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SERIES V: DATA COMMUNICATION OVER THE
TELEPHONE NETWORK

Interworking with other networks

Procedures for supporting voice-band data over IP networks

Recommendation ITU-T V.152



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Recommendation ITU-T V.152

Procedures for supporting voice-band data over IP networks

Summary

Voice-band data traffic has traditionally been transported by circuit switched systems and equipment. With the advent of the networks optimized for the transport of Internet Protocol (IP), and as a result of its considerable growth and pervasive nature, more and more voice-band data traffic is expected to be carried over IP networks.

Given that voice and voice-band data services remain a significant part of telecommunications, there is a need to ensure a high quality of service for voice and voice-band data carried in part, or wholly, via IP. Recommendation ITU-T V.152 defines procedures for equipment that interconnect GSTN networks with IP networks to provide satisfactory, transparent delivery of modulated voice-band data (VBD) as encoded audio content over IP (data modems, facsimile terminals and text telephones).

Annex B defines a method that uses data signal detection and silence insertion in voiceband data that adds a means of providing bandwidth savings during transmission.

Annex C addresses a problem discovered during the implementation of ITU-T V.152 gateways with the transmission of facsimile terminals. While this issue has been resolved by an amendment to Recommendation ITU-T T.30, due to the extremely large numbers of terminals deployed in the field and the low probability that they would be corrected retroactively, it was considered pre-emptive to include a solution in an ITU-T V.152 media gateway.

This Recommendation is complementary to the modem relay and voice-band data Recommendations (Recommendations ITU-T V.150.0 and V.150.1).

This revision includes the updating of references, general editing improvements for clarity and many additional examples of call control. It also integrates changes introduced by Corrigendum 1 (2005) for clarification to clauses 7.1 and 7.1.1; by Corrigendum 2 (2006) for clarifications on the use and control of echo cancellers and the application of IETF RFC 2833 with VBD; and by Amendment 1 (2009) for new Annexes B and C.

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FOREWORD

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The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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Recommendation ITU-T V.152

Procedures for supporting voice-band data over IP networks

1 Scope

This Recommendation describes the voice-band data (VBD) operation of Voice-over-Internet Protocol (VoIP) gateways and media gateways. The term "VBD" refers only to the use of suitable voice-band codecs for the transport of data payloads via RTP. The VBD procedures described in this Recommendation shall apply to VBD-only capable gateways. An ITU-T V.152 gateway only has the guarantee of interworking with another gateway if that gateway also supports ITU-T V.152.

This does not preclude the interworking with non-ITU-T V.152 gateways; however, there are no guarantees of performance and supported functionality with such systems. The negotiation of a VBD capability does not exclude from a VoIP session any other capabilities such as the transport of audio signals, RFC 4733-based telephone events, ITU-T T.38 facsimile relay, RFC 4103 text relay and ITU-T V.150.1 modem relay, etc.

Declaration of VBD support using the session description protocol (SDP) is detailed in clause 7.1.

Declaration of VBD support using ITU-T H.245 is detailed in clause 7.2.

This Recommendation supports hybrid modes of operation; for example, a device may support a VBD and facsimile relay capability but not a modem relay or text relay capability. In this example of hybrid operation modem and text payloads are transported in the VBD mode, while facsimile payloads could be transported in the ITU-T T.38 facsimile relay mode or in the VBD mode. The negotiation of such hybrid sets of capabilities follows SDP and ITU-T H.245 mechanisms (clause 11).

This Recommendation describes the default mechanism for transitioning into VBD mode via payload-type switching as described in clause 10 and the optional mechanism of utilizing the state signalling events (SSE) messages described in clause 11.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T G.168] Recommendation ITU-T G.168 (2004), *Digital network echo cancellers*.
- [ITU-T G.701] Recommendation ITU-T G.701 (1993), *Vocabulary of digital transmission and multiplexing, and pulse code modulation (PCM) terms*.
- [ITU-T G.711] Recommendation ITU-T G.711 (1988), *Pulse code modulation (PCM) of voice frequencies*.
- [ITU-T G.726] Recommendation ITU-T G.726 (1990), *40, 32, 24, 16 kbit/s Adaptive Differential Pulse Code Modulation (ADPCM)*.
- [ITU-T G.728] Recommendation ITU-T G.728 (1992), *Coding of speech at 16 kbit/s using low-delay code excited linear prediction*.

- [ITU-T G.729] Recommendation ITU-T G.729 (1996), *Coding of speech at 8 kbit/s using conjugate-structure algebraic-code-excited linear prediction (CS-ACELP)*.
- [ITU-T H.245] Recommendation ITU-T H.245 (2005), *Control protocol for multimedia communication*.
- [ITU-T H.248.1] Recommendation ITU-T H.248.1v3 (2005), *Gateway control protocol: Version 3*.
- [ITU-T H.248.2] Recommendation ITU-T H.248.2 (2005), *Gateway control protocol: Facsimile, text conversation and call discrimination packages, plus Amendment 1* (2007), *Discriminated call type enhancement*.
- [ITU-T H.248.39] Recommendation ITU-T H.248.39 (2006), *Gateway control protocol: H.248 SDP parameter identification and wildcarding*.
- [ITU-T H.323] Recommendation ITU-T H.323 (2003), *Packet-based multimedia communications systems*.
- [ITU-T T.30] Recommendation ITU-T T.30 (2005), *Procedure for document facsimile transmission in the general switched telephone network*.
- [ITU-T T.35] Recommendation ITU-T T.35 (2000), *Procedure for the allocation of ITU-T defined codes for non-standard facilities*.
- [ITU-T T.38] Recommendation ITU-T T.38 (2004), *Procedures for real-time Group 3 facsimile communication over IP networks*.
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- [ITU-T V.18] Recommendation ITU-T V.18 (2000), *Operational and interworking requirements for DCEs operating in the text telephone mode*.
- [ITU-T V.21] Recommendation ITU-T V.21 (1988), *300 bits per second duplex modem standardized for use in the general switched telephone network*.
- [ITU-T V.34] Recommendation ITU-T V.34 (1998), *A modem operating at data signalling rates of up to 33 600 bit/s for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits*.
- [ITU-T V.150.1] Recommendation ITU-T V.150.1 (2003), *Modem-over-IP networks: Procedures for the end-to-end connection of V-series DCEs*.
- [IETF RFC 768] IETF RFC 768 (1980), *User Datagram Protocol*.
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- [IETF RFC 2198] IETF RFC 2198 (1997), *RTP Payload for Redundant Audio Data*.
- [IETF RFC 3261] IETF RFC 3261 (2002), *SIP: Session Initiation Protocol*.
- [IETF RFC 3264] IETF RFC 3264 (2002), *An Offer/Answer Model with the Session Description Protocol (SDP)*.
- [IETF RFC 3388] IETF RFC 3388 (2002), *Grouping of Media Lines in the Session Description Protocol (SDP)*.
- [IETF RFC 3389] IETF RFC 3389 (2002), *Real-time Transport Protocol (RTP) Payload for Comfort Noise (CN)*.

- [IETF RFC 3550] IETF RFC 3550 (2003), *RTP: A Transport Protocol for Real-Time Applications*.
- [IETF RFC 4103] IETF RFC 4103 (2005), *RTP Payload for Text Conversation*.
- [IETF RFC 4566] IETF RFC 4566 (2006), *SDP: Session Description Protocol*.
- [IETF RFC 4733] IETF RFC 4733 (2006), *RTP Payload for DTMF Digits, Telephony Tones and Telephony Signals*.
- [IETF RFC 4756] IETF RFC 4756 (2006), *Forward Error Correction Grouping Semantics in Session Description Protocol*.
- [IETF RFC 5109] IETF RFC 5109 (2007), *RTP Payload Format for Generic Forward Error Correction*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the terms defined in [ITU-T G.701].

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 audio mode: In this mode, the channel processes speech signals. The mode may include the use of compression algorithms and other processing functions that are not suitable for the transport of modem or facsimile signals.

3.2.2 general switched telephone network (GSTN): This network includes ATM, PSTN, ISDN, wireless networks and private networks.

3.2.3 ITU-T H.248 gateway: A media gateway that complies with the ITU-T H.248x series of Recommendations.

3.2.4 media gateway (MG): The media gateway converts media provided in one type of network to the format required in another type of network. For example, a MG could terminate bearer channels from a switched circuit network (e.g., DS0s) and media streams from a packet network (e.g., RTP streams in an IP network). This gateway may be capable of processing audio, video and ITU-T T.120 multimedia signals alone or in any combination, and will be capable of full duplex media translations. The MG may also play audio/video messages and performs other interactive voice response (IVR) functions, or may perform media conferencing. For the purpose of this Recommendation, the term media gateway refers to a voice gateway.

3.2.5 media gateway controller (MGC): Controls the parts of the call state that pertain to connection control for media channels in a media gateway.

3.2.6 modem: The term modem in this Recommendation covers all ITU-T V-series modems and text telephones types covered in the annexes of [ITU-T V.18].

3.2.7 modem relay: The transport of modem data across a packet network using modem termination at the gateways.

3.2.8 MoIP gateway: A media gateway that is compliant with the ITU-T V.150x series of Recommendations.

3.2.9 off-ramp gateway: The IP network access point that calls an answering DCE. (Abbreviated to G2.)

3.2.10 on-ramp gateway: The access point that is called by an originating DCE that interfaces to the IP network. (Abbreviated to G1.)

3.2.11 transcoding: Translation from one type of encoded media format to another different media format (examples: ITU-T G.711 A-law to μ -law or vice versa, ITU-T G.711 codec to ITU-T G.726-40K, ITU-T G.711 to a broadband codec that operates at 256 kbit/s, etc.).

3.2.12 VBD gateway: A media gateway that is compliant with this Recommendation.

3.2.13 voice-band data mode: The transport of voice-band data over a voice channel of a packet network with the encoding appropriate for modem signals as defined in clause 6 of this Recommendation.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ABNF	Augmented Backus-Naur Form
ACL	Answered Configuration (Codec) List
ANS	Answer Tone
/ANS	Answer tone with phase reversals
ASN.1	Abstract Syntax Notation One
ASNam	Answer Tone
CED	Facsimile CALLED tone
CI	Call Indicator Signal
CNG	Facsimile Calling tone
DS0	Digital Signal, level 0
DSD	Data Signal Detector
DTMF	Dual Tone Multi-Frequency
FAX	Facsimile
FEC	Forward Error Correction
FoIP	Facsimile over Internet Protocol
G3FE	Group 3 Facsimile Equipment
GSTN	General Switched Telephone Network
IP	Internet Protocol
IVR	Interactive Voice Response
MG	Media Gateway
MGC	Media Gateway Controller
MoIP	Modem over Internet Protocol
MPS	Multiple Payload Stream
NCL	Negotiated Configuration (Codec) List
O/A	(SDP) Offer/Answer
OCL	Offered Configuration (Codec) List
OLC	Open Logical Channel
PCL	Preferred Configuration (Codec) List

PCMU	Pulse Code Modulation μ -law
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RTCP	Real Time Control Protocol
RTP	Real Time Protocol
SCL	Supported Configuration (Codec) List
SCN	Switched Circuit Network
SDP	Session Description Protocol
SDP O/A	SDP Offer/Answer
SID	Silence Insertion Description
SIP	Session Initiation Protocol
SPRT	Simple Packet Relay Transport
SS7	Signalling System No. 7
SSE	State Signalling Events
TDM	Time Division Multiplex(ing)
ToIP	Text telephony over Internet Protocol
UDP	User Datagram Protocol
VBD	Voice-band Data
VoIP	Voice over Internet Protocol

5 Conventions

An ITU-T Recommendation, by definition, is not mandatory – compliance is voluntary. The use of the words "shall" and "must" and their negatives "shall not" and "must not" are to be used with care and sparingly. These words are only to be used to express mandatory provisions, when necessary, to give the Recommendation meaning and effect; i.e., if certain values and/or parts of a Recommendation are essential, and the Recommendation will have no meaning if these values and/or parts are not strictly respected or adhered to. Compliance with the Recommendation is achieved only when all mandatory provisions are met. However, the inclusion of mandatory provisions in a Recommendation does not imply, of itself, that compliance with the Recommendation is required of any party.

5.1 Recommendation version

For the purposes of forward and backward compatibility, this Recommendation is assigned a version number, which is defined here.

NOTE – The reader is encouraged to check on the ITU-T website for any normative or informative amendments to this Recommendation.

Version: 1

5.2 SDP Offer/Answer protocol variants

This Recommendation provides example signalling syntax. There are two models for the session description protocol (SDP) concerning the indication and negotiation of media and transport capabilities:

- the name "legacy SDP Offer/Answer" indicates SDP Offer/Answer according to [IETF RFC 3264];
- the name "revised SDP Offer/Answer" indicates SDP Offer/Answer according to [b-IETF RFC 5939] and [b-IETF Draft MediaCapNeg].

6 Definition of the VBD mode of operation

Voice-band data is the transport of modem, facsimile, and text telephony signals over a voice channel of a packet network with a codec appropriate for such signals.

For voice-band data (VBD) mode of operation, all voice-band modulated signal samples shall be transported across an IP network using the RTP protocol defined in [IETF RFC 3550].

When in VBD mode, an ITU-T V.152 compliant implementation shall:

- use a codec that passes voice-band modulated signals with minimal distortion. This codec shall be assigned as the VBD codec with a specific RTP payload type which shall be negotiated with the remote ITU-T V.152 implementations as described in clause 7;
- have end-to-end constant latency;
- disable voice activity detection and comfort noise generation during the data transfer phase;
- disable any DC removal filters that may be integral with the speech encoder used;

and should consider the appropriate application of:

- forward error correction (FEC) (e.g., [IETF RFC 5109]) or other forms of redundancy (e.g., [IETF RFC 2198]) only if support has been successfully negotiated with the remote ITU-T V.152 implementation;
- voice packet loss concealment techniques and algorithms that are suitable for modem and facsimile modulations.

6.1 Minimum requirements for VBD mode of operation

For purposes of interoperability, an ITU-T V.152 compliant implementation shall support at least both ITU-T G.711 A-law and ITU-T G.711 μ -law codecs as VBD codecs.

When negotiating the VBD codec, the initiating ITU-T V.152 implementation must include in the offer either PCMA or PCMU (or both) in the list of VBD codecs, though other VBD codecs may be additionally specified. The ITU-T V.152 implementation answering the offer must indicate support for at least one VBD codec, which need not be PCM-based.

Redundancy as per [IETF RFC 2198] and forward error correction as per [IETF RFC 5109] are supported options.

6.2 Echo canceller and VBD mode

Echo cancellation and VBD mode are independent functions in a VBD gateway. The requirement for echo cancellation is not a VBD characteristic, but depends on the propagation delay in combination with a source of echo present in the connection and refers primarily to voice. An ITU-T V.152 compliant implementation does, therefore, not need to provide echo cancellation.

If an echo canceller (EC) is used on the VBD channel, then the EC shall be compliant to [ITU-T G.168]. The gateway autonomous control of the EC shall thus be orthogonal to the ITU-T V.152 audio-VBD state transitioning.

[ITU-T G.168] implies the detection of inband events in both traffic directions, i.e., from circuit-switched and IP network side in case of a VBD gateway.

6.3 IP transport services for VBD

6.3.1 Non-assured VBD mode

The non-assured VBD transport service is defined by the mandatory capabilities of ITU-T V.152, i.e., according to clause 6.1,

- without RTP transport redundancy (according to [IETF RFC 2198]); and
- without forward error correction of RTP packets (according to [IETF RFC 5109]).

The non-assured VBD mode should be sufficient in case of "good" IP network conditions. The non-assured VBD mode may be operated in two sub-modes with respect to the transfer of inband signals, see the following subclauses.

6.3.1.1 Non-assured transport of modem inband signals

This is a non-assured VBD transport service,

- without RTP payload format for telephony events (according to [IETF RFC 4733]).

6.3.1.2 Assured transport of modem inband signals

[IETF RFC 4733] shall be used according to clause 8 (i.e., the IETF RFC 4733 NTE mode shall be used). Usage of IETF RFC 4733 packets implies a negotiation process with the peer PSTN gateway (see also clause 2.4.1 of [IETF RFC 4733]).

6.3.2 Assured VBD mode

The assured VBD mode may be enabled in case of unreliable IP transport conditions. The assured VBD mode shall then use [IETF RFC 4733] for modem inband signals, and [IETF RFC 2198] and/or [IETF RFC 5109] for modem data information. Usage of [IETF RFC 2198] and [IETF RFC 5109] implies a negotiation process with the peer PSTN gateway:

- IETF RFC 2198 SDP elements for negotiation: see clause 5 of [IETF RFC 2198];
- IETF RFC 5109 SDP elements for negotiation: see [IETF RFC 4756].

7 Negotiation of support of VBD and selection of VBD codec and other VBD enhanced functionality

Negotiation of the support and use of VBD data mode, as defined in this Recommendation, shall be carried out at call establishment during the initial exchange of the call capabilities of the endpoints establishing the call, particularly under the following conditions:

- if it is unclear whether the peer gateway is [ITU-T V.152] or non-[ITU-T V.152] compliant;
- if the same audio codec shall be used as ITU-T V.152 VBD codec, which implies the negotiation of a dynamic RTP PT value for the VBD codec;
- if it is already clear that a PSTN modem call may be expected (with a certain probability); and/or
- if ITU-T V.152 VBDoIP is preferred (by the IP service provider) above packet relay mechanisms (see also clause 7.1.2.1).

Mid-call negotiations may be carried out in exceptional cases, see clause 7.3.

Indication of such support entails assigning RTP payload types to VBD as well as the codecs.

The mechanisms for negotiation vary depending on the endpoint's capabilities exchange protocols used, which can be the session description protocol (defined in [IETF RFC 4566]) or [ITU-T H.245]; the call control protocol, such as those defined in [ITU-T H.323], and the session

initiation protocol (SIP), defined in [IETF RFC 3261]; and/or the media gateway control protocols such as those defined in [ITU-T H.248.1] and [b-ITU-T J.171].

This clause shall describe negotiation procedures for mechanisms that use:

- The session description protocol (SDP) defined in [IETF RFC 4566]), such as, but not limited to, SIP terminals/gateways and ITU-T H.248 gateways;
- [ITU-T H.245] that complies with [ITU-T H.323].

This Recommendation does not preclude the gateways from negotiating support of other mechanisms such as IETF RFC 4733 telephone-events, [ITU-T T.38], [ITU-T V.150.1] and/or text relay, for transporting non-voice signals. RTP shall be used for the transport of VBD.

7.1 Negotiation using the session description protocol

For implementations that use the session description protocol, the "gpmd" (general-purpose media descriptor) attribute shall be used to associate payload types in a media information ('m') line with VBD mode.

7.1.0 New SDP attributes

7.1.0.1 VBD support indication (a=gpmd:)

The general form of this attribute line is:

```
a=gpmd:<format> <parameter list>
```

In the context of VBD declaration, the <format> must be an RTP/AVP payload type. The <parameter list> is a semicolon-separated list of "parameter=value" pairs. For RTP/AVP formats, these pairs address parameters that are not part of their standard MIME definition. For sessions supporting this Recommendation, the parameter of interest is the Boolean 'vbd' that may have the value of 'yes' or 'no'. When set to 'yes', the attribute indicates that the implementation supports VBD mode as described in this Recommendation.

Omission of the "gpmd" attribute with a "vbd=yes" attribute/value pair for any codec in the SDP session description shall be construed as non-support of VBD mode operation as defined in this Recommendation.

Setting vbd=no is an explicit indication that the payload type will not be used for vbd.

Note that this is not the same as omitting the gpmd attribute with vbd.

The payload type marked for voice-band data (VBD) treatment should be a dynamic payload type. It is possible that a codec, such as PCMU, be declared with both static and dynamic payload types, with only one of the two marked for voice-band data use (see example 1 below). If a codec, such a PCMU or PCMA, is declared with only a static payload type, and is also marked for voice-band data use, then this codec must not be used for carrying voice (see example 2 below).

7.1.0.2 Packetization time (a=maxptime:)

In addition to negotiating support of ITU-T V.152 and the corresponding RTP payload type, an ITU-T V.152 implementation should include the 'maxptime' attribute (maximum multiple ptime) to indicate the supported packetization period for all codec payload types.

```
a=maxptime:<list of packet times separated by space>
```

This attribute is a media-level attribute. The maxptime attribute defines a list of maximum packetization time values, expressed in milliseconds, the endpoint is capable of using (sending and receiving) for this connection. There shall be precisely one entry in the list for each <format> entry provided in the "m=" line. Each entry is separated by a space. Entry number j in this list defines the maximum packetization time for entry number j in the "m=" line. The first entry in the list shall be a

decimal number whereas subsequent entries in the list shall be either a decimal number or a hyphen. For those media formats where a single maximum packetization rate does not apply (e.g., non-voice codecs such as telephone-event or comfort noise), a hyphen ("-") shall be included at the corresponding location in the list of packetization periods.

When receiving an SDP session description, the maxmptime attribute conveys the list of maximum packetization periods that the remote endpoint is capable of using for this connection; one for each media format in the "m=" line. For media formats whose packetization period is specified as a hyphen ("-"), the VBD gateway shall use one of the maximum packetization periods that was actually specified in the list.

The "a=ptime" attribute, defined in [IETF RFC 4566], shall be ignored if the SDP session description contains the "maxmptime" attribute.

If the "maxmptime" attribute is absent, then the value of the "ptime" attribute, if present, shall be taken as indicating the packetization period for all codecs present in the "m=" line.

If neither the 'ptime' nor 'maxmptime' attribute are present in the SDP session description, then an ITU-T V.152 implementation shall assume the default packetization period defined in [IETF RFC 3550] (which is 20 ms for ITU-T G.711 and ITU-T G.726-32k). An ITU-T V.152 implementation shall not transmit ITU-T V.152 packets with a packetization time greater than the one offered by the remote end.

7.1.0.3 Examples

Several application scenario examples are provided below.

7.1.0.3.1 Example 1 – Multiple audio and multiple VBD codec types

Below is an SDP-related example that indicates support of ITU-T V.152 as per this Recommendation. For clarity purposes, the example only shows the media descriptions of the SDP session description.

Table 1 provides the encoding of example 1 using Legacy SDP Offer/Answer syntax.

Figure 1 illustrates the four possible media configurations, offered in this example.

Table 2 provides the encoding of example 1 in Revised SDP Offer/Answer syntax.

Table 1 – Example SDP encoding – "Example 1" offer in Legacy SDP Offer/Answer syntax

SDP encoding (shortened SDP description)	Comments
<pre> m=audio 3456 RTP/AVP 18 0 13 96 98 99 a=maxmptime:10 10 - - 20 20 a=rtpmap:96 telephone-event/8000 a=fmtp:96 0-15, 34, 35 a=rtpmap:98 PCMU/8000 a=gpmd:98 vbd=yes a=rtpmap:99 G726-32/8000 a=gpmd:99 vbd=yes </pre>	In the example, static payload type '0' and dynamic payload type '98' each represent the encoding format 'PCMU'. The payload type '0' is not associated with VBD. The payload types '98' (PCMU) and '99' (32 kbit/s ADPCM) are, however, associated with VBD. Concerning the maximum packetization times for each payload type: Voice packets use 10 ms, VBD packets use 20 ms, and a dash is assigned to payload types 13 (silence indication packets) and 96 (IETF RFC 4733) packets) indicating that a maximum ptime is not applicable or necessary.

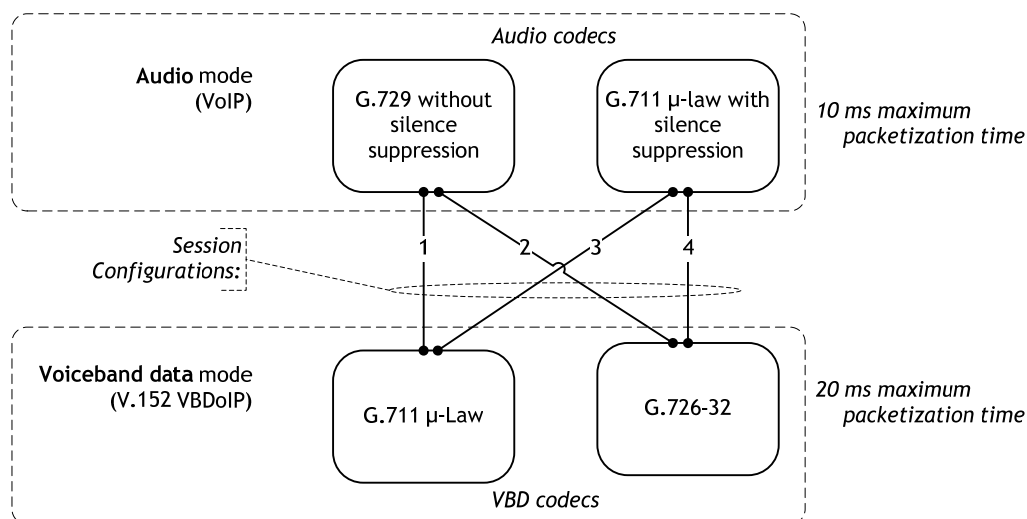


Figure 1 – Potential media configurations offered in example 1

Table 2 – Example SDP encoding – "Example 1" offer in Revised SDP Offer/Answer syntax

SDP encoding (shortened SDP description)	Comments
<pre> ; SESSION CONFIGURATIONS a=sescap:1 1,3 ; VoIP = G729, VBD=V.152 (PCMU) a=sescap:2 1,4 ; VoIP = G729, VBD=V.152 (G726) a=sescap:3 2,3 ; VoIP = PCMU, VBD=V.152 (PCMU) a=sescap:4 2,4 ; VoIP = PCMU, VBD=V.152 (G726) ; ACTUAL CONFIGURATION (due to backward compatibility) m=audio 3456 RTP/AVP 18 0 13 96 98 99 a=maxptime:10 10 - - 20 20 a=rtpmap:96 telephone-event/8000 a=fmtp:96 0-15, 34, 35 a=rtpmap:98 PCMU/8000 a=gpmd:98 vbd=yes a=rtpmap:99 G726-32/8000 a=gpmd:99 vbd=yes ; ; POTENTIAL CONFIGURATIONS a=tcap:1 RTP/AVP ; transport for VoIP & VBD=V.152 a=acap:1 ptime:10 ; for Audio mode a=acap:2 ptime:20 ; for VBD mode a=mcap:1 G729/8000 ; audio codec 1 a=mcap:2,5 PCMU/8000 ; audio codec 2 & VBD codec 1 a=mcap:3 CN/8000 ; comfort noise for audio c. 2 a=mcap:4 telephone-event/8000 ; NTE codec a=mcap:6 G726-32/8000 ; VBD codec 2 </pre>	Offered (4) session configurations: • Preference 1: Audio (ITU-T G.729), VBD (ITU-T V.152 PCMU) & NTE ([IETF RFC 4733]) • Preference 2: Audio (ITU-T G.729), VBD (ITU-T V.152 G.726-32) & NTE ([IETF RFC 4733]) • Preference 3: Audio (PCMU including silence suppression), VBD (ITU-T V.152 PCMU) & NTE ([IETF RFC 4733]) • Preference 4: Audio (PCMU including silence suppression), VBD (ITU-T V.152 G.726-32) & NTE ([IETF RFC 4733]) NOTE – The "a=ms" operator is used to remove all legacy attribute lines on session and media description level. The two audio and two VBD settings are defined as individual potential configurations, in order to assign individual packetization times. This approach allows to avoid usage of "a=maxptime:" parameter. The concept of session configurations is applied for the four audio/VBD combinations.

Table 2 – Example SDP encoding – "Example 1" offer in Revised SDP Offer/Answer syntax

SDP encoding (shortened SDP description)	Comments
a=mfcap:4 0-15,32-35 ; value range DTMF & VBD stimuli a=mscap:5 gpmd vbd=yes ; for V.152 PCMU a=mscap:6 gpmd vbd=yes ; for V.152 G726-32 a=pcfg:1 t=1 a=-ms:1 m=1,4 pt=1:18,4:96 a=pcfg:2 t=1 a=-ms:1 m=2,3,4 pt=2:0,3:13,4:96 a=pcfg:3 t=1 a=-ms:2 m=5 pt=5:98 a=pcfg:4 t=1 a=-ms:2 m=6 pt=6:99	

The following main advantages may be noted concerning Revised versus Legacy SDP Offer/Answer:

- the ITU-T V.152 introduced SDP attribute "*a=maxptime:*" may be replaced by IETF SDP elements;
- there is an explicit indicated, preferred order with regard to the offered media configurations (this is missing in Legacy SDP Offer/Answer: it is unclear, e.g., whether configuration 2 is preferred over configuration 3 or vice versa); and
- the answerer in Legacy SDP Offer/Answer could select both audio codecs and/or both VBD codecs (which may require subsequent Offer/Answer cycles).

7.1.0.3.2 Example 2 – Single audio codec, two VBD codec options

Table 3 provides the encoding of example 2 in Legacy SDP Offer/Answer syntax.

Figure 2 illustrate the two possible media configurations, offered in this example.

Table 3 – Example SDP encoding – "Example 2" offer in Legacy SDP Offer/Answer syntax

SDP encoding (shortened SDP description)	Comments
m=audio 3456 RTP/AVP 0 18 98 a=gpmd:0 vbd=yes a=rtpmap:98 G726-32/8000 a=gpmd:98 vbd=yes a=ptime:20	In this example, the static payload type '0' (PCMU) is marked for VBD treatment, along with the dynamic payload type '98' (mapped to 32 kbit/s ADPCM). Thus, payload type '0' must not be used for carrying voice. It also indicates that the VBD gateway can receive voice and VBD packets with a size of 20 ms.

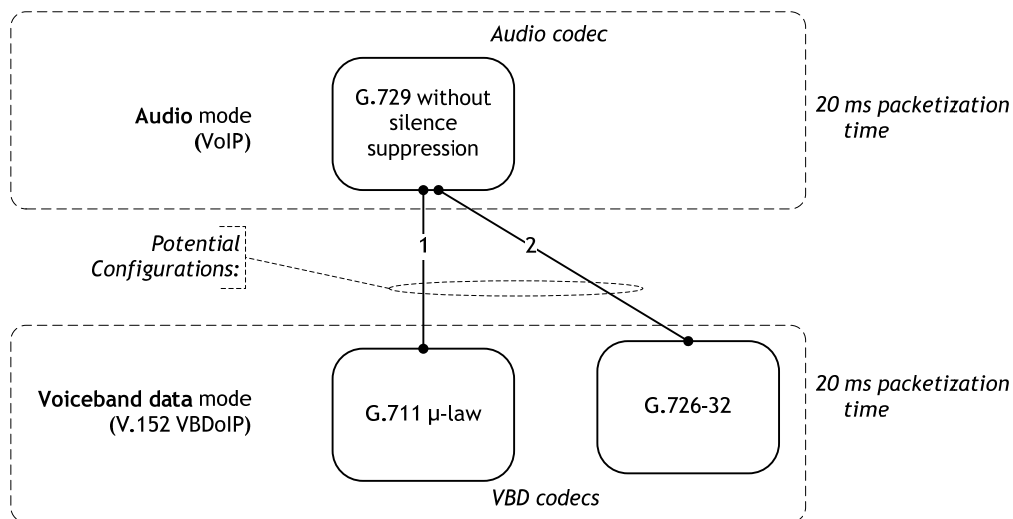


Figure 2 – Potential media configurations offered in example 2

NOTE – The use of static payload types for VBD is strongly discouraged because there is a danger that a non-ITU-T V.152 system would see a proposal with, say, [ITU-T G.711] VBD and [ITU-T G.729]. However, not understanding the VBD attributes, it may consider ITU-T G.711 as a valid audio codec. However, network operators may prefer that [ITU-T G.711] not be utilized, except in the case where VBD is necessary, and that all voice shall be [ITU-T G.729]. To illustrate this point, consider this offer:

```
m=audio 15400 RTP/AVP 0 18
a=gpmd:0 vbd=yes
```

and consider this answer:

```
m=audio 15400 RTP/AVP 0 18
```

The systems would then, most likely, communicate using [ITU-T G.711], rather than the intended [ITU-T G.729], for voice. This is a possible issue and inherent to Legacy SDP Offer/Answer protocol. This problem may be avoided by explicit potential configuration in Revised SDP Offer/Answer, see Table 4.

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