Engineering Advisory 70568

Polycom® UC Software PTT/Group Paging Audio Packet Format

This engineering advisory provides details about the format of the packets used in the Push-to-Talk (PTT) and Group Paging features available in Polycom® UC Software 4.0.x.

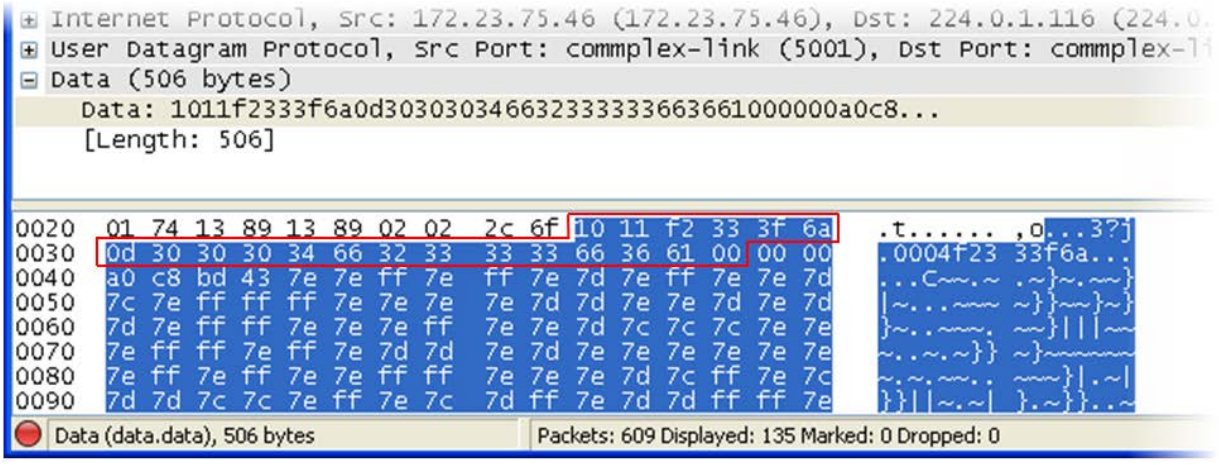
This engineering advisory applies to administrators or product developers who want to interoperate their products with the Polycom Multicast PTT/Group Paging feature.

The PTT and Group Paging features work by multicasting packets on a certain channel to an IP address and port set by an administrator. By default, packets are multicast to the IP address 224.0.1.116 using UDP and port 5001. Each packet consists of either a header, or a header and additional audio, depending on the packet type. The header of each packet is 20 bytes and consists of the 5 fields shown next in Table 1: Header Fields and Size.

Table 1: Header Fields and Size

Op Code	*Channel Number*	*Host Serial Number*	*Caller ID Length*	*Caller ID*
1 byte	1 byte	4 bytes	1 byte	13 bytes

The header network byte order begins with the Op Code field and ends with the Caller ID field as highlighted in the following Wireshark capture.



Header Fields

This section describes each of the 5 fields found in the header.

Op Code

The Op Code field is 1 byte and provides information about the packet type. There are three packet types: *PTT Alert*, *PTT Transmit*, and *PTT End of Transmit*. Use Table 2: Op Codes to match an Op Code to the corresponding packet type and to understand the function of each packet type.

Table 2: Op Codes

Op Code	*Packet Type*	*Packet Purpose*
0F	PTT Alert	This packet signals all phones listening on the current channel that a phone is about to begin broadcasting.
10	PTT Transmit	This packet is used to transfer audio data and is the only packet type which contains audio frames.
FF	PTT End of Transmit	This packet signals all phones that the broadcasting phone has completed its broadcast.

Channel Number

The channel number field is 1 byte and represents the channel that the packet is transmitted on. The channels range from 1 – 50, with channels 1 – 25 for PTT, and channels 26 – 50 for paging. The PTT/Paging feature enables users to broadcast messages with a certain priority level: Normal, Priority, or Emergency. By default, the PTT feature treats channel 24 as a Priority channel and channel 25 as an Emergency channel while the Paging feature treats channel 49 as the Priority channel and channel 50 as the Emergency channel. The Priority and Emergency channels can be changed by administrators.

Host Serial Number

The host serial number field is 4 bytes and represents the last 4 bytes of the serial number/MAC address of the broadcasting phone. This field is used for contention resolution – when multiple phones begin broadcasting on the same channel at the same time, the phone with the lowest serial number continues to broadcast and all other phones will stop broadcasting. Any 32-bit number can be used in place of the serial number as long as its value is guaranteed to be unique among the multicast participants.

Caller ID Length

The caller ID length field is 1 byte and represents the number of bytes in the caller ID field. Although the packet includes the caller ID length, the encoded length and length of the caller ID string are fixed at 13.

Caller ID

The caller ID field is 13 bytes and consists of a text string (a phone's extension for example) that identifies the broadcasting phone. If this string is less than 13 bytes, it is terminated with a null. Otherwise, if this field is null, the value from `reg.1.displayName` (found in the **reg-basic.cfg** file) will be used. If that too is null, the phone's MAC address will be used. A receiving phone displays the caller ID on its screen.

Audio Data

Audio data is only present in a *PTT Transmit* packet. There are two codecs which can be used to send the audio data:

1. G.722 – Typical audio payload is 240 bytes (30ms)
2. G.711u – Typical audio payload is 240 bytes (30ms)

Audio data consists of a 6 byte audio header followed by two frames of audio data. The first frame is a redundant frame—it contains a copy of the audio from the previous packet. The second frame contains the current audio. The only exception is the first PTT Transmit packet, which will not contain a redundant audio frame. An example Audio Header is shown next in Table 3: Audio Header Example

Table 3: Audio Header Example

Number of Bytes	*Description*	*Notes*
1	Codec Type	0x00 means G.711µ 0x09 means G.722
1	Flags Byte	Not applicable
4	Sample Count	RTP timestamp for the second audio frame (except for the first PTT transmit packet, then it's for the first and only audio frame)

PTT/Page Session

A PTT or Page is initiated by sending 31 PTT Alert packets at approximately 30 millisecond intervals, followed by the transmission of the audio data in PTT Transmit packets. Upon completion of the Page, after a 50 millisecond delay, 12 PTT End of Transmit packets are sent at approximately 30 millisecond intervals completing the Page.

Example Page Session

The following example shows a Wireshark capture of a short paging session, specifically a PTT session, using the G.711µ codec with a 20 msec sample size (resulting in an audio frame of 160 bytes). A different PTT session will contain a different number of bytes (and packets).

The following tables (Tables 4 to 12) provide packet details of the entire audio frame (187 packets). Included is:

- Packet number and type
- Transmit time in seconds
- Source and destination IP addresses
- Protocol used
- VLAN formation
- Packet contents—Highlighted contents are explained in detail

In some instances, the packet contents are a repeat of previous packets. These are noted in the following tables.

Table 4: First PTT Alert Packet

Pkt No.	*Time (seconds)*	*Source IP Address*	*Destination IP Address*	*Protocol*	*VLAN Info*
1	0.000000	192.168.1.103	224.0.1.116	UDP	Source port: complex-link Destination port: complex-link
	0000 01 00 5e 00 01 74 00 04 f2 11 15 11 08 00 45 00 ..^..t.....E. 0010 00 30 16 71 00 00 40 11 c0 c8 c0 a8 01 67 e0 00 .0.q..@.....g.. 0020 01 74 13 89 13 89 00 1c 90 63 **0f 1a f2 11 15 11** .t.....c..... 0030 **0d 4d 65 6c 6f 64 79 20 4d 65 73 65 72 76** .Melody Meserv				Alert packet Highlighted contents described in table below

Table 5: Contents of PTT Alert Packet

Field Value	*Number of Bytes*	*Field Name*	*Notes*
0f	1	Op Code	PTT Alert
1a	1	Channel Number	26 (first channel in paging range)

Field Value	*Number of Bytes*	*Field Name*	*Notes*
f2 11 15 11	4	Host Serial Number	Last four bytes of phones MAC address (004f2111511)
0d	1	Caller ID Length	13
4d 65 6c 6f 64 79 20 4d 65 73 65 72 76	13	Caller ID	Melody Meserv

Table 6: Remainder of PTT Alert Packets

Pkt Nos.	*Time (seconds)*	*Source IP Address*	*Destination IP Address*	*Protocol*	*VLAN Info*
2 - 31	every 0.030 (approx.)	192.168.1.103	224.0.1.116	UDP	Source port: complex-link Destination port: complex-link
	0000 01 00 5e 00 01 74 00 04 f2 11 15 11 08 00 45 00 ..^..t.....E. 0010 00 30 16 71 00 00 40 11 c0 c8 c0 a8 01 67 e0 00 .0.q..@.....g.. 0020 01 74 13 89 13 89 00 1c 90 63 0f 1a f2 11 15 11 .t.....c..... 0030 0d 4d 65 6c 6f 64 79 20 4d 65 73 65 72 76 .Melody Meserv				Repeat of Packet 1

After the 32 PTT Alert packets, the actual data transmission starts with the PTT Transmit packets.

Table 7: First PTT Transmit Packet

Pkt No.	*Time (seconds)*	*Source IP Address*	*Destination IP Address*	*Protocol*	*VLAN Info*
32	0.969281	192.168.1.103	224.0.1.116	UDP	Source port: complex-link Destination port: complex-link

Pkt No.	*Time (seconds)*	*Source IP Address*	*Destination IP Address*	*Protocol*	*VLAN Info*
					1st PTT Transmit packet

```
0000  01 00 5e 00 01 74 00 04 f2 11 15 11 08 00 45 00  ..^..t........E.
0010  00 d6 16 90 00 00 40 11 c0 03 c0 a8 01 67 e0 00  ......@......g..
0020  01 74 13 89 13 89 00 c2 65 76 10 1a f2 11 15 11  .t......ev......
0030  0d 4d 65 6c 6f 64 79 20 4d 65 73 65 72 76 09 00  .Melody Meserv..
0040  6f ca 7b f5 5e 7a f7 70 f4 7a 5e db f2 5e d7 dc  o.{.^z.p.z^..^..
0050  f5 f8 ef fb 5c 6d b1 9f b9 9d b9 b3 f3 9d f9 f3  ....\m..........
0060  79 f6 dd f4 9f df fb f2 b3 fb 76 f6 ba d7 fb b8  y.........v.....
0070  de 59 f8 f8 b2 fa dc dc fb df 9b 5f f9 d8 dd b7  .Y........_.....
0080  b8 f9 5d f9 df f9 9d f5 f9 f7 bb 79 f7 9d f5 75  ..]........y...u
0090  f9 f5 9f f9 fb fb f2 f9 79 f9 b7 fb bb df f7 f7  ........y.......
00a0  f9 b9 f9 f9 5f 76 b9 f6 b9 6e ea a8 6d f1 f3 9d  ...._v...n..m...
00b0  df 75 76 9c d7 fa ba 5d da 7e 57 99 dc 98 de f4  .uv....].~W.....
00c0  f3 30 f4 f7 b8 de df f4 73 bb 7e 78 fa da 99 f9  .0......s.~x....
00d0  df 5b de da 5e 5f bc 9c f7 bc 78 f8 79 b4 6d f4  .[..^_....x.y.m.
00e0  fc fb fa bc
```

Highlighted contents described in table below

Table 8: Contents of First PTT Transmit Packet

Field Value	*Number of Bytes*	*Field Name*	*Notes*
10	1	Op Code	PTT Transmit
1a	1	Channel Number	26 (first channel in paging range)
f2 11 15 11	4	Host Serial Number	Last four bytes of phones MAC address (004f2111511)
0d	1	Caller ID Length	13
4d 65 6c 6f 64 79 20 4d 65 73 65 72 76 09	13	Caller ID	Melody Meserv
00	1	Codec	G.711 µ
6f	1	Flags	Not applicable
ca 7c 95 5e	4	RTP Sequence number	
7a f7 70 f4 7a...	160	Audio frame	

Table 9: Second PTT Transmit Packet

Pkt No.	*Time (seconds)*	*Source IP Address*	*Destination IP Address*	*Protocol*	*VLAN Info*
33	0.989055	192.168.1.103	224.0.1.116	UDP	Source port: complex-link Destination port: complex-link
	0000 01 00 5e 00 01 74 00 04 f2 11 15 11 08 00 45 00 ..^..t.....E. 0010 00 d6 16 90 00 00 40 11 c0 03 c0 a8 01 67 e0 00 ......@.....g.. 0020 01 74 13 89 13 89 00 c2 65 76 **10 1a f2 11 15 11** .t.....ev..... 0030 **0d 4d 65 6c 6f 64 79 20 4d 65 73 65 72 76 09 00** .Melody Meserv.. 0040 **6f ca 7b f5 5e** 7a f7 70 f4 7a 5e db f2 5e d7 dc o.{.^z.p.z^..^.. 0050 f5 f8 ef fb 5c 6d b1 9f b9 9d b9 b3 f3 9d f9 f3 ....\m..... 0060 79 f6 dd f4 9f df fb f2 b3 fb 76 f6 ba d7 fb b8 y.....v..... 0070 de 59 f8 f8 b2 fa dc dc fb df 9b 5f f9 d8 dd b7 .Y....._.... 0080 b8 f9 5d f9 df f9 9d f5 f9 f7 bb 79 f7 9d f5 75 ..]....y...u 0090 f9 f5 9f f9 fb fb f2 f9 79 f9 b7 fb bb df f7 f7 ....y..... 00a0 f9 b9 f9 f9 5f 76 b9 f6 b9 6e ea a8 6d f1 f3 9d ...._v...n..m... 00b0 df 75 76 9c d7 fa ba 5d da 7e 57 99 dc 98 de f4 .uv....].~W..... 00c0 f3 30 f4 f7 b8 de df f4 73 bb 7e 78 fa da 99 f9 .0.....s.~x.... 00d0 df 5b de da 5e 5f bc 9c f7 bc 78 f8 79 b4 6d f4 .[..^_....x.y.m. 00e0 fc fb fa bc d7 5f 7b 5a ba f8 be d8 79 f4 dc bb .....{Z....y... 00f0 75 f7 fe f9 78 71 9f b9 71 f5 9d 5f f8 7e d9 bc u...xq..q.._.~.. 0100 ba 5e dd db 7a 5b b0 f6 f0 df 77 78 b5 b9 f4 f2 .^..z[....wx.... 0110 79 fc 5f 73 bc 9f f9 f9 f6 57 fc 79 b8 fc f8 ba y._s.....W.y.... 0120 fe fc fa 73 fc db f5 f7 9d 76 fe fa 9e ba 78 7e ...s.....v....x~ 0130 fe dc de b8 d9 fb f3 de b8 f6 38 fb 9f f3 f5 f7 .....8..... 0140 f8 74 71 9b 7c b8 fa de fe de f3 5e b4 f1 f8 76 .tq.|.....^...v 0150 b8 b8 fc de 75 75 f7 f8 fe be 5c 99 9f 75 7b 7a ....uu....\..u{z 0160 f6 9f 78 f8 f8 fb dd f1 f5 fb fb f2 78 de f3 9e ..x.....x... 0170 f6 9e 7b f5 b8 de f2 7a 97 b7 de f8 75 b7 78 b4 ..{....z....u.x. 0180 5c fa f1 fa				2nd PTT Transmit packet Highlighted contents described in table below

Table 10: Contents of Second PTT Transmit Packet

Field Value	*Number of Bytes*	*Field Name*	*Notes*
10	1	Op Code	PTT Transmit
1a	1	Channel Number	26 (first channel in paging range)
f2 11 15 11	4	Host Serial Number	Last four bytes of phones MAC address (004f2111511)
0d	1	Caller ID Length	13

Field Value	*Number of Bytes*	*Field Name*	*Notes*
4d 65 6c 6f 64 79 20 4d 65 73 65 72 76 09	13	Caller ID	Melody Meserv
00	1	Codec	G.711 µ
6f	1	Flags	Not applicable
ca 7c 95 5e	4	RTP Sequence number	
7a f7 70 f4 7a...	160	Audio frame	Redundant frame (duplicate of last frame in previous packet)
d7 5f 7b 5a ba...	160	Audio frame	New audio frame

The remainder of the PTT Transmit packets (34 - 174) are transmitted every 30 milliseconds. Each packet will contain two audio frames:

- A duplicate of the last audio frame from the previous packet
- A new audio frame

The data transmission is complete. The end of the broadcast is signaled by 12 PTT End of Transmit packets.

Table 11: End of PTT Transmission Packets

Pkt No.	*Time (seconds)*	*Source IP Address*	*Destination IP Address*	*Protocol*	*VLAN Info*
175-187	3.824994	192.168.1.103	224.0.1.116	UDP	Source port: complex-link Destination port: complex-link
	0000 01 00 5e 00 01 74 00 04 f2 11 15 11 08 00 45 00 ..^..t.....E. 0010 00 30 17 1e 00 00 40 11 c0 1b c0 a8 01 67 e0 00 .0....@.....g.. 0020 01 74 13 89 13 89 00 1c a0 62 **ff 1a f2 11 15 11** .t.....b..... 0030 **0d 4d 65 6c 6f 64 79 20 4d 65 73 65 72 76** .Melody Meserv				End of Transmission packet Highlighted contents described in table below

Table 12: Contents of End of PTT Transmission Packet

Field Value	*Number of Bytes*	*Field Name*	*Notes*
ff	1	Op Code	PTT End of Transmit

Field Value	*Number of Bytes*	*Field Name*	*Notes*
1a	1	Channel Number	26 (first channel in paging range)
f2 11 15 11	4	Host Serial Number	Last four bytes of phones MAC address (004f2111511)
0d	1	Caller ID Length	13
4d 65 6c 6f 64 79 20 4d 65 73 65 72 76	13	Caller ID	Melody Meserv

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