VoIP QoS para Frame Relay para Entrelaçamento de ATM com LLQ, PPP LFI e cRTP

Contents

Introduction

Este documento fornece um exemplo de configuração para Voz sobre IP, utilizando PPP Multilink sobre ATM e Entrelaçamento de Frame Relay (VoIP usando MLPoATM/MLPoFR). O foco central dos exemplos de configuração é o fornecimento de Qualidade de Serviço (QoS - Quality of Service) para oferecer suporte adequado de voz em uma WAN interconectada ATM/Frame Relay. Os exemplos de configuração também usam o Real Time Protocol (cRTP) compactado, que tem suporte no ATM desde o Cisco IOS® Software Release 12.2(2)T.

O documento pode ser lido independente para orientação de configuração, exemplos de configuração e comandos de verificação para ser usado na criação da rede. Também são fornecidas algumas informações de fundo sobre questões específicas associadas ao uso de entrelaçamento de ATM / Frame Relay. Consulte estes documentos para obter mais informações sobre QoS para VoIP sobre Frame Relay ou PPP:

- Links de VoIP por PPP com qualidade de serviço (LLQ / prioridade IP RTP, LFI, cRTP)
- VoIP sobre Frame Relay com QoS (fragmentação, molde de tráfego, prioridade LLQ / IP RTP)

Prerequisites

Requirements

Certifique-se de atender a estes requisitos antes de tentar esta configuração:

Você deve estar familiarizado com estas áreas de tecnologia:

- Listas de controle de acesso
- PVCs (circuitos virtuais permanentes) de ATM
- Circuitos virtuais permanentes de Frame Relay (Identificador de Conexão de Enlace de Dados (DLCIs))
- Gerenciamento de largura de banda
- LLQ
- LFI
- Moldes virtuais e interfaces de acesso virtual
- MLPPP
- cRTP

Componentes Utilizados

As informações neste documento são baseadas nestas versões de software e hardware:

- Cisco 3640 como o roteador ATM
- Cisco 2620 como o roteador Frame Relay
- Software Cisco IOS versão 12.2(8)T (IP Plus)

Observação: como diretriz geral, a versão de manutenção de linha principal do Cisco IOS 12.2 é a versão recomendada do software Cisco IOS para uso em MLPoATM/FR. O Cisco IOS Software Release 12.2T é necessário no roteador ATM se cRTP for usado.

Os recursos relevantes foram apresentados nas seguintes versões do software Cisco IOS:

- O LFI foi introduzido no Software Cisco IOS Versão 11.3.
- O LLQ foi introduzido na Versão 12.0(7)T do Software Cisco IOS.
- Os recursos LLQ sobre Frame Relay e ATM por PVC foram introduzidos na versão do software Cisco IOS 12.1(2)T.
- O multienlace PPP LFI para Frame Relay e circuitos virtuais de ATM foi introduzido no software Cisco IOS versão 12.1(5)T.
- O cRTP via ATM foi introduzido no Software Cisco IOS Versão 12.2(2)T.

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.

Conventions

Consulte as Convenções de Dicas Técnicas da Cisco para obter mais informações sobre convenções de documentos.

Informações de Apoio

Os principais problemas em fornecer retardo completo minimizado e prevenção de jitter para VoIP em uma rede interconectada ATM/Frame Relay são:

- Prioridade estrita para tráfego de voz (enfileiramento de baixa latência (LLQ))
- Fragmentação e Intercalação de Link (LFI)
- Formatação de tráfego frame relay (FRTS) para voz
- Formatação de tráfego ATM

Estes documentos fornecem fontes úteis de informações de fundo adicionais:

- Qualidade de serviço de voz sobre IP
- Configurando a fragmentação e interfaceamento de link para Frame Relay e circuitos virtuais ATM

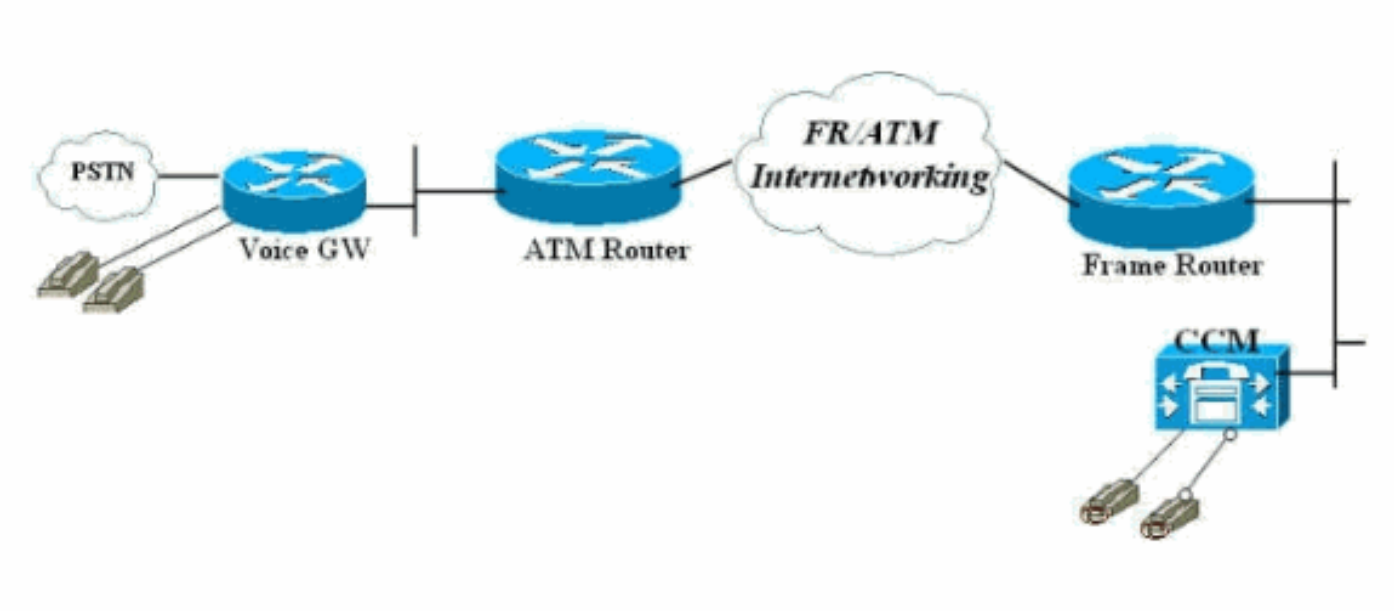
Configurar

Nesta seção, você encontrará informações para configurar os recursos descritos neste documento.

Observação: use a Command Lookup Tool (somente clientes registrados) para encontrar mais informações sobre os comandos usados neste documento.

Diagrama de Rede

Este documento utiliza a seguinte configuração de rede:



Configurações

Este documento utiliza as seguintes configurações:

- Roteador conectado do Frame Relay
- Roteador conectado ATM

Observação: é importante observar que nesta configuração, os dois roteadores são conectados back-to-back em um switch de interfuncionamento Frame Relay para ATM. Na maioria das

topologias, no entanto, os roteadores habilitados para voz podem existir em qualquer lugar. Geralmente, os roteadores de voz usam conectividade de LAN para outros roteadores, que estão conectados à WAN ATM/Frame. Nesses casos, os roteadores conectados à WAN, Frame Relay e ATM devem ser configurados para LLQ, LFI e MLPPP para que possam fornecer QoS, e não os gateways de voz como mostrado nessas configurações.

Roteador conectado do Frame Relay

```
!--- Note: This configuration is commented and numbered
!--- in the order that commands should be entered.


version 12.2
service timestamps debug datetime msec
service timestamps log uptime
no service password-encryption
!
hostname FR
!
enable password cisco
!
username ATM password 0 cisco
voice-card 0
dspfarm
!
ip subnet-zero
!
!
!
!

!--- access-list 105 permit ip any any dscp ef specifies
!--- that all traffic with Differentiated Services Code
Point (DSCP) !--- are set to 40 falls into this access-
list. !--- This class-map command defines a class of
traffic called "voice".

access-list 105 permit ip any any dscp ef
access-list 105 permit udp any any  range 16384 32767
access-list 105 permit ip any any precedence critical
!
class-map match-all voice
match access-group 105
!

!
!
 !--- This policy-map command defines a policy for LLQ
called "VoIP" and !--- maps the "voice" class to the
"VOIP" policy. !--- "priority" defines the amount of
bandwidth reserved for the priority queue. !--- "class-
default" specifies that the default class is also mapped
to this policy. !--- "fair-queue" specifies that all
other traffic is served in the WFQ.


policy-map VOIP
  class voice
    priority 48
  class class-default
   fair-queue
```

```
 !--- Note: Although it is possible to queue various
types of !--- real-time traffic to the priority queue,
!--- Cisco recommends that you direct only voice traffic
!--- to it. Real-time traffic such as video or voice !--
- could introduce variations in delay. Please note voice
and !--- video should not be combined in the same PVC.
!--- (the priority queue is a First In First Out (FIFO)
!--- queue). Voice traffic requires that delay be !---
nonvariable in order to avoid jitter. !--- Note: The sum
of the values for priority and !--- bandwidth statements
needs to be less !--- than or equal to 75% of the link
bandwidth. !--- Otherwise service-policy cannot be !---
assigned to the link. When configuring VoIP over a !---
64 Kbps link to support two !--- voice calls, it is
common to allocate more than 75% !--- (48 Kbps) of the
link bandwidth to !--- the priority queue. In such
cases, you can use the !--- max-reserved-bandwidth <#%>
command in order to raise !--- available bandwidth to a
value more than 75%.


!
!
!
fax interface-type fax-mail
mta receive maximum-recipients 0
!
interface Loopback0
 ip address 10.1.1.2 255.255.255.0
!
!
interface FastEthernet0/0
 ip address 172.17.111.16 255.255.255.224
 duplex auto
 speed auto
!
interface Serial0/0
 no ip address
 encapsulation frame-relay IETF
 no ip route-cache
 no ip mroute-cache
 frame-relay traffic-shaping
!
!--- Choose the frame relay interface to be !---
associated with the virtual interface. The !--- virtual
template could equally have been associated !--- with
the physical interface. !--- The "class mlp" associates
the virtual template interface !--- defined in
"interface Virtual-Template1" with a Frame Relay DLCI.
!--- Associates a Frame Relay map class with a DLCI.
interface Serial0/0.1 point-to-point no ip route-cache
no ip mroute-cache frame-relay interface-dlci 16 ppp
Virtual-Template1 class mlp !--- The interface command
creates a virtual !--- template called Virtual-
Template1. !--- A bandwidth of 64 Kbps is assigned to
this !--- template interface. This bandwidth is used !--
- by Cisco IOS to calculate the data fragment size as
noted regarding !--- interleaving of PPP segments. !---
"ip rtp header-compression"—cRTP is supported in an
ATM/Frame Relay Interworking !--- environment. It
requires Cisco IOS Software Release 12.2(2)T on the !---
ATM router. !--- "service-policy output VOIP"—The VoIP
policy created earlier is assigned !--- to this
```

```
interface in the outbound direction. !--- PPP multilink
is enabled and the !--- maximum delay per segment is
specified. This bandwidth is !--- used by Cisco IOS to
calculate the data fragement size as noted. !---
Interleaving of PPP segments is enabled, which allows !-
-- voice packets to be expedited. Voice !--- packets
need only wait behind a single segment of !--- a
previously queued data packet (for example, 10 ms !---
delay) rather than wait until the end of the !--- entire
data packet. Cisco IOS calculates the !--- data fragment
size using the following formula: !--- fragment size =
delay x bandwidth/8

!
interface Virtual-Template1
 bandwidth 64
 ip unnumbered loopback0
 ip rtp header-compression
 no ip route-cache
 load-interval 30
 max-reserved-bandwidth 99
 service-policy output VOIP
 ppp multilink
 ppp multilink fragment-delay 10
 ppp multilink interleave
!



!
ip classless
ip route 0.0.0.0 0.0.0.0 172.17.111.1
no ip http server
ip pim bidir-enable
!
!
!
 !--- A map class called mlp is created. !--- With "no
frame-relay adaptive-shaping", adaptive !--- shaping is
disabled. You do not !--- want to exceed CIR and have
voice packets !--- possibly queued within the Frame
Relay network. !--- Waiting for a BECN to resolve this
!--- situation could result in poor voice quality. !---
The frame-relay cir 64000 command forces the router to
transmit !--- at the desired CIR rate rather than line
!--- rate for the port. !--- "frame-relay bc 640"
configures the Bc value to force the desired !--- Tc
(shaping interval) value is 10 ms. !--- This formula
should be used to determine !--- the Bc value to use: Tc
= Bc/CIR. A !--- smaller Tc value reduces the interval a
voice !--- packet has to wait to be sent. !--- As in
"frame-relay be 0", the Be value should be set to zero
!--- in order to avoid voice being sent as part of a
burst !--- that is not guaranteed by the Frame Relay
network.


map-class frame-relay mlp

 no frame-relay adaptive-shaping
 frame-relay cir 64000
 frame-relay bc 640
 frame-relay be 0
```

```
!
call rsvp-sync
!
voice-port 1/0/0
!
voice-port 1/0/1
!
!
mgcp profile default
!
dial-peer cor custom
!
!
!
dial-peer voice 123 voip
 destination-pattern 123
 session target ipv4:10.1.1.1
 ip qos dscp cs5 media
 ip qos dscp cs5 signaling
 no vad
!
dial-peer voice 456 pots
 destination-pattern 456
 port 1/0/0
!
!
line con 0
line aux 0
line vty 0 4
 exec-timeout 0 0
 password cisco
 login
!
!
end
```

Roteador conectado ATM

```
!--- Note: This configuration is commented only !---
where additional consideration is required from the !---
above configuration of the Frame Relay router.


version 12.2
service timestamps debug datetime msec
service timestamps log uptime
no service password-encryption
!
hostname ATM
!
enable password cisco
!
username FR password 0 cisco
memory-size iomem 25
ip subnet-zero
!
!
!
access-list 105 permit ip any any dscp ef
access-list 105 permit udp any any  range 16384 32767
access-list 105 permit ip any any precedence critical
!
```

```
class-map match-all voice
 match access-group 105
!
!
!--- Note: Matching commands to the Frame Relay !---
router side of the network.


!
!
policy-map VOIP
  class voice
    priority 48
  class class-default
   fair-queue

!--- Note: Matching commands to the Frame Relay !---
router side of the network.


!
!
fax interface-type fax-mail
mta receive maximum-recipients 0
!
controller T1 2/0
 framing sf
 linecode ami
!
!
!
!
interface ATM0/0
 no ip address
 ip route-cache
 no atm ilmi-keepalive
!
!--- "interface ATM0/0.1 point-to-point" chooses the ATM
subinterface. !--- The physical interface could equally
have been used. !--- "pvc 10/100" creates an ATM PVC. !-
-- "cbr 64"—A VBR PVC has been defined on this example.
!--- This exapmle uses VBR non-realtime and the
sustained !--- cell rate (SCR) should be equal to the
peak !--- cell rate (PCR) in order to avoid bursting. !-
-- ATM cell tax and the possibility !--- of ATM
bandwidth expansion due to poor !--- fragment/cell
alignment, means that it !--- cannot be assumed that the
PCR/SCR on the ATM !--- side should equal the CIR of the
Frame Relay side. !--- Maintain the value of CIR on the
Frame-Relay side to define !--- our SCR, in this case,
64 kbps. This value may in some networks !--- require
some fine-tuning as the CIR on the Frame side does not
!--- exactly match the SCR on the ATM but makes for a
good-enough estimation !--- for most purposes. !---
Refer to Designing and Deploying !--- Multilink PPP over
Frame Relay and ATM !--- for more information. !---
"encapsulation aal5snap" is required. !--- "protocol ppp
Virtual-Template1" associates the virtual !--- template
with the ATM PVC. interface ATM0/0.1 point-to-point ip
route-cache pvc 10/100 cbr 64 encapsulation aal5snap
protocol ppp Virtual-Template1 ! ! interface loopback0
ip address 10.1.1.1 255.255.255.0 ! interface
Ethernet3/0 ip address 172.17.111.15 255.255.255.224
half-duplex ! interface Ethernet3/1 no ip address
```

```
shutdown half-duplex ! interface Virtual-Template1
bandwidth 64 ip unnumbered loopback0 ip rtp header-
compression no ip route-cache load-interval 30 max-
reserved-bandwidth 99 service-policy output VOIP ppp
multilink ppp multilink fragment-delay 10 ppp multilink
interleave !--- Note: The virtual template is created in
!--- exactly the same way as for the !--- Frame Relay
router side of the network. !--- An additional
consideration for !--- the ATM router is that the
fragment size !--- should be optimized to fit into !---
an integral number of ATM cells. !--- Refer to Designing
and Deploying !--- Multilink PPP over Frame Relay and
ATM !--- for more information on this issue. ! ip
classless ip route 0.0.0.0 0.0.0.0 172.17.111.1 ip http
server ip pim bidir-enable ! ! call rsvp-sync ! voice-
port 1/0/0 description FXS ! voice-port 1/0/1 ! voice-
port 1/1/0 description FXO ! voice-port 1/1/1 ! ! mgcp
profile default ! dial-peer cor custom ! ! ! dial-peer
voice 456 voip destination-pattern 456 session target
ipv4:10.1.1.2 ip qos dscp cs5 media ip qos dscp cs5
signaling no vad ! dial-peer voice 123 pots destination-
pattern 123 port 1/1/0 ! ! line con 0 line aux 0 line
vty 0 4 exec-timeout 0 0 password cisco login ! ! end
```

Verificar

Use esta seção para confirmar se a sua configuração funciona corretamente.

A Output Interpreter Tool (somente clientes registrados) (OIT) oferece suporte a determinados comandos show. Use a OIT para exibir uma análise da saída do comando show.

Esses comandos **show** são úteis na verificação do status operacional do ambiente de interfuncionamento ATM/Frame Relay, que inclui estatísticas de DLCI e PVC, status de interface física e virtual, aplicativo de política (QoS) e informações de cRTP:

- **show ppp multilink interface** ***interface-name*** —Verifica se o pacote está ativo/inativo, qual interface de acesso virtual é o pacote (pacote MLPPP) e quais são membros (link PPP). Esse comando também verifica se a portadora descarta células/quadros (fragmentos perdidos **<>** 0). A única perda de fragmento aceitável é aquela causada por erros de verificação de redundância cíclica (CRC).
- **show user** — Exibe o número associado à interface de acesso virtual. É possível utilizar informações desse comando ou do comando show ppp multilink para exibir estatísticas sobre a interface ou limpar a interface.
- **show frame-relay pvc** ***dlci*** —Exibe informações como parâmetros de modelagem de tráfego, valores de fragmentação e pacotes descartados. Esse comando mostra também se a interface física foi vinculada à interface virtual.
- **show atm pvc** ***pvc*** —Exibe todos os PVCs ATM ativos e informações de tráfego.
- **show policy-map interface** ***interface-name*** —Exibe toda a operação de LLQ e todas as quedas no PQ. Consulte Compreendendo os Contadores de Pacotes na saída do comando **show policy-map interface** para obter mais informações sobre os vários campos desse comando.**Observação:** o enfileiramento sofisticado é sempre aplicado à interface de acesso virtual2. As outras interfaces usam o enfileiramento FIFO.
- **show ip rtp header-compression** — Exibe as estatísticas de compactação do cabeçalho RTP, se configurado. Observe que as estatísticas estão conectadas à interface virtual-access2, que

é a interface do pacote.

Exemplos desses comandos são mostrados aqui:

```
FR#show ppp multilink interface virtual-access 2
Virtual-Access2, bundle name is ATM
Bundle up for 00:22:42
0 lost fragments, 0 reordered, 0 unassigned
0 discarded, 0 lost received, 231/255 load
0x2E5 received sequence, 0x10C31 sent sequence
Member links: 1 (max not set, min not set)
Virtual-Access1, since 00:22:42, last rcvd seq 0002E4 160 weight
```

Esta saída mostra o **comando show users** no roteador Frame Relay.

```
FR#show users
Line User Host(s) Idle Location
67 vty 1 idle 00:00:00 10.1.1.1
Interface User Mode Idle Peer Address
Vi1 Virtual PPP (FR ) -
Vi2 Virtual PPP (Bundle) 00:00:00 10.1.1.1
FR#
```

Esta saída mostra o **comando show users** no roteador ATM.

```
ATM#show users
Line User Host(s) Idle Location
131 vty 1 idle 00:00:00 64.104.207.95
Interface User Mode Idle Peer Address
Vi1 Virtual PPP (ATM ) -
Vi2 Virtual PPP (Bundle) 00:00:02 10.1.1.2
ATM#
```

Esta saída mostra o comando **show frame-relay pvc**.

```
FR#show frame-relay pvc 16
 PVC Statistics for interface Serial0/0 (Frame Relay DTE)
 DLCI = 16, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0/0.1

     input pkts 2301 output pkts 2295 in bytes 152266
     out bytes 151891 dropped pkts 0 in FECN pkts 0
     in BECN pkts 0 out FECN pkts 0 out BECN pkts 0
     in DE pkts 0 out DE pkts 0
     out bcast pkts 0 out bcast bytes 0
     5 minute input rate 9000 bits/sec, 9 packets/sec
     5 minute output rate 9000 bits/sec, 9 packets/sec
     pvc create time 23:46:56, last time pvc status changed 00:22:56
     Bound to Virtual-Access1 (up, cloned from Virtual-Template1)
     !--- PPP link interface. cir 64000 bc 640 be 0 byte limit 80 interval 10 mincir 64000 byte
increment 80 Adaptive Shaping none pkts 2296 bytes 152053 pkts delayed 9 bytes delayed 375
shaping active traffic shaping drops 0 Queueing strategy: fifo Output queue 0/40, 0 drop, 0
dequeued FR#
```

Esta saída mostra o comando **show atm pvc 10/100** no roteador ATM.

```
ATM#show atm pvc 10/100
     ATM0/0.1: VCD: 1, VPI: 10, VCI: 100
     CBR, SusRate: 128
     AAL5-LLC/SNAP, etype:0x0, Flags: 0x820, VCmode: 0x0
     OAM frequency: 0 second(s), OAM retry frequency: 1 second(s)
```

```
     OAM up retry count: 3, OAM down retry count: 5
     OAM Loopback status: OAM Disabled
     OAM VC state: Not Managed
     ILMI VC state: Not Managed
     InARP frequency: 15 minutes(s)
     Transmit priority 1
     InPkts: 729, OutPkts: 729, InBytes: 49700, OutBytes: 51158
     InPRoc: 0, OutPRoc: 729
     InFast: 729, OutFast: 0, InAS: 0, OutAS: 0
     InPktDrops: 0, OutPktDrops: 0/0/0 (holdq/outputq/total)
     CrcErrors: 0, SarTimeOuts: 0, OverSizedSDUs: 0, LengthViolation: 0,
     CPIErrors: 0
     OAM cells received: 0
     F5 InEndloop: 0, F5 InSegloop: 0, F5 InAIS: 0, F5 InRDI: 0
     F4 InEndloop: 0, F4 InSegloop: 0, F4 InAIS: 0, F4 InRDI: 0
     OAM cells sent: 0
     F5 OutEndloop: 0, F5 OutSegloop: 0, F5 OutRDI: 0
     F4 OutEndloop: 0, F4 OutSegloop: 0, F4 OutRDI: 0
     OAM cell drops: 0
     Status: UP
   PPP: Virtual-Access2 from Virtual-Template1
    !--- MLPPP bundle interface. ATM#
```

Este é o **show policy-map** no roteador Frame Relay.

```
FR#show policy-map interface Virtual-Access2
Service-policy output: VoIP
Class-map: voice (match-all)
15483 packets, 959502 bytes
30 second offered rate 24000 bps, drop rate 0 bps
Match: ip dscp 40
Weighted Fair Queueing
Strict Priority
!--- LLQ Strict Priority Queue for voice. Output Queue: Conversation 24 Bandwidth 48(kbps) Burst
1500 (Bytes) (pkts matched/bytes matched) 15536/962784 (total drops/bytes drops) 0/0
!--- No drops in the voice queue. Class-map: class-default (match-any)
139 packets, 19481 bytes
30 second offered rate 1000 bps, drop rate 0 bps
Match: any
Weighted Fair Queueing
Flow Based Fair Queueing
Maximum Number of Hashed Queues 16
(total queued/total drops/no-buffer drops) 0/0/0
```

Esta saída mostra o comando **show policy map** no roteador ATM.

```
ATM#show policy-map interface Virtual-Access2
Service-policy output: VOIP
Class-map: voice (match-all)
11293 packets, 699718 bytes
30 second offered rate 24000 bps, drop rate 0 bps
Match: ip dscp 40
Weighted Fair Queueing
Strict Priority
!--- LLQ Strict Priority Queue for voice. Output Queue: Conversation 24 Bandwidth 48 (kbps)
Burst 1500 (Bytes) (pkts matched/bytes matched) 11352/703376 (total drops/bytes drops) 0/0 !---
No drops in the voice queue. Class-map: class-default (match-any) 63 packets, 9772 bytes 30
second offered rate 0 bps, drop rate 0 bps Match: any Weighted Fair Queueing Flow Based Fair
Queueing Maximum Number of Hashed Queues 16 (total queued/total drops/no-buffer drops) 0/0/0
ATM#
```

Esta saída mostra o comando **show ip rtp header-compression** no roteador Frame Relay.

```
FR#show ip rtp header-compression
RTP/UDP/IP header compression statistics:
Interface Virtual-Access1:
Rcvd: 0 total, 0 compressed, 0 errors
0 dropped, 0 buffer copies, 0 buffer failures
Sent: 0 total, 0 compressed,
0 bytes saved, 0 bytes sent
Connect: 16 rx slots, 16 tx slots,
0 long searches, 0 misses 0 collisions

Interface Virtual-Template1:
Rcvd: 0 total, 0 compressed, 0 errors
0 dropped, 0 buffer copies, 0 buffer failures
Sent: 0 total, 0 compressed,
0 bytes saved, 0 bytes sent
Connect: 16 rx slots, 16 tx slots,
0 long searches, 0 misses 0 collisions

Interface Virtual-Access2:
Rcvd: 23682 total, 23681 compressed, 0 errors
0 dropped, 0 buffer copies, 0 buffer failures
Sent: 327 total, 233 compressed,
8821 bytes saved, 5159 bytes sent
2.70 efficiency improvement factor
Connect: 16 rx slots, 16 tx slots,
0 long searches, 94 misses 0 collisions
71% hit ratio, five minute miss rate 0 misses/sec, 0 max
```

Esta saída mostra o comando **show ip rtp header-compression** no roteador ATM.

```
ATM#show ip rtp header-compression
RTP/UDP/IP header compression statistics:
Interface Virtual-Access1:
Rcvd: 0 total, 0 compressed, 0 errors
0 dropped, 0 buffer copies, 0 buffer failures
Sent: 0 total, 0 compressed,
0 bytes saved, 0 bytes sent
Connect: 16 rx slots, 16 tx slots,
0 long searches, 0 misses 0 collisions, 0 negative cache hits

Interface Virtual-Template1:
Rcvd: 0 total, 0 compressed, 0 errors
0 dropped, 0 buffer copies, 0 buffer failures
Sent: 0 total, 0 compressed,
0 bytes saved, 0 bytes sent
Connect: 16 rx slots, 16 tx slots,
0 long searches, 0 misses 0 collisions, 0 negative cache hits

Interface Virtual-Access2:
Rcvd: 283 total, 233 compressed, 0 errors
0 dropped, 0 buffer copies, 0 buffer failures
Sent: 25341 total, 25340 compressed,
955537 bytes saved, 564463 bytes sent
2.69 efficiency improvement factor
Connect: 16 rx slots, 16 tx slots,
0 long searches, 1 misses 0 collisions, 100 negative cache hits
99% hit ratio, five minute miss rate 0 misses/sec, 0 max
```

Troubleshoot

Use esta seção para fazer o troubleshooting da sua configuração.

Esta seção fornece alguns exemplos de depuração destinados a esclarecer o LFI MLP e serve como exemplos de trabalho para solucionar problemas de sua configuração.

Comandos para Troubleshooting

A Output Interpreter Tool (somente clientes registrados) (OIT) oferece suporte a determinados comandos show. Use a OIT para exibir uma análise da saída do comando show.

Nota:Consulte Informações Importantes sobre Comandos de Depuração antes de usar comandos debug.

- **debug ppp negotiation** — Ilustra o processo de clonagem das duas interfaces de acesso virtual para representar os links do pacote PPP e PPP. A interface de acesso virtual 1 (Vi1) é o link PPP ao qual o PVC (ATM ou quadro) está vinculado. A interface virtual 2 (Vi2) é o enlace do pacote PPP ao qual estão anexadas as políticas de enfileiramento.
- **debug ppp multilink fragment** —Ilustra o conceito de pacotes de dados maiores sendo intercalados com pacotes de voz menores. A intercalação ocorre na interface Vi2 (o nível MLP), pois a interface do pacote tem o enfileiramento sofisticado atribuído.

Esta é a saída do comando para o comando **debug ppp negotiation**.

```
FR(config-if)#no shut
FR(config-if)#^Z
FR#
FR#
6d23h: %LINK-3-UPDOWN: Interface Virtual-Access1, changed state to up
*Mar 7 23:20:42.842: Vi1 PPP: Treating connection as
a dedicated line
!--- Vi1 is the PPP link to which the PVC is bound. *Mar 7 23:20:42.842: Vi1 PPP: Phase is
ESTABLISHING, Active Open *Mar 7 23:20:42.842: Vi1 LCP: O CONFREQ [Closed] id 197 len 19 *Mar 7
23:20:42.842: Vi1 LCP: MagicNumber 0xF44128D2 (0x0506F44128D2) *Mar 7 23:20:42.842: Vi1 LCP:
MRRU 1524 (0x110405F4) *Mar 7 23:20:42.842: Vi1 LCP: EndpointDisc 1 FR (0x1305014652)
!--- Router FR at one end of PPP discovery. *Mar 7 23:20:42.858: Vi1 LCP: I CONFREQ [REQsent] id
14 len 20 *Mar 7 23:20:42.858: Vi1 LCP: MagicNumber 0x294819D4 (0x0506294819D4) *Mar 7
23:20:42.858: Vi1 LCP: MRRU 1524 (0x110405F4) *Mar 7 23:20:42.858: Vi1 LCP: EndpointDisc 1 ATM
(0x13060141544D)
!--- Router ATM at the other end of PPP discovery. *Mar 7 23:20:42.858: Vi1 LCP: O CONFACK
[REQsent] id 14 len 20 *Mar 7 23:20:42.862: Vi1 LCP: MagicNumber 0x294819D4 (0x0506294819D4)
*Mar 7 23:20:42.862: Vi1 LCP: MRRU 1524 (0x110405F4) *Mar 7 23:20:42.862: Vi1 LCP: EndpointDisc
1 ATM (0x13060141544D) *Mar 7 23:20:42.870: Vi1 LCP: I CONFACK [ACKsent] id 197 len 19 *Mar 7
23:20:42.870: Vi1 LCP: MagicNumber 0xF44128D2 (0x0506F44128D2) *Mar 7 23:20:42.870: Vi1 LCP:
MRRU 1524 (0x110405F4) *Mar 7 23:20:42.870: Vi1 LCP: EndpointDisc 1 FR (0x1305014652) *Mar 7
23:20:42.870: Vi1 LCP: State is Open *Mar 7 23:20:42.870: Vi1 PPP: Phase is FORWARDING,
Attempting Forward *Mar 7 23:20:42.874: Vi1 PPP: Phase is ESTABLISHING, Finish LCP *Mar 7
23:20:42.874: Vi1 PPP: Phase is VIRTUALIZED *Mar 7 23:20:42.942: Vi2 PPP: Phase is DOWN, Setup
*Mar 7 23:20:43.222: Vi1 IPCP: Packet buffered while building MLP bundle interface
6d23h: %LINK-3-UPDOWN: Interface Virtual-Access2, changed state to up
!--- MLP level queuing. *Mar 7 23:20:43.226: Vi2 PPP: Treating connection as a dedicated line
*Mar 7 23:20:43.226: Vi2 PPP: Phase is ESTABLISHING, Active Open *Mar 7 23:20:43.226: Vi2 LCP: O
CONFREQ [Closed] id 1 len 19 *Mar 7 23:20:43.226: Vi2 LCP: MagicNumber 0xF4412A53
(0x0506F4412A53) *Mar 7 23:20:43.226: Vi2 LCP: MRRU 1524 (0x110405F4) *Mar 7 23:20:43.230: Vi2
LCP: EndpointDisc 1 FR (0x1305014652) *Mar 7 23:20:43.230: Vi2 MLP:
Added first link Vi1 to bundle ATM
!--- PVCs make up the bundle. *Mar 7 23:20:43.230: Vi2 PPP: Phase is UP *Mar 7 23:20:43.230: Vi2
IPCP: O CONFREQ [Closed] id 1 len 10 *Mar 7 23:20:43.234: Vi2 IPCP: Address 10.1.1.2
(0x03060A010102) *Mar 7 23:20:43.234: Vi2 PPP: Pending ncpQ size is 1 *Mar 7 23:20:43.234: Vi1
IPCP: Redirect packet to Vi1 *Mar 7 23:20:43.234: Vi2 IPCP: I CONFREQ [REQsent] id 1 len 10 *Mar
7 23:20:43.234: Vi2 IPCP: Address 10.1.1.1 (0x03060A010101) *Mar 7 23:20:43.234: Vi2 IPCP: O
```

```
CONFACK [REQsent] id 1 len 10 *Mar 7 23:20:43.234: Vi2 IPCP: Address 10.1.1.1 (0x03060A010101)
*Mar 7 23:20:43.266: Vi2 IPCP: I CONFACK [ACKsent] id 1 len 10 *Mar 7 23:20:43.266: Vi2 IPCP:
Address 10.1.1.2 (0x03060A010102) *Mar 7 23:20:43.266: Vi2 IPCP: State is Open *Mar 7
23:20:43.266: Vi2 IPCP: Install route to 10.1.1.1 *Mar 7 23:20:43.270: Vi2 IPCP: Add link info
for cef entry 10.1.1.1
```

Esta saída do comando é do comando **debug ppp multilink fragment**.

```
*Mar 7 23:16:08.034: Vi2 MLP:
Packet interleaved from queue 24
*Mar 7 23:16:08.038: Vi1 MLP: O ppp UNKNOWN(0x0000) (0000) size 64
*Mar 7 23:16:08.038: Vi2 MLP: Packet interleaved from queue 24
*Mar 7 23:16:08.038: Vi1 MLP: O ppp UNKNOWN(0x0000) (0000) size 64
*Mar 7 23:16:08.038: Vi2 MLP: Packet interleaved from queue 24
*Mar 7 23:16:08.038: Vi1 MLP: O ppp UNKNOWN(0x0000) (0000) size 64
*Mar 7 23:16:08.038: Vi1 MLP: O frag 0000829B size 160
*Mar 7 23:16:08.042: Vi1 MLP: I ppp IP (0021) size 64 direct
*Mar 7 23:16:08.046: Vi1 MLP: I ppp IP (0021) size 64 direct
```

Informações Relacionadas

- Projetando e implantando o Multilink PPP por Frame Relay e ATM
- Links de VoIP por PPP com qualidade de serviço (LLQ / prioridade IP RTP, LFI, cRTP)
- VoIP sobre Frame Relay com QoS (fragmentação, molde de tráfego, prioridade LLQ / IP RTP)
- Suporte à Tecnologia de Voz
- Suporte aos produtos de Voz e Comunicações Unificadas
- Troubleshooting da Telefonia IP Cisco
- Suporte Técnico e Documentação - Cisco Systems