# **Troubleshoot Network Related Audio Issues on Catalyst 9000 Switches**

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# Introduction

This document describes how to troubleshoot network-related audio issues in a voice over IP (VoIP) environment.

#### Requirements

Cisco recommends that you have knowledge of these topics:

- QoS
- VoIP networks
- SPAN (Switchport Analyzer)
- Wireshark

#### **Components Used**

The information in this document is based on these software and hardware versions:

- Catalyst 9200
- Catalyst 9300
- Catalyst 9400
- Catalyst 9500
- Catalyst 9600

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, ensure that you understand the potential impact of any command.

# **Background Information**

In a VoIP infrastructure, the quality of the audio can be impacted by network-related issues, whose symptoms include:

- Intermittent gaps in the voice or choppy audio.
- One-way audio.
- Not isolated to a single user but to a group of users that have common characteristics, such as sharing the same VLAN or sharing the same access switch.

In order to troubleshoot network-related issues, it is important to have a clear topology from source to destination of the voice packets. The diagnosis of the problem can start at any point in the network where voice packets are switched or routed, however it is recommended to start the troubleshoot at the access layer and move up to the routing layer.

#### **Network Diagram**



Choose a capture point in the path. It can be either A (Closest to one IP Phone), B (Before routing), C (Closest to the destination).

The SPAN capture is normally taken in both directions (TX and RX) in order to identify both sides of the conversation and extract the respective audio, along with other variables such as jitter, or packet loss, from the capture for further analysis.

After having the capture point determined, setup the SPAN configuration on the switch.

```
<#root>
Switch(config)#
monitor session 1 source interface Gig1/0/1 both
Switch(config)#
monitor session 1 destination interface Gig1/0/6 encapsulation replicate
Switch#
show monitor session all
Session 1
------
Type : Local Session
Source Ports :
Both : Gi1/0/1
Destination Ports : Gi1/0/6
```

Initiate a test call to capture the audio flow from the chosen capture point in a PC/Laptop with Wireshark.

# **Capture Analysis**

1. Open the packet capture taken using Wireshark and navigate to **Statistics > Conversations**. Find the audio conversation based on the IP address of the involved devices (IP Phone source and destination).

| w  | Go    | Capture | Analyze  | Statistics   | Telephony      | Wireless | Tools   | Help   |         |             |            |
|----|-------|---------|----------|--------------|----------------|----------|---------|--------|---------|-------------|------------|
|    |       |         |          | Capture File | e Properties   |          | ር ጐ ೫ C |        | 📕 Testl | PPhoneGi302 | 5.pcap     |
|    |       | Source  | 9        | Resolved A   | ddresses       |          |         | ificat | ion     | Protocol    | Frame leng |
| 17 | :30:  | 5 10.2  | 01.38.14 | Protocol Hi  | erarchy        |          |         | a10    | (31248) | UDP         | 21         |
| 17 | :30:  | 5 10.2  | 01.38.14 | Conversatio  | ons            |          |         | a1b    | (31259) | UDP         | 21         |
| 17 | :30:  | 5 10.2  | 01.38.14 | Endpoints    |                |          |         | a24    | (31268) | UDP         | 21         |
| 17 | :30:  | 5 10.2  | 01.38.14 | Packet Len   | gths           |          |         | a38    | (31288) | UDP         | 21         |
| 17 | :30:  | 5 10.2  | 01.38.14 | I/O Graphs   |                |          |         | a49    | (31305) | UDP         | 21         |
| 17 | :30:  | 5 10.2  | 01.38.14 | Service Res  | sponse Time    |          | ,       | a57    | (31319) | UDP         | 21         |
| 17 | :30:  | 5 10.2  | 01.38.14 |              | sponse mile    |          |         | a58    | (31320) | UDP         | 21         |
| 17 | :30:  | 5 10.2  | 01.38.14 | DHCP (BOC    | OTP) Statistic | s        |         | a61    | (31329) | UDP         | 21         |
| 17 | :30:  | 5 10.2  | 01.38.14 | NetPerfMet   | ter Statistics |          |         | a65    | (31333) | UDP         | 21         |
| 17 | :30:  | 5 10.2  | 01.38.14 | ONC-RPC P    | Programs       |          |         | a77    | (31351) | UDP         | 21         |
| 17 | :30:  | 5 10.2  | 01.38.14 | 29West       |                |          | >       | a8b    | (31371) | UDP         | 21         |
| 17 | . 20. | 5 10 2  | 01 20 1. | 2011000      |                |          |         | -04    | (21200) |             | 21         |

2. Normally, audio streams are carried by the UDP protocol, and most of the times they are not decoded in the proper format for Wireshark to extract the audio embedded into it. Then, the next step is to decode the UDP stream into audio format, by default RTP is used. Right click on any packet of the stream, then click on **Decode as**.

| 4 |          | ٥        | ۲      |         |         | 8          | ۹ 🤞      | • 🔿     | 2  | 5 👱 |        |       | Ð, | Q       |          | • •        |      |    |     |
|---|----------|----------|--------|---------|---------|------------|----------|---------|----|-----|--------|-------|----|---------|----------|------------|------|----|-----|
|   | ip.addr= | =10.201. | 38.140 | 8& ip   | .addr== | 239.0.1.11 |          |         |    |     |        |       |    |         |          |            |      |    |     |
| N | 0.       |          | Arriva | al Time | e       |            | Source   |         |    | D   | estina | tion  |    | lo      | dentific | ation      |      | Pr | ote |
| r | _        | 29       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 | _  | 0       | x7a1     | 0 (3124    | 8)   | U  | DP  |
| Π |          | 32       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | Mark/U  | Inmark   | Packet     |      | ЖM | 2   |
|   |          | 34       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.203 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | Ignore/ | Unign    | ore Packet |      | жD | 2   |
|   |          | 38       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | Set/Un  | set Tin  | ne Referen | ice  | ЖT | 2   |
|   |          | 39       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | Time S  | hift     |            | Ŷ    | жт | 2   |
|   |          | 40       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | Раскет  | Comn     | ients      |      | •  | Þ   |
|   |          | 41       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | Edit Re | solved   | Name       |      |    | þ   |
|   |          | 42       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | A       | - Files  |            |      |    | -2  |
|   |          | 43       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | Apply a | as Fille | ltor       |      |    | 2   |
|   |          | 48       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.203 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | Conver  | e as ri  | Filtor     |      |    | þ   |
|   |          | 51       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | Coloriz | e Com    | versation  |      |    | þ   |
|   |          | 52       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | SCTP    | 0011     | reroution  |      |    | Þ   |
|   |          | 53       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | Follow  |          |            |      |    | þ   |
|   |          | 54       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | -       |          |            |      |    | ->  |
|   |          | 55       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | Сору    |          |            |      | •  | Þ   |
|   |          | 56       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | Protoco | ol Pref  | erences    |      | •  | 2   |
|   |          | 57       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | Decode  | e As     |            |      |    | P   |
|   |          | 58       | Feb    | 21,     | 2023    | 17:30:5.   | . 10.201 | 1.38.14 | 10 | 2   | 239.0  | .1.11 |    | Show P  | Packet   | in New Wi  | ndow |    | 2   |
|   |          | = 0      |        | 0.4     | 0000    | 47 20 5    | 40 000   |         |    |     |        |       | _  |         |          | 0 /04.45   | 01   |    | -   |

3. Look for the **Current** column and choose RTP. Click **Ok**.

| • |                   |       |                          |         | Wireshark      | · Decode As |                     |              |                |                |
|---|-------------------|-------|--------------------------|---------|----------------|-------------|---------------------|--------------|----------------|----------------|
| [ | Field<br>UDP port | Value | Type<br>Integer, base 10 | Default | Current<br>RTP |             |                     |              |                |                |
|   |                   |       |                          | (       |                |             |                     |              |                |                |
|   |                   |       |                          |         |                |             |                     |              |                |                |
|   |                   |       |                          |         |                |             |                     |              |                |                |
|   |                   |       |                          |         |                |             |                     |              |                |                |
|   |                   |       |                          |         |                |             |                     |              |                |                |
|   |                   |       |                          |         |                |             |                     |              |                |                |
|   |                   |       |                          |         |                |             |                     |              |                |                |
|   | + -               | ъ     | 0                        |         |                |             | <u>/Users/laria</u> | asca/.config | /wireshark/dec | ode_as_entries |
|   | Help              | Copy  | r from                   |         |                |             |                     | Save         | Cancel         | ОК             |

Wireshark decodes the entire UDP stream into RTP and we can now analyze the contents.

|      |         | 2      | ۲      |         |         | ×       | 3     | ٩    | ۰    | ۲    | •  | ٠ | ≛ | _       |       | Ð, | e,  |           | 11    |       |        |                 |          |      |        |
|------|---------|--------|--------|---------|---------|---------|-------|------|------|------|----|---|---|---------|-------|----|-----|-----------|-------|-------|--------|-----------------|----------|------|--------|
| l ip | .addr== | 10.201 | 38.140 | 8& ip   | .addr=: | =239.0. | .1.11 |      |      |      |    |   |   |         |       |    |     |           |       |       |        |                 |          |      |        |
| No.  |         |        | Arriva | al Time | )       |         |       | Sour | се   |      |    |   |   | Destina | tion  |    | - I | dentifica | ation |       | Protoc | ol Frame length | Info     |      |        |
| г    |         | 29     | Feb    | 21,     | 2023    | 17:3    | 0:5   | 10.  | 201. | 38.1 | 40 |   |   | 239.0   | .1.11 |    | (   | 0x7a10    | 0 (3  | 1248) | RTP    | 218             | PT=ITU-1 | G.71 | 1 PCMU |
|      |         | 32     | Feb    | 21,     | 2023    | 17:3    | 0:5   | 10.  | 201. | 38.1 | 40 |   |   | 239.0   | .1.11 |    | (   | 0x7a1b    | b (3  | 1259) | RTP    | 218             | PT=ITU-1 | G.71 | 1 PCMU |
|      |         | 34     | Feb    | 21,     | 2023    | 17:3    | 0:5   | 10.  | 201. | 38.1 | 40 |   |   | 239.0   | .1.11 |    | (   | 0x7a24    | 4 (3  | 1268) | RTP    | 218             | PT=ITU-1 | G.71 | 1 PCMU |
|      |         | 38     | Feb    | 21,     | 2023    | 17:3    | 0:5   | 10.  | 201. | 38.1 | 40 |   |   | 239.0   | .1.11 |    | (   | 0x7a38    | 8 (3  | 1288) | RTP    | 218             | PT=ITU-1 | G.71 | 1 PCMU |
|      |         | 39     | Feb    | 21,     | 2023    | 17:3    | 0:5   | 10.  | 201. | 38.1 | 40 |   |   | 239.0   | .1.11 |    | (   | 0x7a49    | 9 (3  | 1305) | RTP    | 218             | PT=ITU-1 | G.71 | 1 PCMU |
|      |         | 40     | Feb    | 21,     | 2023    | 17:3    | 0:5   | 10.  | 201. | 38.1 | 40 |   |   | 239.0   | .1.11 |    | (   | 0x7a57    | 7 (3  | 1319) | RTP    | 218             | PT=ITU-1 | G.71 | 1 PCMU |
|      |         | 41     | Feb    | 21,     | 2023    | 17:3    | 0:5   | 10.  | 201. | 38.1 | 40 |   |   | 239.0   | .1.11 |    | (   | 0x7a58    | 8 (3  | 1320) | RTP    | 218             | PT=ITU-1 | G.71 | 1 PCMU |
|      |         | 42     | Feb    | 21,     | 2023    | 17:3    | 0:5   | 10.  | 201. | 38.1 | 40 |   |   | 239.0   | .1.11 |    | (   | 0x7a63    | 1 (3  | 1329) | RTP    | 218             | PT=ITU-1 | G.71 | 1 PCMU |
|      |         | 43     | Feb    | 21,     | 2023    | 17:3    | 0:5   | 10.  | 201. | 38.1 | 40 |   |   | 239.0   | .1.11 |    | (   | 0x7a65    | 5 (3  | 1333) | RTP    | 218             | PT=ITU-1 | G.71 | 1 PCMU |
|      |         | 48     | Feb    | 21,     | 2023    | 17:3    | 0:5   | 10.  | 201. | 38.1 | 40 |   |   | 239.0   | .1.11 |    | (   | 0x7a77    | 7 (3  | 1351) | RTP    | 218             | PT=ITU-1 | G.71 | 1 PCMU |
|      |         |        |        |         |         |         |       |      |      |      |    |   |   |         |       |    |     |           |       |       |        |                 |          |      |        |

**Caution**: RTP Player is able to play any codec supported by an installed plugin. The codecs supported by RTP Player depend on the version of Wireshark youâ€<sup>TM</sup>re using. The official builds contain all of the plugins maintained by the Wireshark developers, but custom/distribution builds are not include some of those codecs. To check your Wireshark installed codec plugins, do the following: **Open Help** > **About Wireshark**. Select the **Plugins** tab. In the **Filter by** type menu, select **Codec**.

4. Check the RTP statistics to see if there is any jitter or loss in the audio stream. To see the analyzis navigate to **Telephony** > **RTP** > **RTP Stream Analysis**.

| ture  | Analyze    | Statistics | Telephony     | Wireless    | Tools | Help     |               |             |              |          | •     |     |
|-------|------------|------------|---------------|-------------|-------|----------|---------------|-------------|--------------|----------|-------|-----|
|       |            |            | VoIP Calls    |             |       |          | 🚄 Testll      | PPhoneGi302 | 5.pcap       |          |       |     |
| Sourc | e          |            | ANSI          |             | >     | ntificat | ion           | Protocol    | Frame length | Info     |       |     |
| 10.2  | 201.38.140 | )          | GSM           |             | >     | 7a10     | (31248)       | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 201.38.140 | )          | IAX2 Stream   | n Analysis  |       | 7a1b     | (31259)       | RTP         | 218          | PT=ITU-T | G.711 | P   |
| 10.2  | 201.38.140 | )          | ISUP Messa    | ges         |       | :7a24    | (31268)       | RTP         | 218          | PT=ITU-T | G.711 | P   |
| 10.2  | 201.38.140 | )          | LTE           |             | >     | :7a38    | (31288)       | RTP         | 218          | PT=ITU-T | G.711 | P   |
| 10.2  | 201.38.140 | )          | MTP3          |             | >     | :7a49    | (31305)       | RTP         | 218          | PT=ITU-T | G.711 | P   |
| 10.2  | 01.38.140  | )          | Osmux         |             | >     | :7a57    | (31319)       | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 201.38.140 |            | DTD           |             | >     | DTD      | troome        | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 01.38.140  |            | DTCD          |             |       |          | Stream Applus | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 201.38.140 |            | RISP          |             |       | RIPS     | stream Analys | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 201.38.140 |            | SCIP          |             | ,     | RIPP     | layer         | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 201.38.140 |            | SMPP Opera    | ations      |       | :7a8b    | (31371)       | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 201.38.140 |            | UCP Messag    | ges         |       | :7a94    | (31380)       | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 01.38.140  |            | F1AP          |             |       | :7aa8    | (31400)       | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 201.38.140 |            | NGAP          |             |       | :7ab9    | (31417)       | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 201.38.140 | )          | H.225         |             |       | :7abd    | (31421)       | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 201.38.140 | )          | SIP Flows     |             |       | :7ac9    | (31433)       | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 201.38.140 | )          | SIP Statistic | s           |       | :7acf    | (31439)       | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 201.38.140 | )          | WAP-WSP P     | Packet Coun | ter   | :7ad2    | (31442)       | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 201.38.140 |            |               |             | -     | 7ae3،    | (31459)       | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 201.38.140 | )          | 239.0.        | 1.11        | 0     | x7ae6    | (31462)       | RTP         | 218          | PT=ITU-T | G.711 | . P |
| 10.2  | 201.38.140 | )          | 239.0.        | 1.11        | 0     | x7af3    | (31475)       | RTP         | 218          | PT=ITU-T | G.711 | . P |

|               |                    |          |          |            |             |           |           | × Stream 0    | $\times$ Graph |
|---------------|--------------------|----------|----------|------------|-------------|-----------|-----------|---------------|----------------|
| Stream        |                    | Packet ^ | Sequence | Delta (ms) | Jitter (ms) | Skew      | Bandwidth | Marker Status |                |
| 10 201 29 14  | 0.20764 ->         | 29       | 10053    | 0.000000   | 0.000000    | 0.000000  | 1.60      | ~             |                |
| 239.0.1.11:20 | 764                | 32       | 10054    | 20.234000  | 0.014625    | -0.234000 | 3.20      | $\checkmark$  |                |
| 200.0.1.11.20 | /04                | 34       | 10055    | 19.451000  | 0.048023    | 0.315000  | 4.80      | ~             |                |
| SSRC          | 0x695712bb         | 38       | 3 10056  | 20.237000  | 0.059834    | 0.078000  | 6.40      | $\checkmark$  |                |
| Max Delta     | 25.304000 ms @ 141 | 39       | 10057    | 20.218000  | 0.069720    | -0.140000 | 8.00      | $\checkmark$  |                |
| Max Jitter    | 1.826388 ms        | 40       | 10058    | 20.052000  | 0.068612    | -0.192000 | 9.60      | ~             |                |
| Mean Jitter   | 0.298929 ms        | 4        | 10059    | 20.054000  | 0.067699    | -0.246000 | 11.20     | ~             |                |
| Max Skew      | 26.911000 ms       | 42       | 2 10060  | 19.202000  | 0.113343    | 0.552000  | 12.80     | ~             |                |
| RTP Packets   | \$735              | 43       | 10061    | 20.073000  | 0.110821    | 0.479000  | 14.40     | $\checkmark$  |                |
| Expected      | 735                | 48       | 3 10062  | 20.053000  | 0.107208    | 0.426000  | 16.00     | ~             |                |
| Lost          | 0 (0.00 %)         | 51       | 10063    | 20.194000  | 0.112632    | 0.232000  | 17.60     | $\checkmark$  |                |
| Seq Errs      | 0                  | 52       | 10064    | 20.111000  | 0.112530    | 0.121000  | 19.20     | $\checkmark$  |                |
| Start at      | 10.728624 s @ 29   | 53       | 10065    | 20.090000  | 0.111122    | 0.031000  | 20.80     | $\checkmark$  |                |
| Duration      | 14.69 s            | 54       | 10066    | 20.155000  | 0.113864    | -0.124000 | 22.40     | ~             |                |
| Clock Drift   | 18 ms              | 55       | 5 10067  | 20.014000  | 0.107623    | -0.138000 | 24.00     | ~             |                |
| Freq Drift    | 8019 Hz (0.12 %)   | 56       | 5 10068  | 19.925000  | 0.105584    | -0.063000 | 25.60     | ~             |                |
| -             |                    | 57       | 10069    | 20.093000  | 0.104797    | -0.156000 | 27.20     | ~             |                |
|               |                    | 58       | 3 10070  | 19.157000  | 0.150935    | 0.687000  | 28.80     | ~             |                |
|               |                    | 59       | 10071    | 20.060000  | 0.145252    | 0.627000  | 30.40     | ~             |                |
|               |                    | 60       | 10072    | 20.099000  | 0.142361    | 0.528000  | 32.00     | ~             |                |
|               |                    | 6        | 10073    | 20.103000  | 0.139901    | 0.425000  | 33.60     | ~             |                |
|               |                    | 62       | 10074    | 20.098000  | 0.137282    | 0.327000  | 35.20     | ~             |                |
|               |                    | 63       | 10075    | 20.073000  | 0.133264    | 0.254000  | 36.80     | ~             |                |
|               |                    | 64       | 10076    | 40.357000  | 0.147248    | -0.103000 | 38.40     |               |                |

**Jitter:** Is the time delay in sending the voice packets over the network. This is often caused by network congestion or route changes. This measurement must be < 30ms.

Lost: Packets that were not received as part of the audio stream. Packet loss must not be more than 1%.

5. Convert the audio wave from this stream in **Telephony** > **RTP** > **RTP** Streams

| File              | Edit                    | View                    | Go C                          | Capture | Analyze                          | Statistics  | Telephony          | Wireless         | Tools | Help           |                               |                   |                   |                            |
|-------------------|-------------------------|-------------------------|-------------------------------|---------|----------------------------------|-------------|--------------------|------------------|-------|----------------|-------------------------------|-------------------|-------------------|----------------------------|
|                   |                         |                         |                               |         |                                  |             | VoIP Calls         |                  |       |                | TestIPF                       | honeGi302         | 5.pcap            |                            |
| Arriva<br>Feb     | al Time<br>21 . 2       | 023 1                   | 17:30:5                       | Source  | 1.38.14                          | 0           | ANSI<br>GSM        |                  | >     | ntificat       | ion<br>(31248)                | Protocol          | Frame length      | Info<br>PT=TTI             |
| Feb               | 21, 2                   | 023 1                   | 17:30:5                       | 10.20   | 01.38.14                         | 0           | IAX2 Stream        | Analysis<br>des  |       | :7a1b          | (31259)<br>(31268)            | RTP               | 218<br>218        | PT=ITU<br>PT=ITU           |
| Feb<br>Feb        | 21, 2<br>21, 2          | 023 1<br>023 1          | 17:30:5<br>17:30:5            | 10.20   | )1.38.14<br>)1.38.14             | 0           | LTE<br>MTP3        |                  | >     | :7a38<br>:7a49 | (31288)<br>(31305)            | RTP<br>RTP        | 218<br>218        | PT=ITU<br>PT=ITU           |
| Feb<br>Feb        | 21, 2                   | 023 1                   | L7:30:5                       | 10.20   | )1.38.14<br>)1.38.14             | 0           | Osmux              |                  | >     | :7a57          | (31319)<br>Streams            | RTP               | 218<br>218        | PT=ITU<br>PT=ITU           |
| Feb<br>Feb<br>Feb | 21, 2<br>21, 2<br>21, 2 | 023 1<br>023 1<br>023 1 | 17:30:5<br>17:30:5<br>17:30:5 | 10.20   | )1.38.14<br>)1.38.14<br>)1.38.14 | 0<br>0<br>0 | RTSP<br>SCTP       |                  | >     | RTP S<br>RTP P | itream Analysis<br>Player     | RTP<br>RTP<br>RTP | 218<br>218<br>218 | PT=ITU<br>PT=ITU<br>PT=ITU |
| Feb<br>Feb        | 21, 2<br>21, 2          | 023 1<br>023 1          | L7:30:5<br>L7:30:5            | 10.20   | 01.38.14<br>01.38.14             | 0           | SMPP Opera         | itions<br>jes    |       | :7a8b<br>:7a94 | (31371)<br>(31380)            | RTP<br>RTP        | 218<br>218        | PT=ITU<br>PT=ITU           |
| Feb<br>Feb        | 21, 2                   | 023 1                   | 17:30:5<br>17:30:5            | 10.20   | )1.38.14<br>)1.38.14             | 0           | F1AP<br>NGAP       |                  |       | :7aa8<br>:7ab9 | (31400)<br>(31417)            | RTP<br>RTP        | 218<br>218        | PT=ITU<br>PT=ITU           |
| Feb               | 21, 2<br>21, 2<br>21, 2 | 023 1                   | L7:30:5<br>L7:30:5<br>L7:30:5 | 10.20   | 01.38.14<br>01.38.14             | 0<br>0      | H.225<br>SIP Flows |                  |       | :7abd<br>:7ac9 | (31421)<br>(31433)<br>(31439) | RTP               | 218<br>218<br>218 | PT=ITU<br>PT=ITU<br>PT=TTI |
| Feb               | 21, 2 21, 2             | 023 1                   | 17:30:5<br>17:30:5            | 10.20   | 01.38.14                         | 0           | SIP Statistics     | s<br>acket Count | ter   | :7ad2<br>.7ae3 | (31442)<br>(31459)            | RTP               | 218               | PT=ITU<br>PT=ITU           |
| Feb               | 21, 2                   | 023 1                   | 17:30:5                       | 10.20   | 01.38.14                         | 0           | 239.0.             | 1.11             | 0     | x7ae6          | (31462)                       | RTP               | 218               | PT=ITU                     |

6. Select the stream to convert it to audio and click on Play Streams.

| • | • •   | Wireshark · RTP Str  | reams · TestIPPhone       | Gi3025.pcap        |                         |                   |                 |
|---|---|--|---------------------------|--------------------|-------------------------|-------------------|-----------------|
|   | Source Address  A Source P 10.201.38.140 20764  | ort Destination Address<br>239.0.1.11                        | Destination Port<br>20764 | SSRC<br>0x695712bb | Start Time<br>10.728624 | Duration<br>14.69 | Payloa<br>g711L |
|   | 1 streams, 1 selected, 735 total pack<br>Limit to display filter T<br>Help Find Reverse | kets. Right-click for more options.<br>ime of Day<br>Analyze | ► Play Streams            | Сору 🕑             | Export                  |                   | Close           |

An audio wave must show up and the play button is available to listen in to the audio data. Hearing the audio helps to identify if there is choppy voice or one-way audio issues with the streams.



7. Export the stream into an audio file with .wav extension by clicking in **Export > File Synchronized Audio**.

| k Timing: Jitte  | er Buffer  | C Time of      | Day  |                                     |
|------------------|------------|----------------|--|-------------------------------------|
| Inaudible stream | ns Analyze | Prepare Filter | Export V<br>From cursor                              |                                     |
|                  |            |                | Stream Synchronized Audio<br>File Synchronized Audio |                                     |
|                  |            |                | Payload Save audio data synchro                      | nized to start of the capture file. |

## Troubleshoot

After using the SPAN feature to collect and analyze the capture with Wireshark, we would have an understanding if the issue can be related to jitter, packet loss or one-way audio. If any issues found in the packet captures, next step is to check the device where capture was taken for any common problems that can impact a RTP audio stream.

#### **Choppy Audio**

Insufficient bandwidth, jitter and/or packet loss can be common causes to hearing broken voice or distortion in the audio capture.

1. Check if the jitter on the capture is > 30ms. If so, this indicates there is a time delay on the reception of the packets that can be caused by QoS policies or routing issues.

2. Verify if the packet lost on the capture is > 1%. In case this value is high, need to look for packet drops

along the path of the audio stream flow.

3. Check for drops on the ingress and egress interfaces involved in the path.

<#root>

Switch#

show interface Gi1/0/1 | inc drops

```
Input queue: 0/2000/0/0 (size/max/drops/flushes); Total output drops: 0
0 unknown protocol drops
```

<#root>

Switch#

show interfaces Gi1/0/1 counters errors

| Port    | Align-Err  | FCS-Err   | Xmit-E   | rr Rcv-E   | rr UnderSi | ize OutDis | scards |
|---------|------------|-----------|----------|------------|------------|------------|--------|
| Gi1/0/1 | 0          | 0         |          | 0          | 0          | 0          | 0      |
| Port    | Single-Col | Multi-Col | Late-Col | Excess-Col | Carri-Sen  | Runts      | 5      |
| Gi1/0/1 | 0          | 0         | 0        | 0          | 0          | e          | )      |

Verify that there are no incrementing input/output drops or other incrementing errors on the interfaces.

4. Check the QoS egress policy on the interfaces involved in the path. Ensure that your traffic is mapped/classified in the Priority queue and that there are no drops in this queue.

<#root>

Switch#

show platform hardware fed switch 1 gos queue stats interface Gi1/0/1

| AQM G<br>Globa<br>Globa  | lobal coun<br>lHardLimit<br>lSoftLimit | ters<br>: 3976   GlobalH<br>: 15872   GlobalS | ardBufCount: 0<br>oftBufCount: 0 |                        |                     |
|--------------------------|--|---|----------------------------------|------------------------|---------------------|
| High N                   | Vatermark                              | Soft Buffers: Port M                          | onitor Disabled                  |                        |                     |
| Asic:(                   | 0 Core:1 D                             | ATA Port:0 Hardware E                         | nqueue Counters                  |                        |                     |
| Q Bu <sup>-</sup><br>(Co | ffers<br>ount)                         | Enqueue-TH0<br>(Bytes)                        | Enqueue-TH1<br>(Bytes)           | Enqueue-TH2<br>(Bytes) | Qpolicer<br>(Bytes) |
| 0                        | 0                                      | 0   | 707354                           | 2529238                | 0                   |
| <<< P1                   | riority Q                              |   |                                  |                        |                     |
| 1                        | 0                                      | 0   | 0                                | 1858516                | 0                   |
| 2                        | 0                                      | 0   | 0                                | 0                      | 0                   |
| 3                        | 0                                      | 0   | 0                                | 0                      | 0                   |

| 4<br>5<br>6<br>7<br>Asic:0 Cc | 0<br>0<br>0<br>0<br>pre:1 DATA Port:0 Hard | 0<br>0<br>0<br>ware Drop Counters | 0<br>0<br>0         | 0<br>0<br>0         | 0<br>0<br>0<br>0 |
|-------------------------------|--|-----------------------------------|---------------------|---------------------|------------------|
| Q                             | Drop-TH0<br>(Bytes)                        | Drop-TH1<br>(Bytes)               | Drop-TH2<br>(Bytes) | SBufDrop<br>(Bytes) | Qeb<br>(By       |
| 0                             | 0  | 0                                 | 0                   | 0                   |                  |
| <<< Prior                     | tity Q Drops                               |                                   |                     |                     |                  |
| 1                             | 0  | 0                                 | 0                   | 0                   |                  |
| 2                             | 0  | 0                                 | 0                   | 0                   |                  |
| 3                             | 0  | 0                                 | 0                   | 0                   |                  |
| 4                             | 0  | 0                                 | 0                   | 0                   |                  |
| 5                             | 0  | Ø                                 | 0                   | Ø                   |                  |
| 6                             | 0  | 0                                 | 0                   | Ø                   |                  |
| 7                             | 0  | Ő                                 | 0                   | 0                   |                  |

**Note**: If there are drops, make sure to profile the Voice traffic properly with DSCP Expedite Forwarding (EF) markings, and confirm that there are no other rogue flows erroneously been marked with the EF bit, thus congesting the Priority queue.

#### **One-Way Audio**

When a phone call is established, only one of the parties receive the audio. Common causes for this issue are related to reachability issues, routing problems or NAT/Firewall issues.

1. Do a ping to the destination subnet or destination gateway to confirm there is bi-directional reachability.

<#root>

Switch#

```
ping 192.168.1.150
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.150, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

2. Do a traceroute from source to destination subnet and viceversa. This can help check how many hops are in the path and if it is symmetric.

<#root>

Switch#

traceroute 192.168.1.150

Type escape sequence to abort. Tracing the route to 192.168.1.150 VRF info: (vrf in name/id, vrf out name/id)
1 192.168.2.12 2 msec \* 1 msec
2 192.168.1.12 2 msec \* 1 msec
3 192.168.1.150 2 msec 2 msec 1 msec

3. Check that the Gateway device for each subnet has optimal routing in place and that there is no assymetric paths potentially affecting the communication.

**Tip**: Common one-way audio issues are related to misconfigured ACLs on Firewall rules or NAT issues. It is suggested to verify if these things could be affecting the audio stream flow.

4. Take a packet capture on the last device where the audio traffic was seen in for the failing direction. This can help isolate in which device of the path is the audio flow been lost. This is important because ping traffic can be allowed via NAT or firewall device, but specific audio traffic can be blocked or not translated properly.

### **Related Information**

<u>Cisco Technical Support & Downloads</u>