控系统日志消息

本节介绍最相关的阈值违规系统日志消息：

SFP光纤的温度水平

- **解释：**此日志消息是在温度低或超过正常光学操作值时生成的：

```
%SFF8472-3-THRESHOLD_VIOLATION: Te7/3: Temperature high alarm; Operating value: 88.7 C,
Threshold value: 74.0 C.
%SFF8472-3-THRESHOLD_VIOLATION: Fo1/1/1: Temperature low alarm; Operating value: 0.0 C,
Threshold value: 35.0 C.
```

SFP光纤的电压电平

- **解释：**此日志消息是在电压低或超过正常光学操作值时生成的：

```
%SFF8472-3-THRESHOLD_VIOLATION: Gi1/1/3: Voltage high warning; Operating value: 3.50 V,
Threshold value: 3.50 V.
%SFF8472-5-THRESHOLD_VIOLATION: Gi1/1: Voltage low alarm; Operating value: 2.70 V, Threshold
value: 2.97 V.
```

SFP光纤的轻量级

- **解释：**当光功率较低或超过光学操作值时，生成以下日志消息：

```
%SFF8472-3-THRESHOLD_VIOLATION: Gi1/0/1: Rx power high warning; Operating value: -2.7 dBm,
Threshold value: -3.0 dBm.
%SFF8472-5-THRESHOLD_VIOLATION: Te1/1: Rx power low warning; Operating value: -13.8 dBm,
Threshold value: -9.9 dBm.
```

> **提示：**有关DOM的详细信息，请参阅数字光纤监控

思科光纤和前向纠错(FEC)

FEC是一种用于检测和纠正比特流中一定数量的错误的技术，它会在传输之前向消息块附加冗余位和错误检查代码。 作为模块制造商，思科将认真设计收发器以符合规格。当光纤收发器在Cisco主机平台中运行时，FEC默认根据主机软件检测的光纤模块类型启用(请参阅此可下载表)。 在绝大多数情况下，FEC的实施取决于光纤类型支持的行业标准。

对于某些自定义规范，FEC实施有所不同。 有关详细信息，请参阅了解Cisco Optics中的FEC及其实施文档。

示例展示如何配置FEC和一些可用选项：

```
switch(config-if)#fec?
  auto Enable FEC Auto-Neg
  cl108 Enable clause108 with 25G
  cl74 Enable clause74 with 25G
  off Turn FEC off

Use the show interface command to verify FEC configuration:
```

```
TwentyFiveGigE1/0/13 is up, line protocol is up (connected)
Hardware is Twenty Five Gigabit Ethernet, address is 3473.2d93.bc8d (bia 3473.2d93.bc8d)
MTU 9170 bytes, BW 25000000 Kbit/sec, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive set (10 sec)
Full-duplex, 25Gb/s, link type is force-up, media type is SFP-25GBase-SR
  Fec is auto     < -- The configured setting for FEC is displayed here
input flow-control is on, output flow-control is off
ARP type: ARPA, ARP Timeout 04:00:00
--snip--
```

注：链路的两端必须具有相同的FEC encoding 算法使链路启动。

调试命令

下表列出了可用于调试端口抖动的各种命令

注意:**请谨慎使用debug命令。**请注意，许多debug命令会影响实时网络，因此建议仅在重现问题时在实验室环境中使用。 ;

命令	目的
debug pm	端口管理器调试
debug pm port	端口相关事件
debug platform pm	NGWC平台端口管理器调试信息
debug platform pm l2-control	NGWC L2控制基础设施调试
debug platform pm link-status	接口链路检测事件
debug platform pm pm-vectors	端口管理器矢量功能
debug condition interface <interface name>	选择性地启用特定接口的调试
debug interface state	状态转换

这是d的部分输出示**例*ebug*** 表中列出的命令：

```
SW_2#sh debugging
PM (platform):
L2 Control Infra debugging is on <-- debug platform pm l2-control
PM Link Status debugging is on <-- debug platform pm link-status
PM Vectors debugging is on <-- debug platform pm pm-vectors
Packet Infra debugs:

Ip Address Port
-------------------------------------------------------|----------

Port Manager:
Port events debugging is on <-- debug pm port

Condition 1: interface Te1/0/2 (1 flags triggered)
Flags: Te1/0/2
```

------ Sample output ---------

***Aug 25 20:01:05.791: link up/down event : link-down on Te1/0/2**
***Aug 25 20:01:05.791: pm_port 1/2: during state access, got event 5(link_down) <-- Link down event (day/time)**
*Aug 25 20:01:05.791: @@@ pm_port 1/2: access -> pagp
*Aug 25 20:01:05.792: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:05.792: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:05.792: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:05.792: IOS-FMAN-PM-DEBUG-PM-VECTORS: Vp Disable: pd=0x7F1E797914B0 dpidx=10 Te1/0/2
*Aug 25 20:01:05.792: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:05.792: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:05.792: Maintains count of VP per Interface:delete, pm_vp_counter[0]: 14, pm_vp_counter[1]: 14
*Aug 25 20:01:05.792: *** port_modechange: 1/2 mode_none(10)
*Aug 25 20:01:05.792: @@@ pm_port 1/2: pagp -> dtp
***Aug 25 20:01:05.792: stop flap timer : Te1/0/2 pagp**
*Aug 25 20:01:05.792: *** port_bndl_stop: 1/2 : inform yes
*Aug 25 20:01:05.792: @@@ pm_port 1/2: dtp -> present
*Aug 25 20:01:05.792: *** port_dtp_stop: 1/2
*Aug 25 20:01:05.792: stop flap timer : Te1/0/2 pagp
*Aug 25 20:01:05.792: stop flap timer : Te1/0/2 dtp
*Aug 25 20:01:05.792: stop flap timer : Te1/0/2 unknown
***Aug 25 20:01:05.792: *** port_linkchange: reason_link_change(3): link_down(0)1/2 <-- State link change**
*Aug 25 20:01:05.792: pm_port 1/2: idle during state present
***Aug 25 20:01:05.792: @@@ pm_port 1/2: present -> link_down <-- State of the link**
*Aug 25 20:01:06.791: %LINEPROTO-5-UPDOWN: Line protocol on Interface TenGigabitEthernet1/0/2, changed state to down
***Aug 25 20:01:07.792: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/0/2, changed state to down**
***Aug 25 20:01:11.098: IOS-FMAN-PM-DEBUG-LINK-STATUS: Received LINKCHANGE in xcvr message, if_id 10 (TenGigabitEthernet1/0/2)**

***Aug 25 20:01:11.098: IOS-FMAN-PM-DEBUG-LINK-STATUS: if_id 0xA, if_name Te1/0/2, link up <-- Link became up**
***Aug 25 20:01:11.098: link up/down event: link-up on Te1/0/2**
*Aug 25 20:01:11.098: pm_port 1/2: during state link_down, got event 4(link_up)
*Aug 25 20:01:11.098: @@@ pm_port 1/2: link_down -> link_up
*Aug 25 20:01:11.098: flap count for link type : Te1/0/2 Linkcnt = 0
*Aug 25 20:01:11.099: pm_port 1/2: idle during state link_up
*Aug 25 20:01:11.099: @@@ pm_port 1/2: link_up -> link_authentication
*Aug 25 20:01:11.099: pm_port 1/2: during state link_authentication, got event 8(authen_disable)
*Aug 25 20:01:11.099: @@@ pm_port 1/2: link_authentication -> link_ready
*Aug 25 20:01:11.099: *** port_linkchange: reason_link_change(3): link_up(1)1/2
*Aug 25 20:01:11.099: pm_port 1/2: idle during state link_ready
*Aug 25 20:01:11.099: @@@ pm_port 1/2: link_ready -> dtp
*Aug 25 20:01:11.099: IOS-FMAN-PM-DEBUG-PM-VECTORS: Set pm vp mode attributes for Te1/0/2 vlan 1
*Aug 25 20:01:11.099: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.099: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.099: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.099: pm_port 1/2: during state dtp, got event 13(dtp_complete)
*Aug 25 20:01:11.099: @@@ pm_port 1/2: dtp -> dtp
*Aug 25 20:01:11.099: IOS-FMAN-PM-DEBUG-PM-VECTORS: Set pm vp mode attributes for Te1/0/2 vlan 1
*Aug 25 20:01:11.099: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.099: DTP flapping: flap count for dtp type: Te1/0/2 Dtpcnt = 0
*Aug 25 20:01:11.099: pm_port 1/2: during state dtp, got event 110(dtp_done)
*Aug 25 20:01:11.099: @@@ pm_port 1/2: dtp -> pre_pagp_may_suspend
*Aug 25 20:01:11.099: pm_port 1/2: idle during state pre_pagp_may_suspend
*Aug 25 20:01:11.099: @@@ pm_port 1/2: pre_pagp_may_suspend -> pagp_may_suspend
*Aug 25 20:01:11.099: pm_port 1/2: during state pagp_may_suspend, got event 33(pagp_continue)
*Aug 25 20:01:11.099: @@@ pm_port 1/2: pagp_may_suspend -> start_pagp
*Aug 25 20:01:11.099: pm_port 1/2: idle during state start_pagp
*Aug 25 20:01:11.099: @@@ pm_port 1/2: start_pagp -> pagp

```
*Aug 25 20:01:11.100: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.100: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.100: IOS-FMAN-PM-DEBUG-PM-VECTORS: Set pm vp mode attributes for Te1/0/2 vlan 1
*Aug 25 20:01:11.100: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.100: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.100: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.100: *** port_bndl_start: 1/2
*Aug 25 20:01:11.100: stop flap timer : Te1/0/2 pagp
*Aug 25 20:01:11.100: pm_port 1/2: during state pagp, got event 34(dont_bundle)
*Aug 25 20:01:11.100: @@@ pm_port 1/2: pagp -> pre_post_pagp
*Aug 25 20:01:11.100: pm_port 1/2: idle during state pre_post_pagp
*Aug 25 20:01:11.100: @@@ pm_port 1/2: pre_post_pagp -> post_pagp
*Aug 25 20:01:11.100: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.100: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.100: pm_port 1/2: during state post_pagp, got event 14(dtp_access)
*Aug 25 20:01:11.100: @@@ pm_port 1/2: post_pagp -> access
*Aug 25 20:01:11.100: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.100: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.100: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.100: IOS-FMAN-PM-DEBUG-PM-VECTORS: Set pm vp mode attributes for Te1/0/2 vlan 1
*Aug 25 20:01:11.100: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.100: Maintains count of VP per Interface:add, pm_vp_counter[0]: 15,
pm_vp_counter[1]: 15
*Aug 25 20:01:11.100: IOS-FMAN-PM-DEBUG-PM-VECTORS: vlan vp enable for port(Te1/0/2) and vlan:1
*Aug 25 20:01:11.101: IOS-FMAN-PM-DEBUG-PM-VECTORS: VP ENABLE: vp_pvlan_port_mode:access for
Te1/0/2
*Aug 25 20:01:11.101: IOS-FMAN-PM-DEBUG-PM-VECTORS: VP Enable: vp_pvlan_native_vlanId:1 for
Te1/0/2
*Aug 25 20:01:11.101: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.101: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.101: *** port_modechange: 1/2 mode_access(1)
*Aug 25 20:01:11.101: IOS-FMAN-PM-DEBUG-PM-VECTORS: The operational mode of Te1/0/2 in set all
vlans is 1
*Aug 25 20:01:11.101: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:11.101: IOS-FMAN-PM-DEBUG-PM-VECTORS: vp_pvlan port_mode:access vlan:1 for Te1/0/2
*Aug 25 20:01:11.101: IOS-FMAN-PM-DEBUG-PM-VECTORS: vp_pvlan port_mode:access native_vlan:1 for
Te1/0/2
*Aug 25 20:01:11.102: IOS-FMAN-PM-DEBUG-PM-VECTORS: Success sending PM tdl message
*Aug 25 20:01:13.098: %LINK-3-UPDOWN: Interface TenGigabitEthernet1/0/2, changed state to up
*Aug 25 20:01:14.098: %LINEPROTO-5-UPDOWN: Line protocol on Interface TenGigabitEthernet1/0/2,
changed state to up
```

相关信息

[思科光纤到设备兼容性矩阵]

[适用于千兆以太网应用的思科SFP模块产品手册]

[25GE和100GE — 通过投资保护实现企业内更高速度白皮书]

[Cisco CWDM SFP解决方案产品手册]

[支持创新：Cisco TAC如何转变文档和简化自助服务]

[技术支持和文档 - Cisco Systems]

Cisco Bug ID	描述
Cisco Bug ID CSCvu13029	mGig Cat9300交换机上到支持mGig的终端的间歇性链路抖动
Cisco Bug ID CSCvt50788	其他mGig设备的Cat9400 mGig互操作问题会导致链路抖动

Cisco Bug ID CSCvu92432	CAT9400：具有Mgig AP的Mgig接口抖动
Cisco Bug ID CSCve65787	100G/40G/25G Cu收发器的自动支持

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