
mpegable DS

MPEG-4 DirectShow™ Filters

Technical Description



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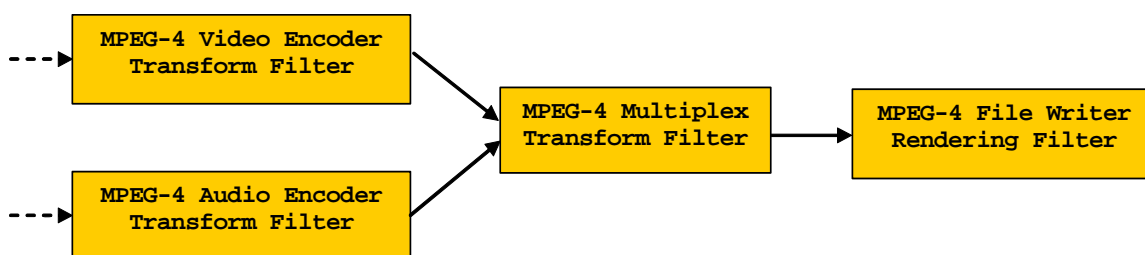
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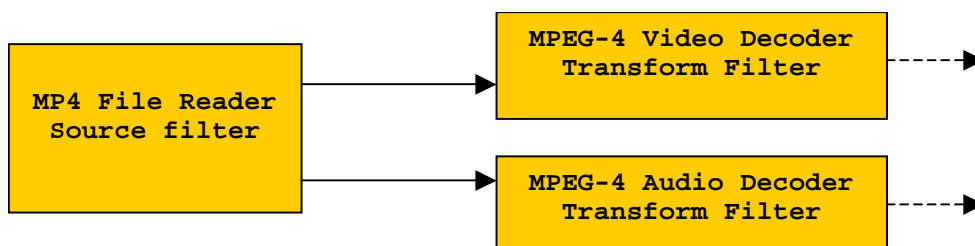
Introduction

mpegable™ DS consists of high performance components for MPEG-4 compliant encoding and decoding ([1][2][3]). mpegable™ DS includes DirectShow ([5]) filters to work within the Microsoft Windows environment.

A principal overview about the encoding process of audio-visual data is shown in figure 1. The video and audio encoder filter perform the encoding of the video and audio data and send them to the multiplexer. The multiplexer produces a single stream from the elementary streams and sends this stream to the rendering filter, which writes the incoming data to a MP4 File on the disk.



On the decoder side, a MP4 File is read from the disk and send to the MP4 splitter, which delivers video- and/ or audio elementary streams. The elementary streams are decompressed by the audio and video decoder filter. The decompressed outputs of the decoder filters can be played by existing audio and video rendering filters.



All filters are described in detail in the next section. The tables list the basic functionalities of each filter. The figures following the tables give a description of the interfaces and media formats supported by the filter according to the DirectShow/COM terminology.

Media types

Together with the DirectShow filters, mpegable™ DS introduces a set of new media types which are explained in this section.

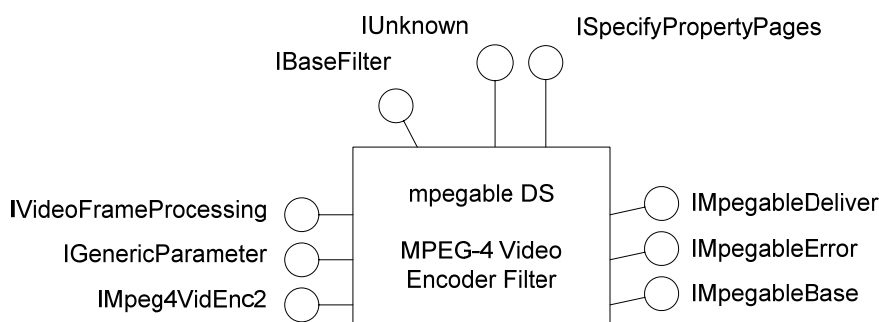
For each supported format there are two DirectShow media types e.g. MEDIASUBTYPE_MPEG4_VIDEO and MEDIASUBTYPE_MPEG4SL_VIDEO for video data coded as MPEG-4. Using the media types containing the SL in its name means that not only the pure elementary stream data is transmitted for each sample but each media sample is preceded by an MPEG4SLHEADER. This header provides some extra information about the sample.

MEDIASUBTYPE_MPEG4_VIDEO	MPEG-4 video	Used by Mpeg4 Video Decoder and Encoder filter, by MP4 File Reader, RTP Stream Reader, RTP Packetizer filter and Mpeg4 Mux filter.
MEDIASUBTYPE_MPEG4SL_VIDEO		
MEDIASUBTYPE_MPEG4_AUDIO	MPEG-4 audio	Used by Mpeg4 Audio Decoder and Encoder filter, by MP4 File Reader, RTP Stream Reader, RTP Packetizer filter and Mpeg4 Mux filter.
MEDIASUBTYPE_MPEG4SL_AUDIO		
MEDIASUBTYPE_LATMAAC_AUDIO	MPEG-4 audio	Used by Mpeg4 Audio Decoder and Encoder filter, by RTP Stream Reader and RTP Packetizer filter.
MEDIASUBTYPE_LATMAACSL_AUDIO		
MEDIASUBTYPE_H263_VIDEO	H.263 video	Used by Mpeg4 Video Decoder and H263Encoder filter, by MP4 File Reader, RTP Stream Reader, RTP Packetizer filter and Mpeg4 Mux filter.
MEDIASUBTYPE_H263SL_VIDEO		
MEDIASUBTYPE_AMR_AUDIO	AMR audio	Used by AMR Audio Decoder and Encoder filter, by MP4 File Reader, RTP Stream Reader, RTP Packetizer filter and Mpeg4 Mux filter.
MEDIASUBTYPE_AMRSL_AUDIO		
MEDIASUBTYPE_MPEG4FLEXMUX	Packetized media data	Used by Mpeg4 Mux filter and Mp4 File Writer filter.
MEDIASUBTYPE_MPEG4AVC_VIDEO	MPEG-4 AVC video	Used by H264 Video Decoder and Encoder filter, by MP4 File Reader, RTP

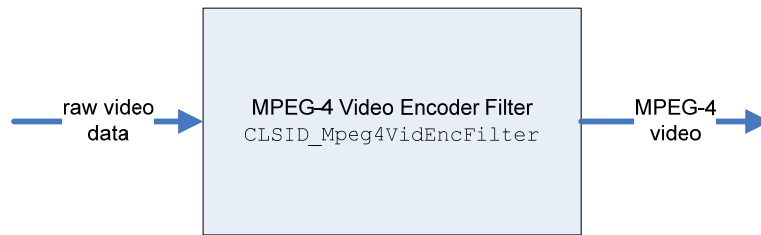
MEDIASUBTYPE_MPEG4AVCSL_VIDEO		Stream Reader, RTP Packetizer filter and Mpeg4 Mux filter.
MEDIASUBTYPE_RTPPACKET	RTP packetized media data	Used by RTP Packetizer filter and by RTP Sender filter.
MEDIASUBTYPE_PCM	uncompressed PCM audio	Used by RTP Stream Reader

MPEG-4 Video Encoder Filter

The MPEG-4 Video Encoder Filter takes the video data from the input pin and performs the encoding. The output of this filter is a MPEG-4 compliant video elementary stream. A special interface allows the setting of encoding parameters like bitrate, key frame period and more. The encoder supports the Simple Profile and the Advanced Simple Profile of the MPEG-4 visual standard [1]. The simple profile is the most common profile for 3gpp and MPEG-4 internet applications providing the basic coding tools. The advanced simple profile enhances the quality by using even more sophisticated tools like B-frames and quarter pixel motion estimation.



Input Pins	1
Media Type	MEDIATYPE_Video
Media Subtype	MEDIASUBTYPE_YUY2, MEDIASUBTYPE_UYVY, MEDIASUBTYPE_RGB24, MEDIASUBTYPE_RGB32
Media Format	FORMAT_VideoInfo
Output Pins	1
Media Type	MEDIATYPE_Video
Media Subtype	MEDIASUBTYPE_MPEG4_VIDEO, MEDIASUBTYPE_MPEG4SL_VIDEO
Media Format	FORMAT_MPEG4Video
Supported Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IMpeg4VidEnc2, IGenericParameter, IVideoFrameProcessing, IMpegableDeliver, IMpegableError, IMpegableBase
MPEG-4 Visual Profiles	Simple, Advanced Simple
Features	<ul style="list-style-type: none"> - Real time encoding up to 720x576 @ 25 Hz - MPEG and H.263 quantization method - Scalable from 20 Kbit/s to 20 Mbit/s - CBR and single pass VBR - Scene change detection - Quarter Pel Motion Estimation - B-Frames



The video encoder filter expects an input pin connected to its output pin that supports

Type MEDIATYPE_Video
 Sub type MEDIASUBTYPE_MPEG4SL_VIDEO
 Format Type: FORMAT_MPEG4Video

The VIDEOINFOHEADER structure as part of the MPEG4VIDEOINFOHEADER structure contains valid values for width and height of the video and the average time per frame. Furthermore the decoder specific info is attached to the MPEG4VIDEOINFOHEADER structure in binary format.

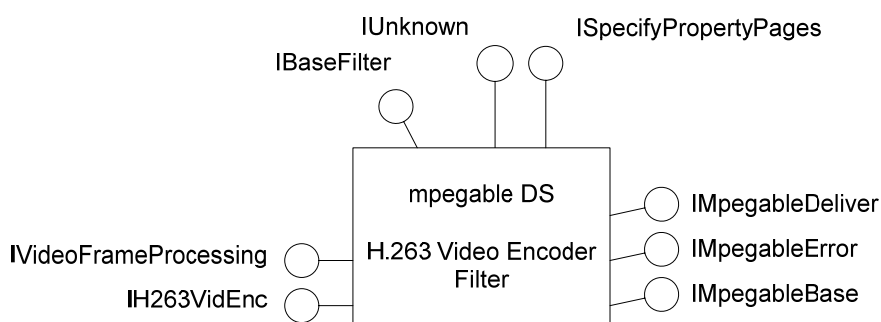
The input pin of the encoder filter supports various media types depending on the color format of the video source

Type MEDIATYPE_Video
 Sub type MEDIASUBTYPE_YUY2, MEDIASUBTYPE_UYVY,
 MEDIASUBTYPE_RGB24 or MEDIASUBTYPE_RGB32
 Format Type: FORMAT_VideoInfo or FORMAT_VideoInfo2

The preferable sub type is MEDIASUBTYPE_YUY2 or MEDIASUBTYPE_UYVY.

H.263 Video Encoder Filter

The H.263 Video Encoder Filter takes the video data from the input pin and performs the encoding. The output of this filter is a H.263 compliant video elementary stream. A special interface allows the setting of encoding parameters like bitrate, key frame period and more. The encoder supports the Baseline Profile and the Profile 3 of the ITU-T H.263 standard [1]. The Baseline Profile is the most common H.263 profile providing the basic coding tools. The Profile 3 (Streaming Profile) enhances the quality by using more sophisticated tools.



Input Pins	1
Media Type	MEDIATYPE_Video
Media Subtype	MEDIASUBTYPE_YUY2, MEDIASUBTYPE_UYVY, MEDIASUBTYPE_RGB24, MEDIASUBTYPE_RGB32
Media Format	FORMAT_VideoInfo
Output Pins	1
Media Type	MEDIATYPE_Video
Media Subtype	MEDIASUBTYPE_H263_VIDEO, MEDIASUBTYPE_H263SL_VIDEO
Media Format	FORMAT_MPEG4Video
Supported Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IH263VidEnc, IVideoFrameProcessing, IMpegableDeliver, IMpegableError, IMpegableBase
MPEG-4 Visual Profiles	Baseline Profile, Profile 3
Features	<ul style="list-style-type: none"> - Real time encoding up to 640x480 - I, P frames - Scene change detection - Adjustable Intra Refresh rate - Advanced Intra Prediction - Modified quantization - Four Motion Vector Mode - Deblocking - Slice Structure



The video encoder filter expects an input pin connected to its output pin that supports

Type MEDIATYPE_Video
 Sub type MEDIASUBTYPE_H2634SL_VIDEO
 Format Type: FORMAT_MPEG4Video

The VIDEOINFOHEADER structure as part of the MPEG4VIDEOINFOHEADER structure contains valid values for width and height of the video and the average time per frame. Furthermore the decoder specific info is attached to the MPEG4VIDEOINFOHEADER structure in binary format.

The input pin of the encoder filter supports various media types depending on the color format of the video source

Type MEDIATYPE_Video
 Sub type MEDIASUBTYPE_YUY2, MEDIASUBTYPE_UYVY,
 MEDIASUBTYPE_RGB24 or MEDIASUBTYPE_RGB32
 Format Type: FORMAT_VideoInfo or FORMAT_VideoInfo2

The preferable sub type is MEDIASUBTYPE_YUY2 or MEDIASUBTYPE_UYVY.

The H.263 at Level 10 only supports a certain set of picture resolutions. The following resolutions are supported in the H.263 at Level 10: 120x96, 176x144, 352x288, 704x576 and 1408x1152. An input video that does not exactly matches one of these resolutions is automatically re-scaled to the next lower resolution.

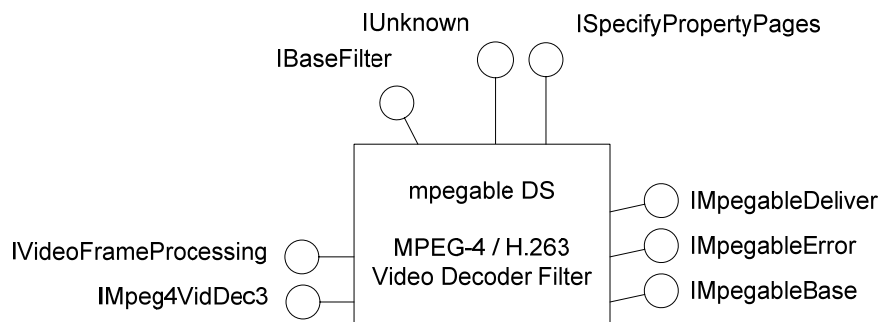
The H.263 standard at Level 50 supports an additional header called PLUSTYPE header that allows the encoding of any image resolutions that are multiple of 4. Furthermore the PLUSTYPE header enables the use of different time resolution instead of only 29.97 Hz.

The default profile for H.263 encoding is the Baseline Profile. If enabled, the Profile 3 uses additional coding tools including four MVs, Advanced Intra Prediction, Slice Structure and De-blocking.

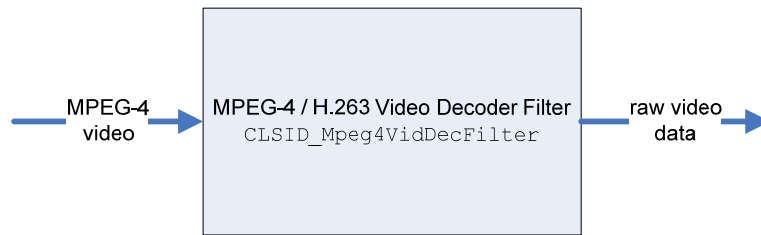
MPEG-4 / H.263 Video Decoder Filter

This filter decodes the video bit stream and sends the decoded frames to the output pin. The output pin should be connected to a rendering filter to display the decoded image. The filter supports Simple, Core and Advanced Simple Profile. The Decoder supports real time decoding up to ITU-R. 601 (720x576) on Pentium III 800 MHz systems.

The decoder features integrated post-filters to reduce coding artifacts (i.e. blocking or ringing artifacts). Enabling the post-filters significantly enhances the visual quality at lower bitrates.



Input Pins	1
Media Type	MEDIATYPE_Video
Media Subtype	MEDIASUBTYPE_MPEG4_VIDEO, MEDIASUBTYPE_H263_VIDEO, MEDIASUBTYPE_MPEG4SL_VIDEO, MEDIASUBTYPE_H263SL_VIDEO
Media Format	FORMAT_MPEG4Video
Output Pins	1
Media Type	MEDIATYPE_Video
Media Subtype	MEDIASUBTYPE_YUY2, MEDIASUBTYPE_UYVY, MEDIASUBTYPE_RGB24, MEDIASUBTYPE_RGB32
Media Format	FORMAT_VideoInfo
Supported Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IMpeg4VidDec3, IVideoFrameProcessing, IMpegableDeliver, IMpegableError, IMpegableBase
MPEG-4 Visual Profiles	Simple Profile, Advanced Simple Profile (all levels)
Features	- Decoding of MPEG-4 video elementary streams (ISO 14496-2) - Decoding of H.263 video elementary streams (Profile 0 Level 10) - Optional post-processing to reduce coding artifacts (de-blocking and de-ringing filter)



The decoder filter expects an output pin connected to its input pin that supports

Type MEDIATYPE_Video
 Sub type MEDIASUBTYPE_MPEG4_VIDEO, MEDIASUBTYPE_H263_VIDEO,
 MEDIASUBTYPE_MPEG4SL_VIDEO, MEDIASUBTYPE_H263SL_VIDEO
 Format Type: FORMAT_VideoInfo

The VIDEOINFOHEADER structure should contain valid values for width and height of the video and the average time per frame. Furthermore the decoder specific info must be attached to the VIDEOINFOHEADER structure in binary format.

The output pin of the decoder filter supports different media types depending on the requested color format

Type MEDIATYPE_Video
 Sub type MEDIASUBTYPE_YUY2, MEDIASUBTYPE_UYVY,
 MEDIASUBTYPE_RGB24, MEDIASUBTYPE_ARGB32 or
 MEDIASUBTYPE_RGB32
 Format Type: FORMAT_VideoInfo or FORMAT_VideoInfo2

The preferable sub type is MEDIASUBTYPE_YUY2 or MEDIASUBTYPE_UYVY.

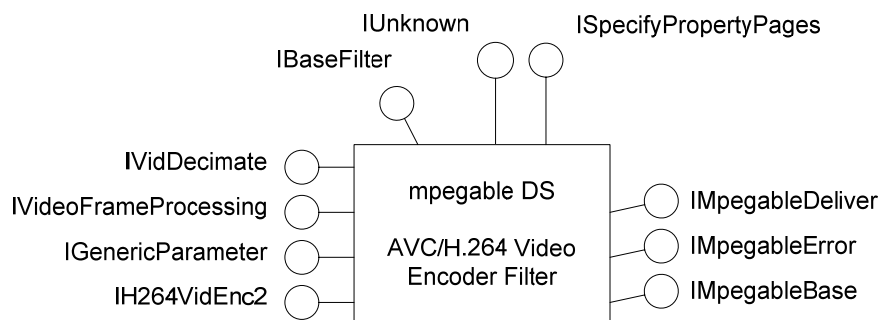
The output pin also defines the following fields of bitmap info header in the VIDEOINFOHEADER structure: biSizelmage, biBitCount and biCompression depending on the color format used as well as the biWidth, biHeight and biPlanes fields.

The IMpeg4VidDecPropData interface allows the user to get information about the stream and to enable/disable post-filtering.

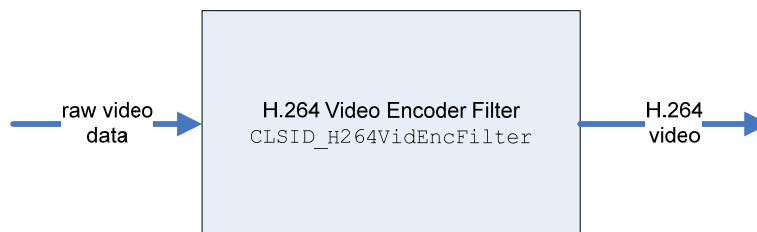
MPEG-4 AVC / H.264 Video Encoder Filter

The MPEG-4 AVC / H.264 Video Encoder filter takes the video data from the input pin and performs the encoding. The output of this filter can be either is a MPEG-4 AVC / H.264 compliant video elementary stream (NALUs), or a stream of AVC samples for storage in MP4 files . A special interface allows the setting of encoding parameters like bitrate, key frame period and more.

The encoder supports the Baseline, Main and High profile of the MPEG-4 AVC/H.264 standard [7].



Input Pins	1
Media Type	MEDIATYPE_Video
Media Subtype	MEDIASUBTYPE_YUY2, MEDIASUBTYPE_UYVY, MEDIASUBTYPE_RGB24, MEDIASUBTYPE_RGB32
Media Format	FORMAT_VideoInfo
Output Pins	1
Media Type	MEDIATYPE_Video
Media Subtype	MEDIASUBTYPE_MPEG4AVC_VIDEO, MEDIASUBTYPE_MPEG4AVCSL_VIDEO, MEDIASUBTYPE_H264_VIDEO, MEDIASUBTYPE_H264SL_VIDEO
Media Format	FORMAT_MPEG4Video
Supported Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IH264VidEnc2, IVideoFrameProcessing, IMpegableDeliver, IMpegableError, IMpegableBase
MPEG-4 Visual Profiles	Baseline, Main und High Profile
Features	<ul style="list-style-type: none"> - Real time encoding up to 720x576 @ 25 Hz - Intra prediction (all modes) - Inter prediction (down to 8x8) - Quarter Pel Motion Estimation - CABAC und VLC - B-Frames - Interlaced ocding - Adjustable Intra Refresh rate - Scalable from 20 Kbit/s to 12 Mbit/s - Bit-rate control - Scene change detection



The video encoder filter expects an input pin connected to its output pin that supports

Type MEDIATYPE_Video
 Sub type MEDIASUBTYPE_MPEG4AVC_VIDEO,
 MEDIASUBTYPE_MPEG4AVCSL_VIDEO, MEDIASUBTYPE_H264_VIDEO
 or MEDIASUBTYPE_H264SL_VIDEO
 Format Type: FORMAT_MPEG4Video

The VIDEOINFOHEADER structure as part of the MPEG4VIDEOINFOHEADER structure contains valid values for width and height of the video and the average time per frame. Furthermore the decoder specific info is attached to the MPEG4VIDEOINFOHEADER structure in binary format.

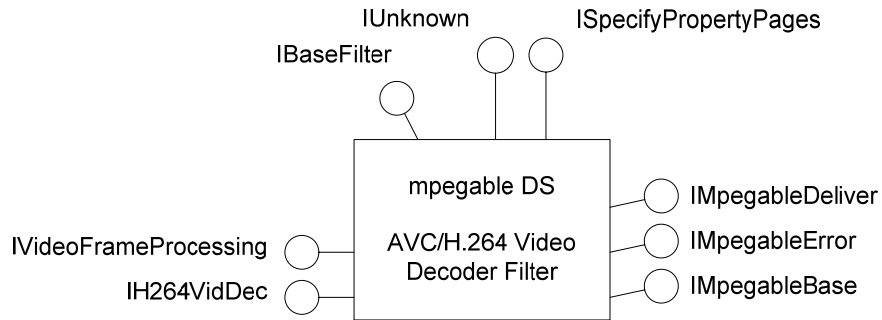
The input pin of the encoder filter supports different media types depending on the color format of the video source

Type MEDIATYPE_Video
Sub type MEDIASUBTYPE_YUY2, MEDIASUBTYPE_UYVY,
 MEDIASUBTYPE_RGB24 or MEDIASUBTYPE_RGB32
Format Type: FORMAT_VideoInfo or FORMAT_VideoInfo2

The preferable sub type is MEDIASUBTYPE_YUY2 or MEDIASUBTYPE_UYVY.

MPEG-4 AVC/H.264 Video Decoder Filter

This filter decodes the video bitstream and sends the decoded frames to the output pin. The output pin should be connected to a rendering filter to display the decoded image. The filter supports the Baseline and Main Profile of the MPEG-4 Part 10 (AVC) / H.264 standard. The decoder enables real time decoding up to ITU-R. 601 (720x576) on a Pentium IV 1.0 Ghz.



Input Pins	1
Media Type	MEDIATYPE_Video
Media Subtype	MEDIASUBTYPE_MPEG4AVC_VIDEO, MEDIASUBTYPE_H264_VIDEO, MEDIASUBTYPE_MPEG4AVCSL_VIDEO, MEDIASUBTYPE_H264SL_VIDEO
Media Format	FORMAT_MPEG4Video
Output Pins	1
Media Type	MEDIATYPE_Video
Media Subtype	MEDIASUBTYPE_YUY2, MEDIASUBTYPE_UYVY, MEDIASUBTYPE_RGB24, MEDIASUBTYPE_RGB32
Media Format	FORMAT_VideoInfo
Supported Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IH264VidDec, IVideoFrameProcessing, IMpegableDeliver, IMpegableError, IMpegableBase
MPEG-4 Visual Profiles	Baseline, Main and High profile
Features	- Decoding of H.264/AVC video elementary streams (ISO 14496-10)



The decoder filter expects an output pin connected to its input pin that supports

Type MEDIATYPE_Video
 Sub type MEDIASUBTYPE_AVCSAMPLE_VIDEO, MEDIASUBTYPE_H264_VIDEO,
 MEDIASUBTYPE_AVCSAMPLESL_VIDEO,
 MEDIASUBTYPE_H264SL_VIDEO
 Format Type: FORMAT_VideoInfo

The VIDEOINFOHEADER structure should contain valid values for width and height of the video and the average time per frame. Furthermore the decoder specific info must be attached to the VIDEOINFOHEADER structure in binary format.

The output pin of the decoder filter supports different media types depending on the requested color format

Type MEDIATYPE_Video
 Sub type MEDIASUBTYPE_YUY2, MEDIASUBTYPE_UYVY,
 MEDIASUBTYPE_RGB24, MEDIASUBTYPE_ARGB32 or
 MEDIASUBTYPE_RGB32
 Format Type: FORMAT_VideoInfo or FORMAT_VideoInfo2

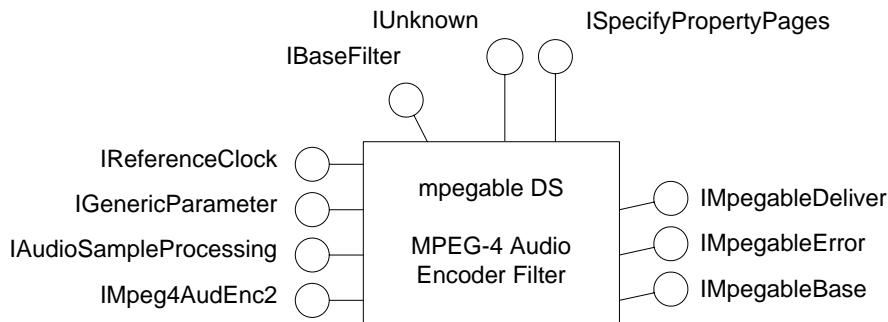
The preferable sub type is MEDIASUBTYPE_YUY2 or MEDIASUBTYPE_UYVY.

The output pin also defines the following fields of bitmap info header in the VIDEOINFOHEADER structure: biSizeImage, biBitCount and biCompression depending on the color format used as well as the biWidth, biHeight and biPlanes fields.

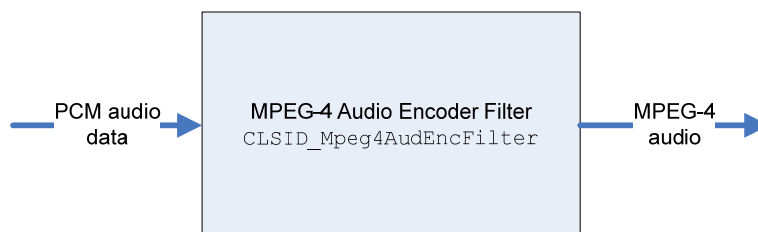
The IH264VidDecPropData interface allows the user to get information about the stream.

MPEG-4 Audio Encoder Filter

The MPEG-4 Audio Transform Filter encodes PCM-coded audio data and produces a MPEG-4 compliant audio elementary stream. The audio encoder supports the AAC low complexity profile. The filter provides an interface to set the encoding bitrate.



Input Pins	1
Media Type	MEDIATYPE_Audio
Media Subtype	MEDIASUBTYPE_PCM
Media Format	FORMAT_WaveFormatEx
Output Pins	1
Media Type	MEDIATYPE_Audio
Media Subtype	MEDIASUBTYPE_MPEG4_AUDIO, MEDIASUBTYPE_MPEG4SL_AUDIO, MEDIASUBTYPE_LATMAAC_AUDIO
Media Format	FORMAT_WaveFormatEx
Supported Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IMpeg4AudEnc2, IAudioSampleProcessing, IGenericParameter, IReferenceClock, IMpegableDeliver, IMpegableError, IMpegableBase
MPEG-4 Audio Profiles	MPEG-4 AAC LC
Features	Bit-rate from 8 kBit/s to 96 kBit/s per channel, mono and stereo, sample rates from 9,6 kHz up to 48 kHz



The audio encoder filter expects an input pin connected to its output pin that supports

Type MEDIATYPE_Audio

Sub type MEDIASUBTYPE_MPEG4_AUDIO
Format Type: FORMAT_WaveFormatEx

The WAVEFORMATEX structure contains valid values for the number of channels, the sample rate and the average number of bytes per second (bitrate) of the audio stream. Furthermore the decoder specific info is attached to the WAVEFORMATEX structure in binary format.

The input pin of the audio encoder filter supports the following media type

Type MEDIATYPE_Audio
Sub type MEDIASUBTYPE_NULL
Format Type: FORMAT_WaveFormatEx

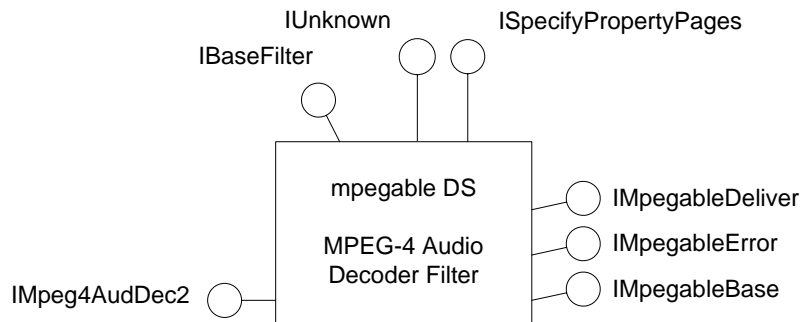
The input pin expects the following fields of WAVEFORMATEX structure to contain valid values:

wFormatTag = WAVE_FORMAT_PCM, wBitsPerSample (= 16), cbSize (= 0) , nChannels, nSamplesPerSec, nBlockAlign, nAvgBytesPerSec.

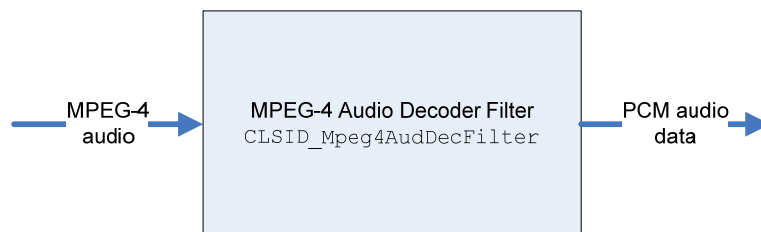
The `IMpeg4AudEncPropData` interface allows to set the bit-rate measured in bits per second for the encoded audio stream.

MPEG-4 Audio Decoder Filter

The MPEG-4 audio decoder filter takes an audio elementary bitstream at the input pin and transforms it to uncompressed PCM-coded audio data. As the encoder transform filter it supports MPEG-2/4 AAC low complexity profile.



Input Pins	1
Media Type	MEDIATYPE_Audio
Media Subtype	MEDIASUBTYPE_MPEG4_AUDIO
Media Format	FORMAT_WaveFormatEx
Output Pins	1
Media Type	MEDIATYPE_Audio
Media Subtype	MEDIASUBTYPE_PCM
Media Format	FORMAT_WaveFormatEx
Supported Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IMpeg4AudDec2, IMpegableDeliver, IMpegableError, IMpegableBase
MPEG-4 Audio Profiles	AAC Low Complexity
Features	- Decoding of MPEG-4 audio elementary streams (ISO 14496-3) - mono or stereo, up to 48 kHz sample rate



The audio decoder filter expects an output pin connected to its input pin that supports

Type MEDIATYPE_Audio
 Sub type MEDIASUBTYPE_MPEG4_AUDIO
 Format Type: FORMAT_WaveFormatEx

The WAVEFORMATEX structure should contain valid values for the number of channels, the sample rate and the average number of bytes per second (bitrate) of the audio stream. Furthermore the decoder specific info must be attached to the WAVEFORMATEX structure in binary format.

The output pin supports the following media type

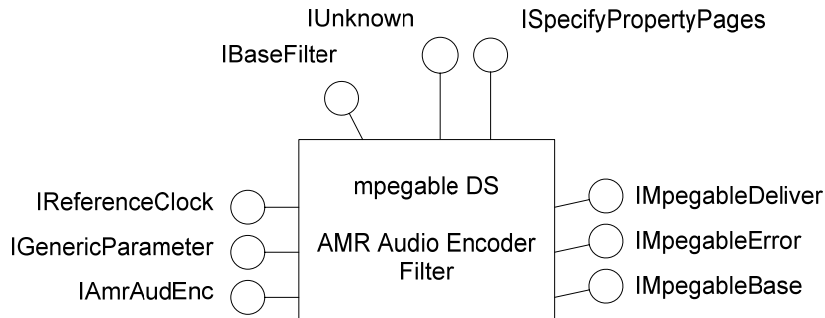
Type MEDIATYPE_Audio
Sub type MEDIASUBTYPE_NULL
Format Type: FORMAT_WaveFormatEx

The output pin also defines the following fields of WAVEFORMATEX structure: wFormatTag (= WAVE_FORMAT_PCM), wBitsPerSample (= 16), cbSize (= 0) and nChannels, nSamplesPerSec, nBlockAlign, nAvgBytesPerSec depending on the number of channels and the sample rate of the input stream.

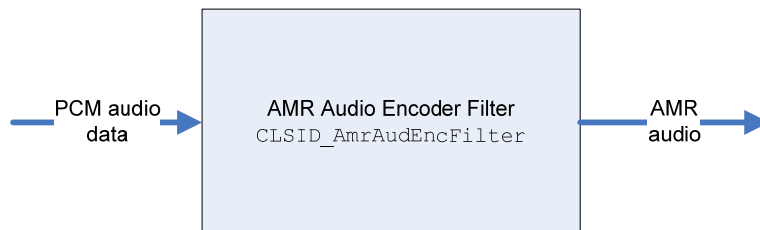
The IMpeg4AudDecPropData interface provides information about the stream.

AMR Audio Encoder Filter

The AMR Audio Transform Filter encodes PCM-coded audio data and produces an AMR compliant audio elementary stream. The audio encoder supports the AMR narrow band (NB) and AMR wide band (WB). The filter provides an interface to set the AMR mode and the encoding bitrate.



Input Pins	1
Media Type	MEDIATYPE_Audio
Media Subtype	MEDIASUBTYPE_PCM
Media Format	FORMAT_WaveFormatEx
Output Pins	1
Media Type	MEDIATYPE_Audio
Media Subtype	MEDIASUBTYPE_AMR_AUDIO, MEDIASUBTYPE_AMRSL_AUDIO
Media Format	FORMAT_WaveFormatEx
Supported Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IAmrAudEnc, IGenericParameter, IReferenceClock, IMpegableDeliver, IMpegableError, IMpegableBase
Audio Profiles	AMR-NB, AMR-WB
Features	Bit-rate from 4.75 kBit/s to 23.85 kBit/s mono, sample rate 8 kHz or 16 kHz



The audio encoder filter expects an input pin connected to its output pin that supports

Type MEDIATYPE_Audio
Sub type MEDIASUBTYPE_AMR_AUDIO

Format Type: `FORMAT_WaveFormatEx`

The `WAVEFORMATEX` structure contains valid values for the sample rate of the audio stream. Furthermore the decoder specific info is attached to the `WAVEFORMATEX` structure in binary format.

The input pin of the audio encoder filter supports the following media type

Type `MEDIATYPE_Audio`
Sub type `MEDIASUBTYPE_NULL`
Format Type: `FORMAT_WaveFormatEx`

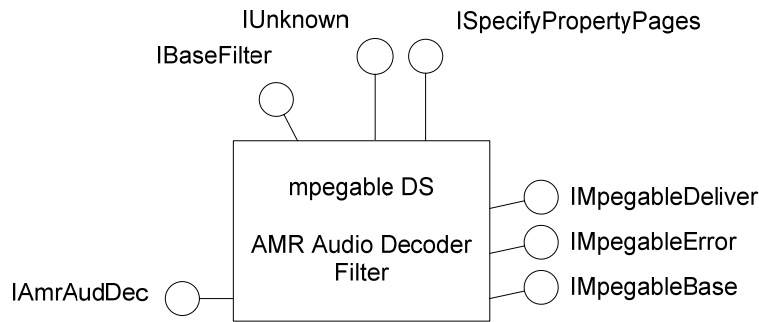
The input pin expects the following fields of `WAVEFORMATEX` structure to contain valid values:

`wFormatTag = WAVE_FORMAT_PCM`, `wBitsPerSample (= 16)`, `cbSize (= 0)`, `nChannels (=1)`, `nSamplesPerSec (=8000/16000)`, `nBlockAlign`, `nAvgBytesPerSec`.

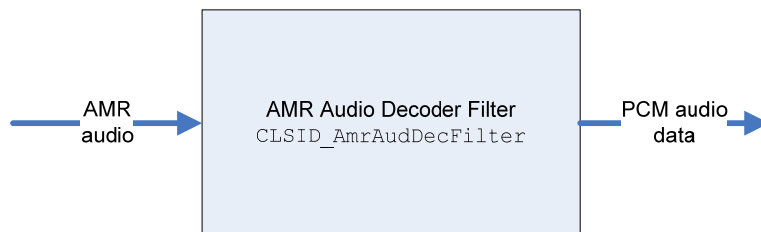
The `IAMrAudEnc` interface allows to set the a bit-rate index indicating the bits per second for the encoded audio stream.

AMR Audio Decoder Filter

The AMR audio decoder filter takes an audio elementary bitstream at the input pin and transforms it to uncompressed PCM-coded audio data. It supports AMR narrow band and AMR wide band at all bitrates.



Input Pins	1
Media Type	MEDIATYPE_Audio
Media Subtype	MEDIASUBTYPE_AMR_AUDIO, MEDIASUBTYPE_AMRSL_AUDIO
Media Format	FORMAT_WaveFormatEx
Output Pins	1
Media Type	MEDIATYPE_Audio
Media Subtype	MEDIASUBTYPE_PCM
Media Format	FORMAT_WaveFormatEx
Supported Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IAmrAudDec, IMpegableDeliver, IMpegableError, IMpegableBase
Audio Profiles	AMR-NB, AMR-WB
Features	Bit-rate from 4.75 kBit/s to 23.85 kBit/s mono, sample rate 8 kHz or 16 kHz



The audio decoder filter expects an output pin connected to its input pin that supports

Type MEDIATYPE_Audio
 Sub type MEDIASUBTYPE_AMR_AUDIO
 Format Type: FORMAT_WaveFormatEx

The WAVEFORMATEX structure should contain valid values for the number of channels, the sample rate and the average number of bytes per second (bitrate) of the audio stream. Furthermore the decoder specific info must be attached to the WAVEFORMATEX structure in binary format.

The output pin supports the following media type

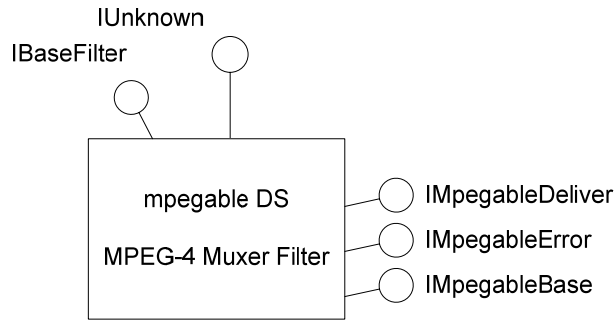
Type MEDIATYPE_Audio
Sub type MEDIASUBTYPE_NULL
Format Type: FORMAT_WaveFormatEx

The output pin also defines the following fields of WAVEFORMATEX structure: wFormatTag (= WAVE_FORMAT_PCM), wBitsPerSample (= 16), cbSize (= 0) and nChannels (=1), nSamplesPerSec (=8000 or 16000), nBlockAlign, nAvgBytesPerSec depending on the number of channels and the sample rate of the input stream.

The `IAmrAudDec` interface provides information about the stream.

MP4 Multiplex Filter

This filter does the multiplex of the MPEG-4 video- and/ or audio-elementary streams. Any data samples that the input pin receives will be sent down to the output pin adding a SL-packet header (*SL = Sync Layer*) [3].



Input Pins	up to 2
Media Type	MEDIATYPE_Video, MEDIATYPE_Audio
Media Subtype	MEDIASUBTYPE_MPEG4SL_VIDEO, MEDIASUBTYPE_MPEG4SL_AUDIO
Media Format	FORMAT_MPEG4Video, FORMAT_WaveFormatEx
Output Pins	1
Media Type	MEDIATYPE_Stream
Media Subtype	MEDIASUBTYPE_MPEG4FLEXMUX
Media Format	FORMAT_MPEG4FlexMux
Supported Interfaces	IUnknown, IBaseFilter, IMpegableDeliver, IMpegableError, IMpegableBase
Features	Multiplexing of MPEG-4 audio and video data streams to ISO compatible MP4 files



The multiplex filter always has on more free input pin that waits to be connected to an output pin for either MPEG-4 video or audio.

- a) The media type of a video input pin is
 - Type: MEDIATYPE_Video
 - Subtype: MEDIASUBTYPE_MPEG4SL_VIDEO, MEDIASUBTYPE_H263SL_VIDEO or MEDIASUBTYPE_AVCSAMPLESL_VIDEO

Format Type: `FORMAT_MPEG4VideoInfo`

The `MPEG4VIDEOINFOHEADER` structure is used to submit information about width and height of the video, as well as time scale and average time per frame (frame-rate).

Attached to the `MPEG4VIDEOINFOHEADER` structure must be the decoder specific info (containing Video Object header and Video Object Layer header of the MPEG-4 video [1]) in binary format. The length of this field is determined by the length of the format field minus `sizeof (MPEG4VIDEOINFOHEADER)`.

b) The media type of an audio output pin is

Type: `MEDIATYPE_Audio`

Subtype: `MEDIASUBTYPE_MPEG4SL_AUDIO`, `MEDIASUBTYPE_MPEG4_AUDIO`,
`MEDIASUBTYPE_AMRSL_AUDIO` or `MEDIASUBTYPE_AMR_AUDIO`

Format Type: `FORMAT_WaveFormatEx`

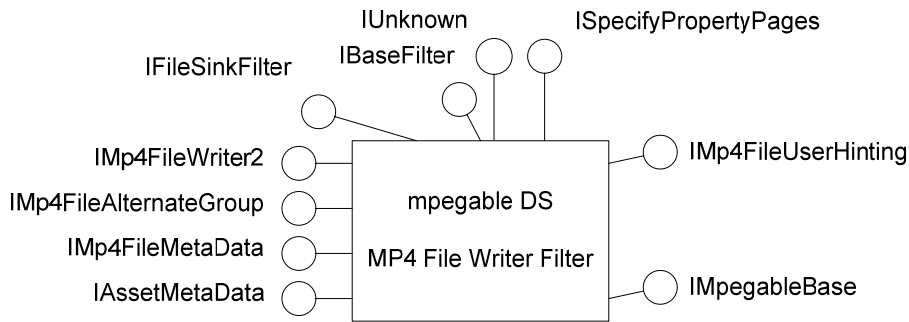
The `WAVEFORMATEX` structure is used to submit information about the number of channels (mono or stereo), the sample rate and the average number of bytes per second.

Attached to the `WAVEFORMATEX` structure is the decoder specific info (containing General Audio header of the MPEG-4 audio [2]) in binary format. The length of this field is determined by the length of the format field minus `sizeof (WAVEFORMATEX)`.

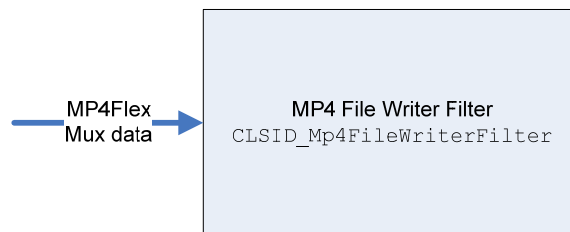
The output pin of the multiplex filter must be attached to the input pin of the file writer filter. For every audio or video stream attached to the multiplexer, the file writer creates a track in the MP4 file.

MP4 File Writer Filter

The MP4 File Writer Filter receives the encoded and multiplexed audio and/or video packets and writes a MP4 File to the disk. This MP4 files can be optionally hinted. Hinted MP4 files can be streamed by any streaming server that complies with ISMA 1.0 [4].

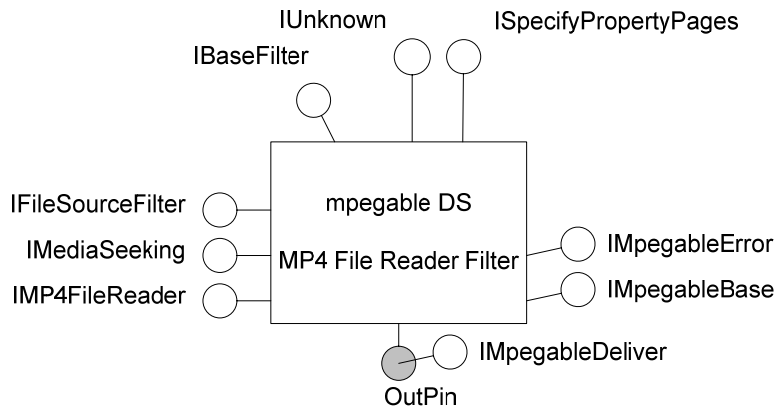


Input Pins	1
Media Type	MEDIATYPE_Stream
Media Subtype	MEDIASUBTYPE_MPEG4FLEXMUX
Media Format	FORMAT_MPEG4FlexMux
Supported Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IFileSinkFilter, IMP4FileWriter2, IAssetMetaData, IMP4FileMetaData, IMP4FileAlternateGroup, IMpegableBase
Features	Creating of ISO compatible MP4 files Adding of hint tracks for "streamable" ISMA compliant MP4 files

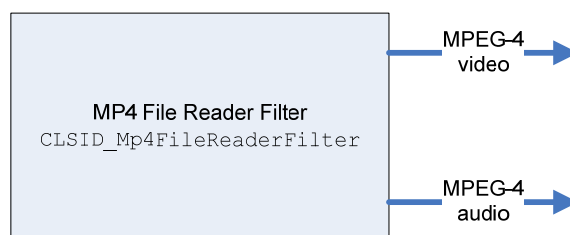


MP4 File Reader Filter

MP4 File Source Filter reads data from audio and video tracks of MP4 or 3gpp files and sends the elementary stream samples to the appropriate downstream filter. The MP4FileReaderProperty interface informs about meta data of every track in the file.



Output Pins	One for every audio or video track in the MP4 file
Supported Pin Interfaces	IUnknown, IPin, IMpegableDeliver
Media Type	MEDIATYPE_Video MEDIATYPE_Audio
Media Subtype	MEDIASUBTYPE_MPEG4_VIDEO, MEDIASUBTYPE_H263_VIDEO, MEDIASUBTYPE_MPEG4_AUDIO, MEDIASUBTYPE_AMR_AUDIO, MEDIASUBTYPE_MPEG4SL_VIDEO, MEDIASUBTYPE_H263SL_VIDEO, MEDIASUBTYPE_MPEG4SL_AUDIO, MEDIASUBTYPE_AMRSL_AUDIO
Media Format	FORMAT_MPEG4Video, FORMAT_WaveFormatEx
Supported Filter Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IFileSourceFilter, IMediaSeeking, IMP4FileReader, IMpegableError, IMpegableBase
Features	Reading of ISO compatible MP4/3GPP files



The filter expects the path and name of a valid MP4 or 3gpp file. It creates one output pin for each audio and video track in the file. Some properties of every media track and of the OD and BIFS track are available via the `IMP4FileReaderProperty` interface.

a) The media type of a video output pin is

Type: `MEDIATYPE_Video`
Subtype: `MEDIASUBTYPE_MPEG4_VIDEO`, `MEDIASUBTYPE_H263_VIDEO`,
`MEDIASUBTYPE_MPEG4SL_VIDEO`, `MEDIASUBTYPE_H263SL_VIDEO`,
`MEDIASUBTYPE_AVCSAMPLE_VIDEO` or
`MEDIASUBTYPE_AVCSAMPLESL_VIDEO`.
Format Type: `FORMAT_VideoInfo`

The `VIDEOINFOHEADER` structure is used to submit information about width and height of the video, and average time per frame (frame-rate).

Attached to the `VIDEOINFOHEADER` structure is the decoder specific info (containing Video Object header and Video Object Layer header of the MPEG-4 video [1]) in binary format. The length of this field is determined by the length of the format field minus `sizeof(VIDEOINFOHEADER)`.

b) The media type of an audio output pin is

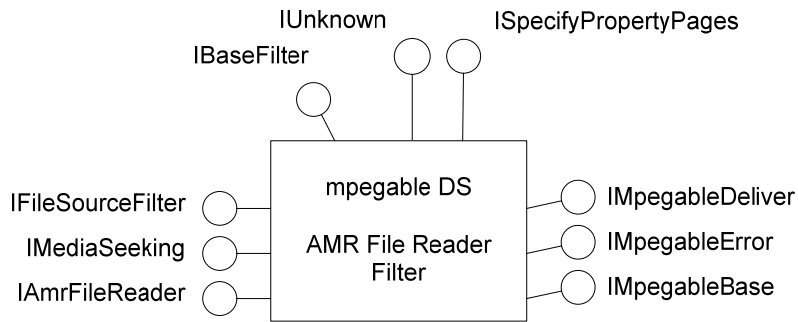
Type: `MEDIATYPE_Audio`
Subtype: `MEDIASUBTYPE_MPEG4_AUDIO`, `MEDIASUBTYPE_AMR_AUDIO`,
`MEDIASUBTYPE_MPEG4SL_AUDIO`, `MEDIASUBTYPE_AMRSL_AUDIO`
Format Type: `FORMAT_WaveFormatEx`

The `WAVEFORMATEX` structure is used to submit information about the number of channels (mono or stereo), the sample rate and the average number of bytes per second.

Attached to the `WAVEFORMATEX` structure is the decoder specific info (containing General Audio header of the MPEG-4 audio [2]) in binary format. The length of this field is determined by the length of the format field minus `sizeof(WAVEFORMATEX)`.

AMR File Reader Filter

The AMR file reader filter reads AMR file and transfers the AMR packets to an AMR decoder filter. It supports AMR-NB and AMR-WB at all bitrates. The current version only supports a single audio channel.



Output Pins	1
Media Type	MEDIATYPE_Audio
Media Subtype	MEDIASUBTYPE_AMR_AUDIO, MEDIASUBTYPE_AMRSL_AUDIO
Media Format	FORMAT_WaveFormatEx
Supported Filter Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IFileSourceFilter, IMediaSeeking, IAmrFileReader, IMpegableDeliver, IMpegableError, IMpegableBase
Audio Profiles	AMR-NB, AMR-WB
Features	Bit-rate from 4.75 kBit/s to 23.85 kBit/s mono, sample rate 8 kHz or 16 kHz



The output pin of the filter supports the following media type

Type MEDIATYPE_Audio
 Sub type MEDIASUBTYPE_AMR_AUDIO, MEDIASUBTYPE_AMRSL_AUDIO
 Format Type: FORMAT_WaveFormatEx

The output pin also defines the following fields of WAVEFORMATEX structure:

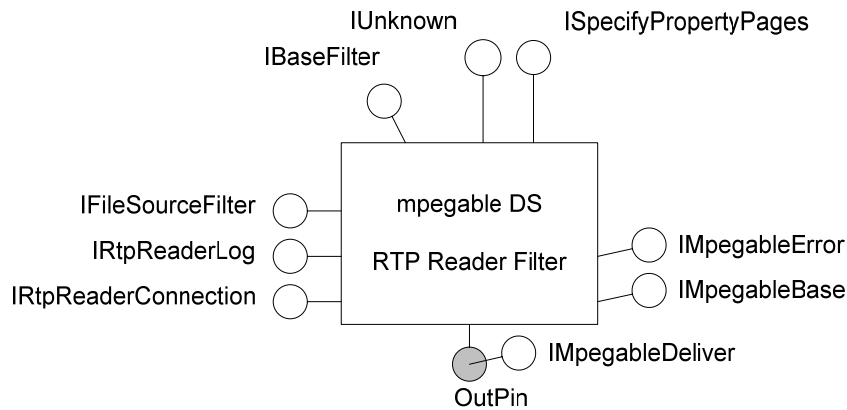
wFormatTag (= WAVE_FORMAT_PCM), wBitsPerSample (= 16), cbSize (= 0) and nChannels (=1), nSamplesPerSec (=8000 or 16000), nBlockAlign, nAvgBytesPerSec depending on the sample rate of the input stream.

The `IAmrFileReader` interface provides information about the stream.

RTP Stream Reader Filter

The RTP Stream Reader Source Filter receives ISMA and 3GPP compliant RTP streams from the IP network and sends the video and audio elementary stream samples to the appropriate downstream filter. The filter accepts an IP address and establishes an RTSP connection to a corresponding streaming server, e.g. Darwin Streaming Server (Apple), Helix server (Real Networks) and others. Alternatively the filter expects the name of a SDP file containing the information to read a unicast or multicast stream.

The IRtpReaderConnection interface allows the setting of network related parameters and informs about meta data of each media stream.



Output Pins	One for each audio or video stream
Supported Pin Interfaces	IUnknown, IPin, IMpegableDeliver
Media Type	MEDIATYPE_Video MEDIATYPE_Audio
Media Subtype	MEDIASUBTYPE_MPEG4SL_VIDEO, MEDIASUBTYPE_MPEG4SL_AUDIO, MEDIASUBTYPE_LATMAACSL_AUDIO, MEDIASUBTYPE_H263SL_VIDEO, MEDIASUBTYPE_H264SL_VIDEO, MEDIASUBTYPE_AMRSL_AUDIO, MEDIASUBTYPE_MPEG4_VIDEO, MEDIASUBTYPE_MPEG4_AUDIO, MEDIASUBTYPE_LATMAAC_AUDIO, MEDIASUBTYPE_H263_VIDEO, MEDIASUBTYPE_H264_VIDEO, MEDIASUBTYPE_AMR_AUDIO, MEDIASUBTYPE_PCM
Media Format	FORMAT_MPEG4Video, FORMAT_WaveFormatEx
Supported Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IFileSourceFilter, IRtpReaderConnection, IRtpReaderLog, IMpegableError, IMpegableBase
Features	Reading of ISMA and 3GPP compliant RTP streams either unicast or multicast
Streaming formats	ISMA, 3GPP (RFC3016, RFC3640, RFC2429, RFC3210, RFC 3984)



The filter expects either the URL of an MP4 stream on an ISMA compliant streaming server, or the path and name of a valid SDP file describing a ISMA compliant multicast stream. It then creates one output pin for each audio and video stream in the session. Some properties of each media stream are available via the `IMpeg4RtpReaderProperty` interface. The `IMpeg4RtpReaderLog` interface allows an easy logging of all RTSP commands as well as the arrival of RTP packets.

- a) The media type of a video output pin is
 - Type: MEDIATYPE_Video
 - Subtype: MEDIASUBTYPE_MPEG4_VIDEO
 - Format Type: FORMAT_VideoInfo

The VIDEOINFOHEADER structure is used to submit information about width and height of the video, and average time per frame (frame-rate).

Attached to the VIDEOINFOHEADER structure is the decoder specific info (containing Video Object header and Video Object Layer header of the MPEG-4 video [1]) in binary format. The length of this field is determined by the length of the format field minus sizeof (VIDEOINFOHEADER).

b) The media type of an audio output pin is

Type: MEDIATYPE_Audio
Subtype: MEDIASUBTYPE_MPEG4_AUDIO
Format Type: FORMAT_WaveFormatEx

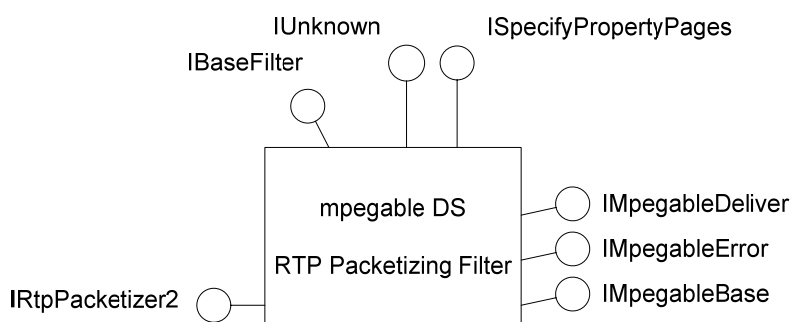
The WAVEFORMATEX structure is used to submit information about the number of channels (mono or stereo), the sample rate and the average number of bytes per second.

Attached to the VIDEOINFOHEADER structure is the decoder specific info (containing General Audio header of the MPEG-4 audio [2]) in binary format. The length of this field is determined by the length of the format field minus sizeof (WAVEFORMATEX).

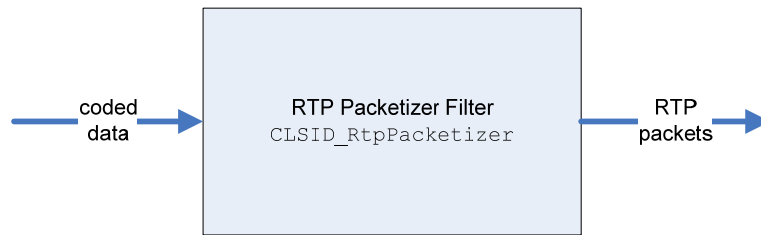
RTP Packetizer Filter

The RTP Stream Packetizer Filter receives encoded video and audio elementary stream data and performs the distribution of the data onto RTP packets due to the specified protocol (basically ISMA and 3GPP). The filter's output pin shall be connected with the RTP sender filter to actually send the RTP packets. The filter must be configured with a protocol specification and a target streaming bitrate.

The IRtpPacketizer interface allows the setting of RTP related parameters and - most important - the streaming bitrate.



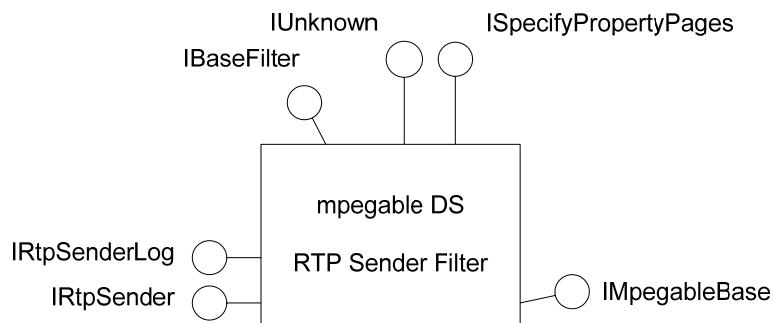
Input Pins	1
Media Type	MEDIATYPE_Video, MEDIATYPE_Audio
Media Subtype	MEDIASUBTYPE_MPEG4SL_VIDEO, MEDIASUBTYPE_MPEG4SL_AUDIO, MEDIASUBTYPE_LATMAACSL_AUDIO, MEDIASUBTYPE_H263SL_VIDEO, MEDIASUBTYPE_H264SL_VIDEO, MEDIASUBTYPE_AMRSL_AUDIO
Media Format	FORMAT_VideoInfo , FORMAT_WaveFormatEx
Output Pins	1
Media Type	MEDIATYPE_Stream
Media Subtype	MEDIASUBTYPE_RTPPACKET
Media Format	FORMAT_RTPPacket
Supported Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IRtpPacketizer2, IMpegableDeliver, IMpegableError, IMpegableBase
Streaming formats	ISMA, 3GPP (RFC3016, RFC3640, RFC2429, RFC3210, RFC 3984)
Features	Bandwidth-smoothing, configurable packet-size



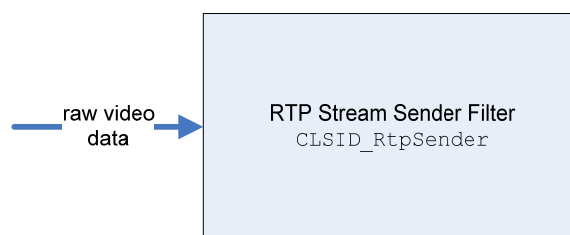
RTP Sender Filter

The RTP Sender Filter receives packetized media samples from the RTP packetizer filter and performs the actual delivery of the RTP packets using the configured network addresses.

The IRtpSender interface allows the setting of source and destination IP-address and port. The filter supports unicast as well as multicast streaming



Input Pins	1
Media Type	MEDIATYPE_Stream
Media Subtype	MEDIASUBTYPE_RTTPACKET
Media Format	FORMAT_RTTPacket
Supported Interfaces	IUnknown, IBaseFilter, ISpecifyPropertyPages, IRtpSender, IRtpSenderLog, IMpegableError, IMpegableBase
Features	Delivery of RTP streams, either unicast or multicast, configurable multicast TTL



References

- [1] ISO/IEC 14496-2, Information Technology – Generic coding of audio-visual objects – Part 2: Visual, 2000
- [2] ISO/IEC 14496-3, Information Technology – Generic coding of audio-visual objects – Part 3: Audio, 1999
- [3] ISO/IEC 14496-1, Information Technology – Coding of audio-visual objects – Part 1: Systems, 1999
- [4] ISMA Implementation Specification, Version 1.0, 28 August 2001
- [5] DirectX 8.1 Programmer's Reference, Microsoft, 2001
- [6] ITU-T Recommendation H.263
- [7] ISO/IEC 14496-10, Information Technology – Generic coding of audio-visual objects – Part 10: Advanced Video Coding, 2002

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dicas is a software technology firm providing innovative solutions for MPEG-based applications and systems. Furthermore, we customize our products to individual requirements and integrate them into our customer's applications and appliances. With a B2B focus we provide the industry with the highest quality core technologies for digital video.

Further Information

For further information about our products please contact us at:

dicas digital image coding GmbH
Rheinstr. 45
D – 12161 Berlin, Germany

Tel.: +49-30-850743-04
Fax.: +49-30-850743-06

Email: contact@dicas.de

or visit our website at

<http://www.dicas.de>
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