

TRANSPORT DES DTMF SUR RESEAU IP

1. DTMF RFC2833

L'appel de l'IPAC commence par la réception d'une requête SIP « INVITE » envoyée par l'appelant en passant via l'IP-PBX.

0	13.422875	192.168.0.252	192.168.0.57	SIP/SDP	1131 Request: INVITE sip:1012@192.168.0.57:5060
1	13.453700	192.168.0.57	192.168.0.252	SIP	344 Status: 100 Trying
2	13.511200	192.168.0.57	192.168.0.252	SIP	429 Status: 180 Ringing
4	15.206475	192.168.0.57	192.168.0.252	SIP/SDP	810 Status: 200 Ok
0	15.215025	192.168.0.252	192.168.0.57	SIP	461 Request: ACK sip:1012@192.168.0.57:5060
4	21.865050	192.168.0.31	192.168.0.252	SIP	833 Request: REGISTER sip:192.168.0.252:5060 (1 binding)
5	21.873675	192.168.0.252	192.168.0.31	SIP	530 Status: 401 Unauthorized
1	21.901275	192.168.0.31	192.168.0.252	SIP	833 Request: REGISTER sip:192.168.0.252:5060 (1 binding)
5	21.944400	192.168.0.252	192.168.0.31	SIP	784 Request: NOTIFY sip:1006@192.168.0.31:5060
5	21.946950	192.168.0.252	192.168.0.31	SIP	459 Status: 200 OK (1 binding)

Lors de l'envoi du INVITE, on trouve dans la trame SDP l'information **rtpmap:101 telephone-event**, cela correspond au payload de la RFC2833 utilisant les digits DTMF de 0-16 transmis par protocole RTP.

```
Session Description Protocol
  Session Description Protocol Version (v): 0
  Owner/Creator, Session Id (o): - 812222083 812222083 IN IP4 192.168.0.252
  Session Name (s): Asterisk
  Connection Information (c): IN IP4 192.168.0.252
  Bandwidth Information (b): CT:384
  Time Description, active time (t): 0 0
  Media Description, name and address (m): audio 6476 RTP/AVP 0 8 3 2 9 18 101
    Media Type: audio
    Media Port: 6476
    Media Protocol: RTP/AVP
    Media Format: ITU-T G.711 PCMU
    Media Format: ITU-T G.711 PCMA
    Media Format: GSM 06.10
    Media Format: ITU-T G.721
    Media Format: ITU-T G.722
    Media Format: ITU-T G.729
    Media Format: DynamicRTP-Type-101
  Media Attribute (a): rtpmap:0 PCMU/8000
  Media Attribute (a): rtpmap:8 PCMA/8000
  Media Attribute (a): rtpmap:3 GSM/8000
  Media Attribute (a): rtpmap:2 G726-32/8000
  Media Attribute (a): rtpmap:10 G729/8000
  Media Attribute (a): rtpmap:18 G729/8000
  Media Attribute (a): rtpmap:101 telephone-event/8000
  Media Attribute (a): fmp:101 0-16
    Media Attribute Fieldname: fmp
    Media Format: 101 [telephone-event]
    Media format specific parameters: 0-16
  Media Attribute (a): ptime:20
    Media Attribute Fieldname: ptime
    Media Attribute Value: 20
  Media Attribute (a): maxptime:150
    Media Attribute Fieldname: maxptime
    Media Attribute Value: 150
  Media Attribute (a): sendrecv
14 2d f5 00 01 8c 00 0b 82 62 46 86 08 00 45 00 ..... .bf...E.
04 5d 00 00 40 00 49 11 b4 0a c0 a8 00 fc c0 a8 .J...@. ....
00 39 13 c4 13 c4 04 49 86 e0 49 4e 56 49 54 45 .9....I ..INVITE
20 73 69 70 3a 31 30 31 32 40 31 39 32 2e 31 36 sip:101 2@192.16
58 2e 20 2e 2e 27 2a 25 20 26 20 20 53 40 50 2f 6.0.5725.668.8194
```

Les paquets RTP EVENT = codes DTMF RFC2833

11	16.793525	192.168.0.252	192.168.0.57	RTP	214 PT=ITU-T G.711 PCMU, SSRC=0xc866210, Seq=23516, Time=12640
12	16.793925	192.168.0.57	192.168.0.252	RTP	214 PT=ITU-T G.711 PCMU, SSRC=0x2fbfc1cb, Seq=76, Time=12480
13	16.815150	192.168.0.252	192.168.0.57	RTP EVENT	58 Payload type=RTP Event, DTMF One 1
14	16.815325	192.168.0.252	192.168.0.57	RTP EVENT	58 Payload type=RTP Event, DTMF One 1
15	16.836275	192.168.0.57	192.168.0.252	RTP	214 PT=ITU-T G.711 PCMU, SSRC=0x2fbfc1cb, Seq=77, Time=12640
16	16.836375	192.168.0.57	192.168.0.252	RTP	214 PT=ITU-T G.711 PCMU, SSRC=0x2fbfc1cb, Seq=78, Time=12800
17	16.836475	192.168.0.57	192.168.0.252	RTP	214 PT=ITU-T G.711 PCMU, SSRC=0x2fbfc1cb, Seq=79, Time=12960
18	16.836650	192.168.0.252	192.168.0.57	RTP EVENT	58 Payload type=RTP Event, DTMF One 1
19	16.837050	192.168.0.252	192.168.0.57	RTP EVENT	58 Payload type=RTP Event, DTMF One 1
20	16.837375	192.168.0.252	192.168.0.57	RTP EVENT	58 Payload type=RTP Event, DTMF One 1
21	16.873050	192.168.0.57	192.168.0.252	RTP	214 PT=ITU-T G.711 PCMU, SSRC=0x2fbfc1cb, Seq=80, Time=13120
22	16.873425	192.168.0.252	192.168.0.57	RTP EVENT	58 Payload type=RTP Event, DTMF One 1
23	16.895050	192.168.0.252	192.168.0.57	RTP EVENT	58 Payload type=RTP Event, DTMF One 1 (end)
24	16.895225	192.168.0.252	192.168.0.57	RTP EVENT	58 Payload type=RTP Event, DTMF One 1 (end)
25	16.895325	192.168.0.252	192.168.0.57	RTP EVENT	58 Payload type=RTP Event, DTMF One 1 (end)
26	16.913600	192.168.0.252	192.168.0.57	RTP	214 PT=ITU-T G.711 PCMU, SSRC=0xc866210, Seq=23526, Time=13592
27	16.916075	192.168.0.57	192.168.0.252	RTP	214 PT=ITU-T G.711 PCMU, SSRC=0x2fbfc1cb, Seq=81, Time=13280
28	16.916175	192.168.0.57	192.168.0.252	RTP	214 PT=ITU-T G.711 PCMU, SSRC=0x2fbfc1cb, Seq=82, Time=13440
29	16.916275	192.168.0.57	192.168.0.252	RTP	214 PT=ITU-T G.711 PCMU, SSRC=0x2fbfc1cb, Seq=83, Time=13600

2. DTMF Inband (audio)

Par rapport à la RFC2833 dans la requête d'INVITE en mode Inband, il n'y a de present que les payload des codecs audios. Les DTMF passent en mode audio avec la voix.

Rappel : 0 = PCMU , 8 = PCMA , 3 = GSM, 2 = G.726/G.721 , 9 = G.722 , 18 = G.729

```
192.168.0.57:5060> 192.168.0.252:5060: SIP/2.0 192.168.0.57:5060 Request: INVITE sip:1012@192.168.0.57/5060
> CSeq: 9709 INVITE
> Allow: OPTIONS, INFO, SUBSCRIBE, NOTIFY, PUBLISH, INVITE, ACK, BYE, CANCEL, UPDATE, PRACK, MESSAGE, REFER, REGISTER
> Supported: 100rel, timer, replaces, noferesub
> Session-Expires: 1800
> Min-SE: 90
> Max-Forwards: 70
> User-Agent: Grandstream UCM6102V1.5A 1.0.10.44
> Content-Type: application/sdp
> Content-Length: 316
< Message Body
  < Session Description Protocol
    < Session Description Protocol Version (v): 0
    < Owner/Creator, Session Id (o): - 1955212376 1955212376 IN IP4 192.168.0.252
    < Session Name (s): Asterisk
    < Connection Information (c): IN IP4 192.168.0.252
    < Bandwidth Information (b): CT:384
    < Time Description, active time (t): 0 0
    < Media Description, name and address (m): audio 6644 RTP/AVP 0 8 3 2 9 18
      < Media Type: audio
      < Media Port: 6644
      < Media Protocol: RTP/AVP
      < Media Format: ITU-T G.711 PCMU
      < Media Format: ITU-T G.711 PCMA
      < Media Format: GSM 06.10
      < Media Format: ITU-T G.721
      < Media Format: ITU-T G.722
      < Media Format: ITU-T G.729
      < Media Attribute (a): rtpmap:0 PCMU/8000
      < Media Attribute (a): rtpmap:8 PCMA/8000
      < Media Attribute (a): rtpmap:3 GSM/8000
      < Media Attribute (a): rtpmap:2 G726-32/8000
      < Media Attribute (a): rtpmap:9 G722/8000
00 14 2d f5 00 01 8c 00 0b 82 62 46 86 08 00 45 00 ..... .bf...E.
10 04 26 00 00 40 00 04 11 b4 41 c0 a8 00 fc c0 a8 ..@.@. .A.....
20 00 39 13 c4 13 c4 04 12 86 a9 49 4e 56 49 54 45 ..9..... .INVITE
30 20 73 69 70 3a 31 30 31 32 40 31 39 32 2e 31 36 sip:1012@192.168.
40 38 2e 30 2e 35 37 3a 35 30 36 30 20 53 49 50 2f 8.0.57:5.060 SIP/
```

3. DTMF SIP-INFO

Dans ce cas, lors de l'envoi de la requête INVITE, le type de media DTMF est de format : **Media Attribute (a) : sendrecv**, soit SIP-INFO. Les DTMF seront transmis par requête INFO.

```
Frame 8: 1028 bytes on wire (8224 bits), 1028 bytes captured (8224 bits) on interface 0
> Ethernet II, Src: Grandstr_68:d2:2b (00:0b:82:68:d2:2b), Dst: Amphitech_00:01:8c (14:2d:f5:00:01:8c)
> Internet Protocol Version 4, Src: 192.168.0.168 (192.168.0.168), Dst: 192.168.0.57 (192.168.0.57)
> User Datagram Protocol, Src Port: 5060 (5060), Dst Port: 5060 (5060)
< Session Initiation Protocol (INVITE)
  < Request-Line: INVITE sip:192.168.0.57:5060 SIP/2.0
  < Message Header
  < Message Body
    < Session Description Protocol
      < Session Description Protocol Version (v): 0
      < Owner/Creator, Session Id (o): 1000 8000 8000 IN IP4 192.168.0.168
      < Session Name (s): SIP Call
      < Connection Information (c): IN IP4 192.168.0.168
      < Time Description, active time (t): 0 0
      < Media Description, name and address (m): audio 9078 RTP/AVP 8 0 9
        < Media Type: audio
        < Media Port: 9078
        < Media Protocol: RTP/AVP
        < Media Format: ITU-T G.711 PCMA
        < Media Format: ITU-T G.711 PCMU
        < Media Format: ITU-T G.722
        < Media Attribute (a): sendrecv
        < Media Attribute (a): rtpmap:8 PCMA/8000
        < Media Attribute (a):ptime:20
        < Media Attribute (a): rtpmap:0 PCMU/8000
        < Media Attribute (a): rtpmap:9 G722/8000
        < Media Description, name and address (m): video 9080 RTP/AVP 97
        < Bandwidth Information (b): AS:2240
        < Media Attribute (a): sendrecv
        < Media Attribute (a): rtpmap:97 H264/90000
        < Media Attribute (a): fmtp:97 profile-level-id=4D0014; packetization-mode=1
        < Media Attribute (a): content=main
        < Media Attribute (a): lshl=11
0000 14 2d f5 00 01 8c 00 0b 82 68 d2 2b 08 00 45 c0 ..... .h+...E.
0010 03 f6 88 56 00 00 40 11 cb af c0 a8 00 a8 c0 a8 ...V..@. k.....
0020 00 39 13 c4 13 c4 03 e2 86 25 49 4e 56 49 54 45 ..9..... .INVITE
0030 20 73 69 70 3a 31 30 32 2e 31 36 30 2e 30 2e 35 sip:192.168.0.5
```

Amphitech

535	7.648025	192.168.0.168	192.168.0.57	SIP	660	Request: INFO sip:1012@192.168.0.57
560	7.751735	192.168.0.57	192.168.0.168	SIP	359	Status: 200 Ok
670	8.231177	192.168.0.168	192.168.0.57	SIP	661	Request: INFO sip:1012@192.168.0.57
691	8.307565	192.168.0.57	192.168.0.168	SIP	360	Status: 200 Ok
769	8.696995	192.168.0.168	192.168.0.57	SIP	661	Request: INFO sip:1012@192.168.0.57
785	8.785003	192.168.0.57	192.168.0.168	SIP	360	Status: 200 Ok
873	9.281331	192.168.0.168	192.168.0.57	SIP	661	Request: INFO sip:1012@192.168.0.57
890	9.380309	192.168.0.57	192.168.0.168	SIP	360	Status: 200 Ok
994	9.879140	192.168.0.168	192.168.0.57	SIP	660	Request: INFO sip:1012@192.168.0.57
1006	9.943903	192.168.0.57	192.168.0.168	SIP	359	Status: 200 Ok
1806	14.012849	192.168.0.168	192.168.0.57	SIP	592	Request: BYE sip:1012@192.168.0.57

Ci-dessus on remarque la requête SIP de type INFO , en la détaillant ci-dessous, on trouve le DTMF envoyé (ici DTMF = 1).

```
Frame 873: 661 bytes on wire (5288 bits), 661 bytes captured (5288 bits) on interface 0
Ethernet II, Src: Grandstr_68:d2:2b (00:0b:82:68:d2:2b), Dst: Amphitec_00:01:8c (14:2d:f5:00:01:8c)
Internet Protocol Version 4, Src: 192.168.0.168 (192.168.0.168), Dst: 192.168.0.57 (192.168.0.57)
User Datagram Protocol, Src Port: 5060 (5060), Dst Port: 5060 (5060)
  Source Port: 5060 (5060)
  Destination Port: 5060 (5060)
  Length: 627
  Checksum: 0x84b6 [validation disabled]
  [Stream index: 0]
Session Initiation Protocol (INFO)
  Request-Line: INFO sip:1012@192.168.0.57 SIP/2.0
  Method: INFO
  Request-URI: sip:1012@192.168.0.57
  [Resent Packet: False]
  Message Header
  Message Body
    Signal=1\r\n
    Duration=240\r\n
```