VoIP QoS voor Frame Relay naar ATM Interworking met LLQ, PPP LFI en cRTP

Inhoud

Inleiding

Dit document biedt een voorbeeldconfiguratie voor Voice-over-IP met behulp van Multilink PPP over ATM en Frame Relay Interworking (VoIP met MLPoATM/MLPoFR). De centrale focus van de configuratievoorbeelden is de levering van Quality of Service (QoS) om spraak via een door ATM/Frame Relay geïntegreerd WAN correct te ondersteunen. De configuratievoorbeelden maken ook gebruik van gecomprimeerd Real Time Protocol (cRTP), dat op ATM is ondersteund sinds Cisco IOS-softwarerelease 12.2(2)T.

Het document kan op zichzelf worden gelezen voor configuratiehandleidingen, configuratievoorbeelden en verificatieopdrachten om in het netwerk te kunnen worden gebruikt. Er wordt ook achtergrondinformatie verstrekt over specifieke kwesties die verband houden met het gebruik van ATM / Frame Relay-interworking. Raadpleeg deze documenten voor meer informatie over QoS voor VoIP via Frame Relay of PPP:

- [VoIP over PPP Links met Quality of Service (LLQ/IP RTP-prioriteit, LFI, cRTP)](#)
- [VoIP via Frame Relay met QoS (fragmentatie, traffic shaping, LLQ/IP RTP-prioriteit)](#)

Voorwaarden

Vereisten

Zorg ervoor dat u aan deze vereisten voldoet voordat u deze configuratie probeert:

U dient bekend te zijn met deze technologiegebieden:

- Toegangscontrolelijsten
- ATM permanente virtuele circuits (PVC's)
- Frame Relay permanente virtuele circuits (datalink-verbinding-identificator (DLCI's))
- Bandbreedtebeheer
- LLQ
- LFI
- Virtuele sjablonen en virtuele toegangsinterfaces
- MLPPP
- cRTP

Gebruikte componenten

De informatie in dit document is gebaseerd op de volgende software- en hardware-versies:

- Cisco 3640 als de ATM-router
- Cisco 2620 als Frame Relay-router
- Cisco IOS-softwarerelease 12.2(8)T (IP Plus)

Opmerking: Als algemeen richtlijn, is de nieuwste Cisco IOS 12.2 hoofdonderhoudsrelease de aanbevolen Cisco IOS-softwarerelease om te gebruiken voor MLPoATM/FR. Cisco IOS-softwarerelease 12.2T is vereist op de ATM-router als cRTP wordt gebruikt.

Relevante functies zijn geïntroduceerd in deze Cisco IOS-softwarereleases:

- LFI is geïntroduceerd in Cisco IOS-softwarerelease 11.3.
- LLQ is geïntroduceerd in Cisco IOS-softwarerelease 12.0(7)T.
- LLQ over Frame Relay en ATM per PVC is geïntroduceerd in Cisco IOS-softwarerelease 12.1(2)T.
- Multilink PPP LFI voor Frame Relay en virtuele ATM-circuits zijn geïntroduceerd in Cisco IOS-softwarerelease 12.1(5)T.
- cRTP over ATM is geïntroduceerd in Cisco IOS-softwarerelease 12.2(2)T.

De informatie in dit document is gebaseerd op de apparaten in een specifieke laboratoriumomgeving. Alle apparaten die in dit document worden beschreven, hadden een opgeschoonde (standaard)configuratie. Als uw netwerk live is, moet u de potentiële impact van elke opdracht begrijpen.

Conventies

Raadpleeg [Cisco Technical Tips Conventions (Conventies voor technische tips van Cisco) voor meer informatie over documentconventies.](#)

Achtergrondinformatie

De belangrijkste kwesties bij het bieden van geminimaliseerde end-to-end vertraging en jittervermijding voor VoIP via een geïntegreerd ATM/Frame Relay-netwerk zijn:

- Strikte prioriteit voor spraakverkeer (lage wachtrijen)

- Link Fragmentation and Interleaving (LFI)
- Frame Relay Traffic Shaping (FRTS) voor spraak
- ATM traffic shaping

Deze documenten bieden nuttige achtergrondinformatie:

- [Quality-of-Service voor Voice-over-IP](#)
- [Configuratie van Link Fragmentation en Interleaving voor Frame Relay en virtuele ATM-circuits](#)

Configureren

Deze sectie bevat informatie over het configureren van de functies die in dit document worden beschreven.

N.B.: Gebruik het [Opdrachtupgereedschap](#) ([alleen geregistreerde](#) klanten) om meer informatie te vinden over de opdrachten die in dit document worden gebruikt.

Netwerkdiagram

Het netwerk in dit document is als volgt opgebouwd:
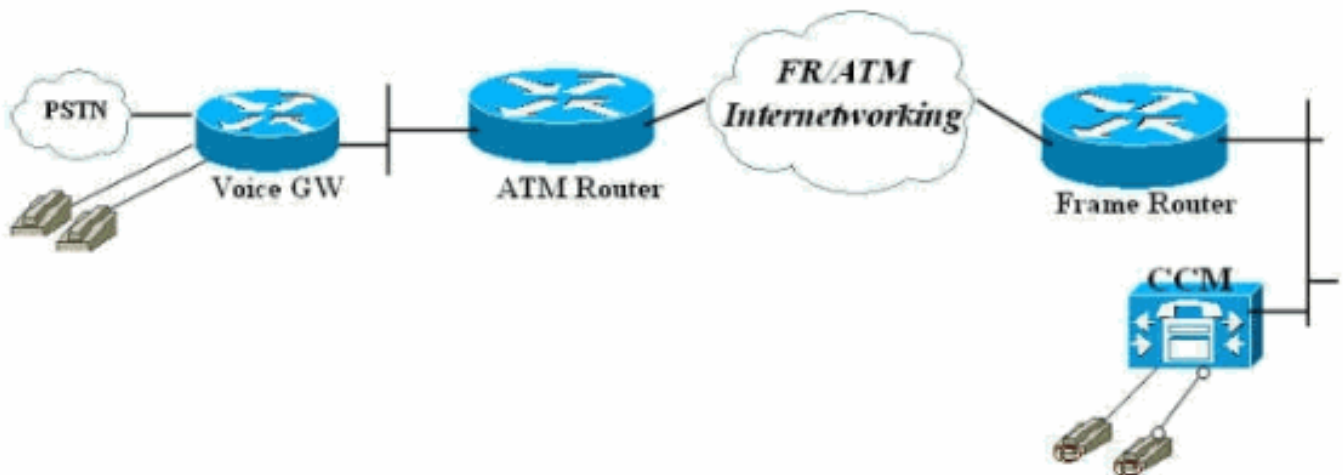
Configuraties

Dit document gebruikt deze configuraties:

- [Frame Relay Connected Router](#)
- [ATM Connected Router](#)

N.B.: Het is belangrijk om op te merken dat in deze configuratie de twee routers via Frame Relay terug-naar-back-up zijn verbonden met ATM Interworking-switch. In de meeste topologieën echter, kunnen de spraak-enabled routers overal bestaan. Normaal gesproken gebruiken de spraakrouters LAN-connectiviteit op andere routers, die worden aangesloten op ATM/Frame WAN. In die gevallen moeten de routers die zijn aangesloten op WAN, Frame Relay en ATM voor LLQ, LFI en MLPPP worden geconfigureerd zodat ze QoS kunnen leveren en niet de

spraakgateways zoals in deze configuraties worden getoond.

Frame Relay Connected Router

```
!--- 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
```

ATM Connected Router

```
!--- 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
```

Verifiëren

Gebruik dit gedeelte om te bevestigen dat de configuratie correct werkt.

Het Uitvoer Tolk (uitsluitend geregistreerde klanten) (OIT) ondersteunt bepaalde **show** opdrachten. Gebruik de OIT om een analyse van **tonen** opdrachtoutput te bekijken.

Deze **show** opdrachten zijn nuttig bij de verificatie van de operationele status van de ATM/Frame Relay-interworking-omgeving, die DLCI- en PVC-statistieken, de fysieke en virtuele interfacestatus, QoS-toepassing (Policy) en cRTP-informatie bevat:

- **Geef de *naam* van de *interface*-multilink-**verifieert of de bundel omhoog/omlaag is, welke virtuele-toegangsinterface de bundel (MLPPP bundel) is en welke leden (PPP verbinding) zijn. Deze opdracht verifieert ook of de drager cellen/frames laat vallen (verloren fragmenten <> 0). Het enige acceptabele fragmentatieverlies is een veroorzaakt door CRC-fouten (Cyclic redundantie).
- **Laat gebruiker** —Hier wordt het nummer weergegeven dat aan de virtuele toegangsinterface is gekoppeld. U kunt informatie uit deze opdracht of de opdracht **tonen** MPP **multilink** gebruiken zodat u statistieken over de interface kunt weergeven of de interface kunt wissen.
- **Laat frame-relais pvc *dlci* **-displays zoals traffic shaping parameters, fragmentatiewaarden en geworpen pakketten zien. Deze opdracht toont ook of de fysieke interface aan de virtuele interface is gebonden.
- **ATM pvc *pvc* tonen** —hiermee worden alle actieve ATM PVC's en verkeersinformatie weergegeven.
- **toon beleid-kaart interface *interface-naam*-**Hiermee geeft u alle LLQ-handeling en alle druppels in het PQ weer. Raadpleeg het gedeelte Packet Counters begrijpen in de opdrachtoutput **van de** showbeleid-map interface voor meer informatie over de verschillende velden van deze opdracht.**Opmerking:** de fancy wachtrij wordt altijd toegepast op de virtuele access2 interface. De andere interfaces gebruiken een wachtrij voor FIFO.
- **Toon ip rtp header-compressie** —Geeft indien geconfigureerd de RTP header compressiestatistieken weer. Merk op dat de statistieken zijn aangesloten op de virtuele access2 interface, de bundelinterface.

Hier worden voorbeelden van deze opdrachten gegeven:

```
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
```

Deze uitvoer toont de **showgebruikers** op de 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#
```

Deze output toont de **show gebruikers** op de 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#
```

Deze uitvoer toont de opdracht **frame-relais 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#
```

Deze uitvoer toont de opdracht **ATM pvc 10/100** op de 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-Template1
     !--- MLPPP bundle interface. ATM#
```

Dit is de **show beleid-map** op de 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
```

Deze output toont het bevel van de **show beleidsplan** op de router van 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#
```

Deze uitvoer toont de opdracht voor **tonen van IP header-compressie** op de router van 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
```

Deze uitvoer toont de opdracht van de **show IP header-compressie** op de 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-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
```

Problemen oplossen

Deze sectie bevat troubleshooting-informatie voor uw configuratie.

Deze sectie verschaft een aantal voorbeelddetails die bedoeld zijn om MLP LFI te verhelderen en

dient als werkvoorbeelden voor het oplossen van uw configuratie.

Opdrachten voor troubleshooting

Het Uitvoer Tolk (uitsluitend geregistreerde klanten) (OIT) ondersteunt bepaalde **show** opdrachten. Gebruik de OIT om een analyse van **tonen** opdrachtoutput te bekijken.

Opmerking: Raadpleeg Belangrijke informatie over debug Commands voordat u **debug-** opdrachten gebruikt.

- **debug van PPP onderhandeling**-illustreert het proces van het klonen van de twee virtueel-toegangsinterfaces om de PPP en PPP bundelverbindingen te vertegenwoordigen. Virtual-Access Interface 1 (Vi1) is de PPP-link waaraan het (ATM of frame) PVC is gebonden. Virtual interface 2 (Vi2) is de PPP-bundellink waaraan een Wachtend beleid is gekoppeld.
- **debug ppp multilink fragment**-illustreert het concept van grotere gegevenspakketten die met kleinere spraakpakketten worden doorgestuurd. De interleaving vindt plaats op de Vi2-interface (het MLP-niveau) omdat de bundelinterface de chique wachtrij heeft toegewezen.

Dit is de opdrachtoutput voor de opdracht **debug ppp onderhandeling**.

```
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
```
Deze opdrachtoutput komt van de opdracht **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
```

Gerelateerde informatie

- [Ontwerpen en implementeren van multilink PPP via Frame Relay en ATM](#)
- [VoIP over PPP Links met Quality of Service (LLQ/IP RTP-prioriteit, LFI, cRTP)](#)
- [VoIP via Frame Relay met QoS (fragmentatie, traffic shaping, LLQ/IP RTP-prioriteit)](#)
- [Ondersteuning voor spraaktechnologie](#)
- [Productondersteuning voor spraak en Unified Communications](#)
- [Probleemoplossing voor Cisco IP-telefonie](#)
- [Technische ondersteuning en documentatie – Cisco Systems](#)