

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

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Introdução

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 a disposição do Qualidade de Serviço (QoS) a fim apoiar corretamente a Voz através de um ATM/Frame WAN colaborado relé. Os exemplos de configuração igualmente utilizam o Compressed Real-Time Protocol (cRTP), que foi apoiado no ATM desde a liberação 12.2(2)T do Cisco IOS ® Software.

O original pode ser autônomo lido para a orientação de configuração, os exemplos de configuração, e os comandos de verificação a fim para ser usado em construir a rede. Também são fornecidas algumas informações de fundo sobre questões específicas associadas ao uso de entrelaçamento de ATM / Frame Relay. Refira estes originais para obter mais informações sobre de QoS para o VOIP sobre o Frame Relay ou o PPP:

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

Pré-requisitos

Requisitos

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

Você deve ser familiar 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 ATM Router
- Cisco 2620 como o Frame Relay Router
- Cisco IOS Software Release 12.2(8)T (IP Plus)

Nota: Como uma diretriz geral, a versão de manutenção a mais atrasada do mainline do Cisco IOS 12.2 é o Cisco IOS Software Release recomendado a usar-se para o MLPoATM/Cisco IOS Software Release 12.2T do QUADRO está exigida no ATM Router se o cRTP é usado.

As características relevantes foram introduzidas nestes Cisco IOS Software Release:

- 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.

As informações neste documento foram criadas a partir de dispositivos em um ambiente de laboratório específico. Todos os dispositivos utilizados neste documento foram iniciados com uma configuração (padrão) inicial. Se a sua rede estiver ativa, certifique-se de que entende o impacto potencial de qualquer comando.

Convenções

Consulte as [Convenções de Dicas Técnicas da Cisco](#) para obter mais informações sobre convenções de documentos.

Informações de Apoio

As questões básicas em fornecer a prevenção de retardo e atraso de sincronização de ponta a ponta minimizada para VoIP através de uma rede colaborada relé do ATM/Frame são:

- Prioridade estrita para tráfego de voz (enfileiramento de baixa latência (LLQ))
- Fragmentação e intercalação de link (LFI)
- Modelagem de Tráfego Frame Relay (FRTS) para voz
- Modelagem de tráfego ATM

Estes originais fornecem fontes úteis de uma informações de fundo mais adicional:

- [Qualidade de serviço de voz sobre IP](#)
- [Configurando a fragmentação e interfaceamento de link para Frame Relay e circuitos virtuais ATM](#)

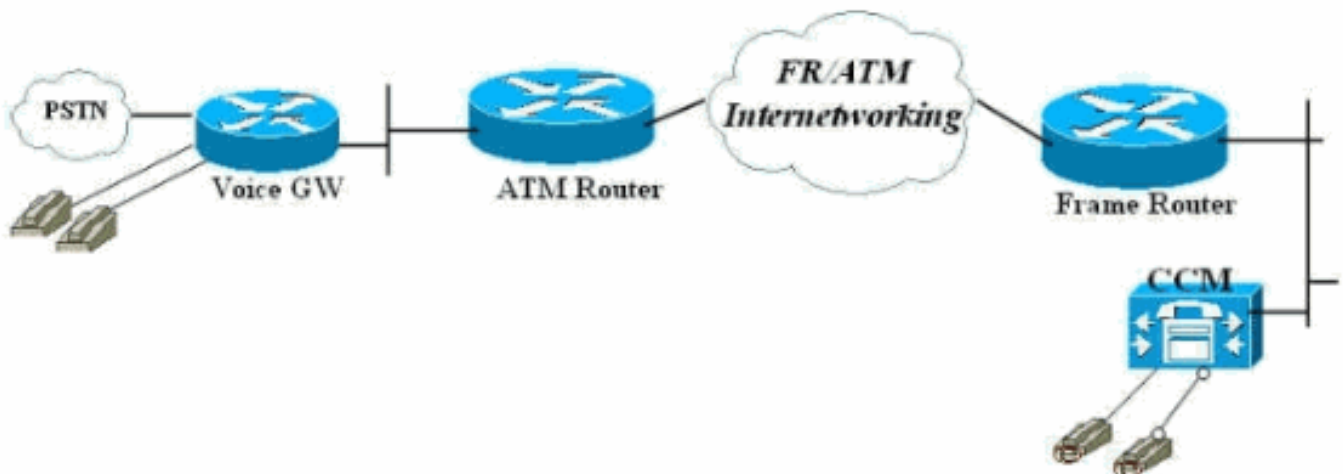
Configurar

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

Nota: Use a [ferramenta de consulta de comandos \(clientes registrados somente\)](#) a fim encontrar mais informação nos comandos usados neste original.

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](#)

Nota: É importante notar que nesta configuração, os dois Roteadores são lado a lado conectado sobre um Frame Relay ao switch de entrelaçamento ATM. Na maioria de topologias contudo, os

roteadores ativado da Voz podem existir em qualquer lugar. Geralmente, o Roteadores da Voz usa a conectividade de LAN ao outro Roteadores, que são conectados ao ATM/Frame WAN. Nos casos, o Roteadores conectado a WAN, o Frame Relay, e o ATM têm que ser configurados para o LLQ, o LFI, e o MLPPP assim que pode fornecer QoS, e não o Gateways de voz segundo as indicações destas 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 fragmentation 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-Templat1  
  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-Templatel
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](#) ([apenas para clientes registrados](#)) (OIT) suporta determinados comandos show. Use a OIT para exibir uma análise da saída do comando show.

Estes **comandos show** são úteis na verificação do status operacional do ambiente de colaboração do relé do ATM/Frame, que inclui o DLCI e as estatísticas do PVC, o estado do exame e da interface virtual, o aplicativo da política (QoS), e a informação de cRTP:

- **show ppp multilink interface interface-name** - Verifica se o pacote está up/down, qual interface de acesso virtual é o pacote (pacote MLPPP) e quais são membros (link PPP). Este comando igualmente verifica se as pilhas das quedas de portadora/quadros (<> perdido 0 dos fragmentos). 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** — Indica a informação tal como parâmetros de modelagem de tráfego, valores de fragmentação, e pacotes descartado. Esse comando mostra também se a interface física foi vinculada à interface virtual.
- **show atm pvc pvc** - Exibe todos os ATM PVCs ativos e informações de tráfego.
- **show policy-map interface interface-name** Exibe toda a operação LLQ e as quedas no PQ. Refira compreendendo contadores de pacote de informação no **comando show policy-map interface** output para obter mais informações sobre dos vários campos deste comando.**Nota:** O enfileiramento complexo é sempre aplicado a uma interface virtual-access2. As outras interfaces usam o enfileiramento FIFO.
- **show ip rtp header-compression** – Exibe as estatísticas de compactação de cabeçalho RTP, se configuradas. Observe que as estatísticas estão anexadas à relação virtual-access2, que é

o bundle interface.

Os exemplos destes 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 os usuários da mostra no Frame Relay Router.
```

```
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 os usuários da mostra no ATM Router.

```
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-Templatel)
!--- 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 ATM Router.

```
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-Templatel

!--- MLPPP bundle interface. ATM#

Este é o mapa de política da mostra no Frame Relay Router.

```
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 ATM Router.

```
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 Frame Relay Router.

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-Templatel:

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 ATM Router.

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-Templatel:

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

[Troubleshooting](#)

Use esta seção para fazer o troubleshooting da sua configuração.

Esta seção fornece algum exemplo de depuração pretendido esclarecer MLP LFI e servir-lo como exemplos de funcionamento para pesquisar defeitos sua configuração.

[Comandos para Troubleshooting](#)

A [Output Interpreter Tool \(apenas para clientes registrados\)](#) (OIT) suporta 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.

- depurar negociação de ppp - Ilustra o processo de clonagem das duas interfaces de acesso virtual para representar o PPP e os enlaces do conjunto PPP. A interface de acesso virtual 1 (Vi1) é o link de PPP a que (ATM ou quadro) o PVC é limitado. 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 relação Vi2 (o nível MLP) desde que o bundle interface tem o fancy queuing atribuído.

Este é o comando output 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 ao Produto de Voz e Comunicações Unificadas](#)
- [Troubleshooting da Telefonia IP Cisco](#)
- [Suporte Técnico e Documentação - Cisco Systems](#)