Changes of the V4L2 API

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 2)

Unknown directive type "c:namespace".

```
.. c:namespace:: V4L
```

Soon after the V4L API was added to the kernel it was criticised as too inflexible. In August 1998 Bill Dirks proposed a number of improvements and began to work on documentation, example drivers and applications. With the help of other volunteers this eventually became the V4L2 API, not just an extension but a replacement for the V4L API. However it took another four years and two stable kernel releases until the new API was finally accepted for inclusion into the kernel in its present form.

Early Versions

1998-08-20: First version.

1998-08-27: The :c:func:`select()` function was introduced.

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 23); *backlink*

Unknown interpreted text role "c:func".

1998-09-10: New video standard interface.

1998-09-18: The `VIDIOC_NONCAP` ioctl was replaced by the otherwise meaningless `O_TRUNC` :c:func:`open()` flag, and the aliases `O_NONCAP` and `O_NOIO` were defined. Applications can set this flag if they intend to access controls only, as opposed to capture applications which need exclusive access. The `VIDEO_STD_XXX` identifiers are now ordinals instead of flags, and the `video_std_construct()` helper function takes id and transmission arguments.

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 27); *backlink*

Unknown interpreted text role "c:func".

1998-09-28: Revamped video standard. Made video controls individually enumerable.

1998-10-02: The `id` field was removed from struct `video_standard` and the color subcarrier fields were renamed. The :ref:`VIDIOC_QUERYSTD` ioctl was renamed to :ref:`VIDIOC_ENUMSTD`, :ref:`VIDIOC_G_INPUT <VIDIOC_G_INPUT>` to :ref:`VIDIOC_ENUMINPUT`. A first draft of the Codec API was released.

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 39); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 39); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 39); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 39); *backlink*

Unknown interpreted text role "ref".

1998-11-08: Many minor changes. Most symbols have been renamed. Some material changes to struct v4l2_capability.

1998-11-12: The read/write directon of some ioctls was misdefined.

1998-11-14: `V4L2_PIX_FMT_RGB24` changed to `V4L2_PIX_FMT_BGR24`, and `V4L2_PIX_FMT_RGB32` changed to `V4L2_PIX_FMT_BGR32`. Audio controls are now accessible with the :ref:`VIDIOC_G_CTRL <VIDIOC_G_CTRL>` and :ref:`VIDIOC_S_CTRL <VIDIOC_G_CTRL>` ioctls under names starting with `V4L2_CID_AUDIO`. The `V4L2_MAJOR` define was removed from `videodev.h` since it was only used once in the `videodev` kernel module. The `YUV422` and `YUV411` planar image formats were added.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 52); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 52); *backlink*

Unknown interpreted text role "ref".

1998-11-28: A few ioctl symbols changed. Interfaces for codecs and video output devices were added.

1999-01-14: A raw VBI capture interface was added.

1999-01-19: The `VIDIOC_NEXTBUF` ioctl was removed.

V4L2 Version 0.16 1999-01-31

1999-01-27: There is now one QBUF ioctl, VIDIOC_QWBUF and VIDIOC_QRBUF are gone. VIDIOC_QBUF takes a v4l2_buffer as a parameter. Added digital zoom (cropping) controls.

V4L2 Version 0.18 1999-03-16

Added a v4l to V4L2 ioctl compatibility layer to videodev.c. Driver writers, this changes how you implement your ioctl handler. See the Driver Writer's Guide. Added some more control id codes.

V4L2 Version 0.19 1999-06-05

1999-03-18: Fill in the category and catname fields of v4l2_queryctrl objects before passing them to the driver. Required a minor change to the VIDIOC_QUERYCTRL handlers in the sample drivers.

1999-03-31: Better compatibility for v4l memory capture ioctls. Requires changes to drivers to fully support new compatibility features, see Driver Writer's Guide and v4l2cap.c. Added new control IDs: V4L2_CID_HFLIP, _VFLIP. Changed V4L2_PIX_FMT_YUV422P to _YUV422P, and _YUV411P to _YUV411P.

1999-04-04: Added a few more control IDs.

1999-04-07: Added the button control type.

1999-05-02: Fixed a typo in videodev.h, and added the V4L2_CTRL_FLAG_GRAYED (later V4L2_CTRL_FLAG_GRABBED) flag.

1999-05-20: Definition of VIDIOC_G_CTRL was wrong causing a malfunction of this ioctl.

1999-06-05: Changed the value of V4L2_CID_WHITENESS.

V4L2 Version 0.20 (1999-09-10)

Version 0.20 introduced a number of changes which were *not backward compatible* with 0.19 and earlier versions. Purpose of these changes was to simplify the API, while making it more extensible and following common Linux driver API conventions.

1. Some typos in `V4L2_FMT_FLAG` symbols were fixed. struct v4l2_clip was changed for compatibility with v4l. (1999-08-30)
2. `V4L2_TUNER_SUB_LANG1` was added. (1999-09-05)

3. All ioctl() commands that used an integer argument now take a pointer to an integer. Where it makes sense, ioctls will return the actual new value in the integer pointed to by the argument, a common convention in the V4L2 API. The affected ioctls are: VIDIOC_PREVIEW, VIDIOC_STREAMON, VIDIOC_STREAMOFF, VIDIOC_S_FREQ, VIDIOC_S_INPUT, VIDIOC_S_OUTPUT, VIDIOC_S_EFFECT. For example

```
err = ioctl (fd, VIDIOC_XXX, V4L2_XXX);
```

becomes

```
int a = V4L2_XXX; err = ioctl(fd, VIDIOC_XXX, &a);
```

4. All the different get- and set-format commands were swept into one :ref:`VIDIOC_G_FMT <VIDIOC_G_FMT>` and :ref:`VIDIOC_S_FMT <VIDIOC_G_FMT>` ioctl taking a union and a type field selecting the union member as parameter. Purpose is to simplify the API by eliminating several ioctls and to allow new and driver private data streams without adding new ioctls.

> **System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 137); *backlink***
>
> Unknown interpreted text role "ref".

> **System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 137); *backlink***
>
> Unknown interpreted text role "ref".

This change obsoletes the following ioctls: `VIDIOC_S_INFMT`, `VIDIOC_G_INFMT`, `VIDIOC_S_OUTFMT`, `VIDIOC_G_OUTFMT`, `VIDIOC_S_VBIFMT` and `VIDIOC_G_VBIFMT`. The image format struct v4l2_format was renamed to struct v4l2_pix_format, while struct v4l2_format is now the envelopping structure for all format negotiations.

5. Similar to the changes above, the `VIDIOC_G_PARM` and `VIDIOC_S_PARM` ioctls were merged with `VIDIOC_G_OUTPARM` and `VIDIOC_S_OUTPARM`. A `type` field in the new struct v4l2_streamparm selects the respective union member.

   This change obsoletes the `VIDIOC_G_OUTPARM` and `VIDIOC_S_OUTPARM` ioctls.

6. Control enumeration was simplified, and two new control flags were introduced and one dropped. The `catname` field was replaced by a `group` field.

   Drivers can now flag unsupported and temporarily unavailable controls with `V4L2_CTRL_FLAG_DISABLED` and `V4L2_CTRL_FLAG_GRABBED` respectively. The `group` name indicates a possibly narrower classification than the `category`. In other words, there may be multiple groups within a category. Controls within a group would typically be drawn within a group box. Controls in different categories might have a greater separation, or may even appear in separate windows.

7. The struct v4l2_buffer `timestamp` was changed to a 64 bit integer, containing the sampling or output time of the frame in nanoseconds. Additionally timestamps will be in absolute system time, not starting from zero at the beginning of a stream. The data type name for timestamps is stamp_t, defined as a signed 64-bit integer. Output devices should not send a buffer out until the time in the timestamp field has arrived. I would like to follow SGI's lead, and adopt a multimedia timestamping system like their UST (Unadjusted System Time). See http://web.archive.org/web/*/http://reality.sgi.com/cpirazzi_engr/lg/time/intro.html. UST uses timestamps that are 64-bit signed integers (not struct timeval's) and given in nanosecond units. The UST clock starts at zero when the system is booted and runs continuously and uniformly. It takes a little over 292 years for UST to overflow. There is no way to set the UST clock. The regular Linux time-of-day clock can be changed periodically, which would cause errors if it were being used for timestamping a multimedia stream. A real UST style clock will require some support in the kernel that is not there yet. But in anticipation, I will change the timestamp field to a 64-bit integer, and I will change the v4l2_masterclock_gettime() function (used only by drivers) to return a 64-bit integer.

8. A `sequence` field was added to struct v4l2_buffer. The `sequence` field counts captured frames, it is ignored by output devices. When a capture driver drops a frame, the sequence number of that frame is skipped.

V4L2 Version 0.20 incremental changes

1999-12-23: In struct v4l2_vbi_format the `reserved1` field became `offset`. Previously drivers were required to clear the `reserved1` field.

2000-01-13: The `V4L2_FMT_FLAG_NOT_INTERLACED` flag was added.

2000-07-31: The `linux/poll.h` header is now included by `videodev.h` for compatibility with the original `videodev.h` file.

2000-11-20: `V4L2_TYPE_VBI_OUTPUT` and `V4L2_PIX_FMT_Y41P` were added.

2000-11-25: V4L2_TYPE_VBI_INPUT was added.

2000-12-04: A couple typos in symbol names were fixed.

2001-01-18: To avoid namespace conflicts the fourcc macro defined in the videodev.h header file was renamed to v4l2_fourcc.

2001-01-25: A possible driver-level compatibility problem between the videodev.h file in Linux 2.4.0 and the videodev.h file included in the videodevX patch was fixed. Users of an earlier version of videodevX on Linux 2.4.0 should recompile their V4L and V4L2 drivers.

2001-01-26: A possible kernel-level incompatibility between the videodev.h file in the videodevX patch and the videodev.h file in Linux 2.2.x with devfs patches applied was fixed.

2001-03-02: Certain V4L ioctls which pass data in both direction although they are defined with read-only parameter, did not work correctly through the backward compatibility layer. [Solution?]

2001-04-13: Big endian 16-bit RGB formats were added.

2001-09-17: New YUV formats and the :ref:`VIDIOC_G_FREQUENCY <VIDIOC_G_FREQUENCY>` and :ref:`VIDIOC_S_FREQUENCY <VIDIOC_G_FREQUENCY>` ioctls were added. (The old VIDIOC_G_FREQ and VIDIOC_S_FREQ ioctls did not take multiple tuners into account.)

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 237); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 237); *backlink*

Unknown interpreted text role "ref".

2000-09-18: V4L2_BUF_TYPE_VBI was added. This may *break compatibility* as the :ref:`VIDIOC_G_FMT <VIDIOC_G_FMT>` and :ref:`VIDIOC_S_FMT <VIDIOC_G_FMT>` ioctls may fail now if the struct v4l2_fmt type field does not contain V4L2_BUF_TYPE_VBI. In the documentation of the struct v4l2_vbi_format`, the offset field the ambiguous phrase "rising edge" was changed to "leading edge".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 243); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 243); *backlink*

Unknown interpreted text role "ref".

V4L2 Version 0.20 2000-11-23

A number of changes were made to the raw VBI interface.

1. Figures clarifying the line numbering scheme were added to the V4L2 API specification. The start[0] and start[1] fields no longer count line numbers beginning at zero. Rationale: a) The previous definition was unclear. b) The start[] values are ordinal numbers. c) There is no point in inventing a new line numbering scheme. We now use line number as defined by ITU-R, period. Compatibility: Add one to the start values. Applications depending on the previous semantics may not function correctly.
2. The restriction "count[0] > 0 and count[1] > 0" has been relaxed to "(count[0] + count[1]) > 0". Rationale: Drivers may allocate resources at scan line granularity and some data services are transmitted only on the first field. The comment that both count values will usually be equal is misleading and pointless and has been removed. This change *breaks compatibility* with earlier versions: Drivers may return EINVAL, applications may not function correctly.
3. Drivers are again permitted to return negative (unknown) start values as proposed earlier. Why this feature was dropped is unclear. This change may *break compatibility* with applications depending on the start values being positive. The use of EBUSY and EINVAL error codes with the :ref:`VIDIOC_S_FMT <VIDIOC_G_FMT>` ioctl was clarified. The EBUSY error code was finally documented, and the reserved2 field which was previously mentioned only in the videodev.h header

file.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 273); *backlink*

Unknown interpreted text role "ref".

4. New buffer types `V4L2_TYPE_VBI_INPUT` and `V4L2_TYPE_VBI_OUTPUT` were added. The former is an alias for the old `V4L2_TYPE_VBI`, the latter was missing in the `videodev.h` file.

V4L2 Version 0.20 2002-07-25

Added sliced VBI interface proposal.

V4L2 in Linux 2.5.46, 2002-10

Around October-November 2002, prior to an announced feature freeze of Linux 2.5, the API was revised, drawing from experience with V4L2 0.20. This unnamed version was finally merged into Linux 2.5.46.

1. As specified in :ref:`related`, drivers must make related device functions available under all minor device numbers.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 298); *backlink*

Unknown interpreted text role "ref".

2. The :c:func:`open()` function requires access mode `O_RDWR` regardless of the device type. All V4L2 drivers exchanging data with applications must support the `O_NONBLOCK` flag. The `O_NOIO` flag, a V4L2 symbol which aliased the meaningless `O_TRUNC` to indicate accesses without data exchange (panel applications) was dropped. Drivers must stay in "panel mode" until the application attempts to initiate a data exchange, see :ref:`open`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 301); *backlink*

Unknown interpreted text role "c:func".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 301); *backlink*

Unknown interpreted text role "ref".

3. The struct v4l2_capability changed dramatically. Note that also the size of the structure changed, which is encoded in the ioctl request code, thus older V4L2 devices will respond with an `EINVAL` error code to the new :ref:`VIDIOC_QUERYCAP` ioctl.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 310); *backlink*

Unknown interpreted text role "ref".

There are new fields to identify the driver, a new RDS device function `V4L2_CAP_RDS_CAPTURE`, the `V4L2_CAP_AUDIO` flag indicates if the device has any audio connectors, another I/O capability `V4L2_CAP_ASYNCIO` can be flagged. In response to these changes the `type` field became a bit set and was merged into the `flags` field. `V4L2_FLAG_TUNER` was renamed to `V4L2_CAP_TUNER`, `V4L2_CAP_VIDEO_OVERLAY` replaced `V4L2_FLAG_PREVIEW` and `V4L2_CAP_VBI_CAPTURE` and `V4L2_CAP_VBI_OUTPUT` replaced `V4L2_FLAG_DATA_SERVICE`. `V4L2_FLAG_READ` and `V4L2_FLAG_WRITE` were merged into `V4L2_CAP_READWRITE`.

The redundant fields `inputs`, `outputs` and `audios` were removed. These properties can be determined as described in :ref:`video` and :ref:`audio`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-

resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master] [Documentation] [userspace-api] [media] [v4l]hist-v4l2.rst, line 328); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master] [Documentation] [userspace-api] [media] [v4l]hist-v4l2.rst, line 328); *backlink*

Unknown interpreted text role "ref".

The somewhat volatile and therefore barely useful fields `maxwidth`, `maxheight`, `minwidth`, `minheight`, `maxframerate` were removed. This information is available as described in :ref:`format` and :ref:`standard`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master] [Documentation] [userspace-api] [media] [v4l]hist-v4l2.rst, line 332); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master] [Documentation] [userspace-api] [media] [v4l]hist-v4l2.rst, line 332); *backlink*

Unknown interpreted text role "ref".

`V4L2_FLAG_SELECT` was removed. We believe the select() function is important enough to require support of it in all V4L2 drivers exchanging data with applications. The redundant `V4L2_FLAG_MONOCHROME` flag was removed, this information is available as described in :ref:`format`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master] [Documentation] [userspace-api] [media] [v4l]hist-v4l2.rst, line 337); *backlink*

Unknown interpreted text role "ref".

4. In struct v4l2_input the `assoc_audio` field and the `capability` field and its only flag `V4L2_INPUT_CAP_AUDIO` was replaced by the new `audioset` field. Instead of linking one video input to one audio input this field reports all audio inputs this video input combines with.

   New fields are `tuner` (reversing the former link from tuners to video inputs), `std` and `status`.

   Accordingly struct v4l2_output lost its `capability` and `assoc_audio` fields. `audioset`, `modulator` and `std` where added instead.

5. The struct v4l2_audio field `audio` was renamed to `index`, for consistency with other structures. A new capability flag `V4L2_AUDCAP_STEREO` was added to indicated if the audio input in question supports stereo sound. `V4L2_AUDCAP_EFFECTS` and the corresponding `V4L2_AUDMODE` flags where removed. This can be easily implemented using controls. (However the same applies to AVL which is still there.)

   Again for consistency the struct v4l2_audioout field `audio` was renamed to `index`.

6. The struct v4l2_tuner `input` field was replaced by an `index` field, permitting devices with multiple tuners. The link between video inputs and tuners is now reversed, inputs point to their tuner. The `std` substructure became a simple set (more about this below) and moved into struct v4l2_input. A `type` field was added.

   Accordingly in struct v4l2_modulator the `output` was replaced by an `index` field.

   In struct v4l2_frequency the `port` field was replaced by a `tuner` field containing the respective tuner or modulator index number. A tuner `type` field was added and the `reserved` field became larger for future extensions (satellite tuners in particular).

7. The idea of completely transparent video standards was dropped. Experience showed that applications must be able to work with video standards beyond presenting the user a menu. Instead of enumerating supported standards with an ioctl applications can now refer to standards by :ref:`v4l2_std_id <v4l2-std-id>` and symbols defined in the `videodev2.h` header file. For details see :ref:`standard`. The :ref:`VIDIOC_G_STD <VIDIOC_G_STD>` and :ref:`VIDIOC_S_STD <VIDIOC_G_STD>` now take a pointer to this type as argument. :ref:`VIDIOC_QUERYSTD` was added to autodetect the received standard, if the hardware has this capability. In struct v4l2_standard an `index` field was added for :ref:`VIDIOC_ENUMSTD`. A :ref:`v4l2_std_id <v4l2-std-id>` field named `id` was added as machine readable identifier, also replacing the `transmission` field. The misleading `framerate` field was renamed to `frameperiod`. The now obsolete

`colorstandard` information, originally needed to distguish between variations of standards, were removed.

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 383); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 383); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 383); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 383); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 383); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 383); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 383); *backlink*

Unknown interpreted text role "ref".

Struct `v4l2_enumstd` ceased to be. :ref:`VIDIOC_ENUMSTD` now takes a pointer to a struct v4l2_standard directly. The information which standards are supported by a particular video input or output moved into struct v4l2_input and struct v4l2_output fields named `std`, respectively.

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 403); *backlink*

Unknown interpreted text role "ref".

8. The struct :ref:`v4l2_queryctrl <v4l2-queryctrl>` fields `category` and `group` did not catch on and/or were not implemented as expected and therefore removed.

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 411); *backlink*

Unknown interpreted text role "ref".

9. The :ref:`VIDIOC_TRY_FMT <VIDIOC_G_FMT>` ioctl was added to negotiate data formats as with :ref:`VIDIOC_S_FMT <VIDIOC_G_FMT>`, but without the overhead of programming the hardware and regardless of

I/O in progress.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 415); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 415); *backlink*

Unknown interpreted text role "ref".

In struct v4l2_format the `fmt` union was extended to contain struct v4l2_window. All image format negotiations are now possible with `VIDIOC_G_FMT`, `VIDIOC_S_FMT` and `VIDIOC_TRY_FMT`; ioctl. The `VIDIOC_G_WIN` and `VIDIOC_S_WIN` ioctls to prepare for a video overlay were removed. The `type` field changed to type enum v4l2_buf_type and the buffer type names changed as follows.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 429)

Unknown directive type "flat-table".

```
.. flat-table::
    :header-rows:  1
    :stub-columns: 0

    * - Old defines
      - enum v4l2_buf_type
    * - ``V4L2_BUF_TYPE_CAPTURE``
      - ``V4L2_BUF_TYPE_VIDEO_CAPTURE``
    * - ``V4L2_BUF_TYPE_CODECIN``
      - Omitted for now
    * - ``V4L2_BUF_TYPE_CODECOUT``
      - Omitted for now
    * - ``V4L2_BUF_TYPE_EFFECTSIN``
      - Omitted for now
    * - ``V4L2_BUF_TYPE_EFFECTSIN2``
      - Omitted for now
    * - ``V4L2_BUF_TYPE_EFFECTSOUT``
      - Omitted for now
    * - ``V4L2_BUF_TYPE_VIDEOOUT``
      - ``V4L2_BUF_TYPE_VIDEO_OUTPUT``
    * - ``-``
      - ``V4L2_BUF_TYPE_VIDEO_OVERLAY``
    * - ``-``
      - ``V4L2_BUF_TYPE_VBI_CAPTURE``
    * - ``-``
      - ``V4L2_BUF_TYPE_VBI_OUTPUT``
    * - ``-``
      - ``V4L2_BUF_TYPE_SLICED_VBI_CAPTURE``
    * - ``-``
      - ``V4L2_BUF_TYPE_SLICED_VBI_OUTPUT``
    * - ``V4L2_BUF_TYPE_PRIVATE_BASE``
      - ``V4L2_BUF_TYPE_PRIVATE`` (but this is deprecated)
```

10. In struct v4l2_fmtdesc a enum v4l2_buf_type field named `type` was added as in struct v4l2_format. The `VIDIOC_ENUM_FBUFFMT` ioctl is no longer needed and was removed. These calls can be replaced by :ref:`VIDIOC_ENUM_FMT` with type `V4L2_BUF_TYPE_VIDEO_OVERLAY`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 462); *backlink*

Unknown interpreted text role "ref".

11. In struct v4l2_pix_format the `depth` field was removed, assuming applications which recognize the format by its four-character-code already know the color depth, and others do not care about it. The same rationale lead to the removal of the `V4L2_FMT_FLAG_COMPRESSED` flag. The `V4L2_FMT_FLAG_SWCONVECOMPRESSED` flag was removed because drivers are

not supposed to convert images in kernel space. A user library of conversion functions should be provided instead. The V4L2_FMT_FLAG_BYTESPERLINE flag was redundant. Applications can set the bytesperline field to zero to get a reasonable default. Since the remaining flags were replaced as well, the flags field itself was removed.

The interlace flags were replaced by a enum v4l2_field value in a newly added field field.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 483)

Unknown directive type "flat-table".

```
.. flat-table::
    :header-rows:  1
    :stub-columns: 0

    * - Old flag
      - enum v4l2_field
    * - ``V4L2_FMT_FLAG_NOT_INTERLACED``
      - ?
    * - ``V4L2_FMT_FLAG_INTERLACED`` = ``V4L2_FMT_FLAG_COMBINED``
      - ``V4L2_FIELD_INTERLACED``
    * - ``V4L2_FMT_FLAG_TOPFIELD`` = ``V4L2_FMT_FLAG_ODDFIELD``
      - ``V4L2_FIELD_TOP``
    * - ``V4L2_FMT_FLAG_BOTFIELD`` = ``V4L2_FMT_FLAG_EVENFIELD``
      - ``V4L2_FIELD_BOTTOM``
    * - ``-``
      - ``V4L2_FIELD_SEQ_TB``
    * - ``-``
      - ``V4L2_FIELD_SEQ_BT``
    * - ``-``
      - ``V4L2_FIELD_ALTERNATE``
```

The color space flags were replaced by a enum v4l2_colorspace value in a newly added colorspace field, where one of V4L2_COLORSPACE_SMPTE170M, V4L2_COLORSPACE_BT878, V4L2_COLORSPACE_470_SYSTEM_M or V4L2_COLORSPACE_470_SYSTEM_BG replaces V4L2_FMT_CS_601YUV.

12. In struct v4l2_requestbuffers the type field was properly defined as enum v4l2_buf_type. Buffer types changed as mentioned above. A new memory field of type enum v4l2_memory was added to distinguish between I/O methods using buffers allocated by the driver or the application. See :ref:`io` for details.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 510); *backlink*

Unknown interpreted text role "ref".

13. In struct v4l2_buffer the type field was properly defined as enum v4l2_buf_type. Buffer types changed as mentioned above. A field field of type enum v4l2_field was added to indicate if a buffer contains a top or bottom field. The old field flags were removed. Since no unadjusted system time clock was added to the kernel as planned, the timestamp field changed back from type stamp_t, an unsigned 64 bit integer expressing the sample time in nanoseconds, to struct timeval. With the addition of a second memory mapping method the offset field moved into union m, and a new memory field of type enum v4l2_memory was added to distinguish between I/O methods. See :ref:`io` for details.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 517); *backlink*

Unknown interpreted text role "ref".

The V4L2_BUF_REQ_CONTIG flag was used by the V4L compatibility layer, after changes to this code it was no longer needed. The V4L2_BUF_ATTR_DEVICEMEM flag would indicate if the buffer was indeed allocated in device memory rather than DMA-able system memory. It was barely useful and so was removed.

14. In struct v4l2_framebuffer the base[3] array anticipating double- and triple-buffering in off-screen video memory, however without defining a synchronization mechanism, was replaced by a single pointer. The V4L2_FBUF_CAP_SCALEUP and V4L2_FBUF_CAP_SCALEDOWN flags were removed. Applications can determine this capability more accurately using the new cropping and scaling interface. The V4L2_FBUF_CAP_CLIPPING flag was replaced by V4L2_FBUF_CAP_LIST_CLIPPING and V4L2_FBUF_CAP_BITMAP_CLIPPING.

15. In struct v4l2_clip the x, y, width and height field moved into a c substructure of type struct v4l2_rect. The x and y fields

were renamed to `left` and `top`, i. e. offsets to a context dependent origin.

16. In struct v4l2_window the `x`, `y`, `width` and `height` field moved into a `w` substructure as above. A `field` field of type enum v4l2_field was added to distinguish between field and frame (interlaced) overlay.

17. The digital zoom interface, including struct `v4l2_zoomcap`, struct `v4l2_zoom`, `V4L2_ZOOM_NONCAP` and `V4L2_ZOOM_WHILESTREAMING` was replaced by a new cropping and scaling interface. The previously unused struct v4l2_cropcap and struct v4l2_crop where redefined for this purpose. See :ref:`crop` for details.

    System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 559); *backlink*

    Unknown interpreted text role "ref".

18. In struct v4l2_vbi_format the `SAMPLE_FORMAT` field now contains a four-character-code as used to identify video image formats and `V4L2_PIX_FMT_GREY` replaces the `V4L2_VBI_SF_UBYTE` define. The `reserved` field was extended.

19. In struct v4l2_captureparm the type of the `timeperframe` field changed from unsigned long to struct v4l2_fract. This allows the accurate expression of multiples of the NTSC-M frame rate 30000 / 1001. A new field `readbuffers` was added to control the driver behaviour in read I/O mode.

    Similar changes were made to struct v4l2_outputparm.

20. The struct `v4l2_performance` and `VIDIOC_G_PERF` ioctl were dropped. Except when using the :ref:`read/write I/O method <rw>`, which is limited anyway, this information is already available to applications.

    System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 581); *backlink*

    Unknown interpreted text role "ref".

21. The example transformation from RGB to YCbCr color space in the old V4L2 documentation was inaccurate, this has been corrected in :ref:`pixfmt`.

    System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 586); *backlink*

    Unknown interpreted text role "ref".

V4L2 2003-06-19

1. A new capability flag `V4L2_CAP_RADIO` was added for radio devices. Prior to this change radio devices would identify solely by having exactly one tuner whose type field reads `V4L2_TUNER_RADIO`.

2. An optional driver access priority mechanism was added, see :ref:`app-pri` for details.

    System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 597); *backlink*

    Unknown interpreted text role "ref".

3. The audio input and output interface was found to be incomplete.

    Previously the :ref:`VIDIOC_G_AUDIO <VIDIOC_G_AUDIO>` ioctl would enumerate the available audio inputs. An ioctl to determine the current audio input, if more than one combines with the current video input, did not exist. So `VIDIOC_G_AUDIO` was renamed to `VIDIOC_G_AUDIO_OLD`, this ioctl was removed on Kernel 2.6.39. The :ref:`VIDIOC_ENUMAUDIO` ioctl was added to enumerate audio inputs, while :ref:`VIDIOC_G_AUDIO <VIDIOC_G_AUDIO>` now reports the current audio input.

    System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 602); *backlink*

    Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 602); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 602); *backlink*

Unknown interpreted text role "ref".

The same changes were made to :ref:`VIDIOC_G_AUDOUT <VIDIOC_G_AUDOUT>` and :ref:`VIDIOC_ENUMAUDOUT <VIDIOC_ENUMAUDOUT>`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 612); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 612); *backlink*

Unknown interpreted text role "ref".

Until further the "videodev" module will automatically translate between the old and new ioctls, but drivers and applications must be updated to successfully compile again.

4. The :ref:`VIDIOC_OVERLAY` ioctl was incorrectly defined with write-read parameter. It was changed to write-only, while the write-read version was renamed to `VIDIOC_OVERLAY_OLD`. The old ioctl was removed on Kernel 2.6.39. Until further the "videodev" kernel module will automatically translate to the new version, so drivers must be recompiled, but not applications.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 620); *backlink*

Unknown interpreted text role "ref".

5. :ref:`overlay` incorrectly stated that clipping rectangles define regions where the video can be seen. Correct is that clipping rectangles define regions where *no* video shall be displayed and so the graphics surface can be seen.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 627); *backlink*

Unknown interpreted text role "ref".

6. The :ref:`VIDIOC_S_PARM <VIDIOC_G_PARM>` and :ref:`VIDIOC_S_CTRL <VIDIOC_G_CTRL>` ioctls were defined with write-only parameter, inconsistent with other ioctls modifying their argument. They were changed to write-read, while a `_OLD` suffix was added to the write-only versions. The old ioctls were removed on Kernel 2.6.39. Drivers and applications assuming a constant parameter need an update.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 632); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 632); *backlink*

Unknown interpreted text role "ref".

V4L2 2003-11-05

1. In :ref:`pixfmt-rgb` the following pixel formats were incorrectly transferred from Bill Dirks' V4L2 specification. Descriptions below refer to bytes in memory, in ascending address order.

   System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 643); *backlink*

   Unknown interpreted text role "ref".

   System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 648)

   Unknown directive type "flat-table".

   ```
   .. flat-table::
       :header-rows:  1
       :stub-columns: 0

       * - Symbol
         - In this document prior to revision 0.5
         - Corrected
       * - ``V4L2_PIX_FMT_RGB24``
         - B, G, R
         - R, G, B
       * - ``V4L2_PIX_FMT_BGR24``
         - R, G, B
         - B, G, R
       * - ``V4L2_PIX_FMT_RGB32``
         - B, G, R, X
         - R, G, B, X
       * - ``V4L2_PIX_FMT_BGR32``
         - R, G, B, X
         - B, G, R, X
   ```

   The `V4L2_PIX_FMT_BGR24` example was always correct.

   In :ref:`v4l-image-properties` the mapping of the V4L `VIDEO_PALETTE_RGB24` and `VIDEO_PALETTE_RGB32` formats to V4L2 pixel formats was accordingly corrected.

   System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 670); *backlink*

   Unknown interpreted text role "ref".

2. Unrelated to the fixes above, drivers may still interpret some V4L2 RGB pixel formats differently. These issues have yet to be addressed, for details see :ref:`pixfmt-rgb`.

   System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 674); *backlink*

   Unknown interpreted text role "ref".

V4L2 in Linux 2.6.6, 2004-05-09

1. The :ref:`VIDIOC_CROPCAP` ioctl was incorrectly defined with read-only parameter. It is now defined as write-read ioctl, while the read-only version was renamed to `VIDIOC_CROPCAP_OLD`. The old ioctl was removed on Kernel 2.6.39.

   System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 681); *backlink*

   Unknown interpreted text role "ref".

V4L2 in Linux 2.6.8

1. A new field `input` (former `reserved[0]`) was added to the struct v4l2_buffer. Purpose of this field is to alternate between video inputs (e. g. cameras) in step with the video capturing process. This function must be enabled with the new `V4L2_BUF_FLAG_INPUT` flag. The `flags` field is no longer read-only.

V4L2 spec erratum 2004-08-01

1. The return value of the :ref:`func-open` function was incorrectly documented.

   System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 699); *backlink*

   Unknown interpreted text role "ref".

2. Audio output ioctls end in -AUDOUT, not -AUDIOOUT.
3. In the Current Audio Input example the `VIDIOC_G_AUDIO` ioctl took the wrong argument.
4. The documentation of the :ref:`VIDIOC_QBUF` and :ref:`VIDIOC_DQBUF <VIDIOC_QBUF>` ioctls did not mention the struct v4l2_buffer `memory` field. It was also missing from examples. Also on the `VIDIOC_DQBUF` page the `EIO` error code was not documented.

   System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 707); *backlink*

   Unknown interpreted text role "ref".

   System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 707); *backlink*

   Unknown interpreted text role "ref".

V4L2 in Linux 2.6.14

1. A new sliced VBI interface was added. It is documented in :ref:`sliced` and replaces the interface first proposed in V4L2 specification 0.8.

   System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 716); *backlink*

   Unknown interpreted text role "ref".

V4L2 in Linux 2.6.15

1. The :ref:`VIDIOC_LOG_STATUS` ioctl was added.

   System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 723); *backlink*

   Unknown interpreted text role "ref".

2. New video standards `V4L2_STD_NTSC_443`, `V4L2_STD_SECAM_LC`, `V4L2_STD_SECAM_DK` (a set of SECAM D, K and K1), and `V4L2_STD_ATSC` (a set of `V4L2_STD_ATSC_8_VSB` and `V4L2_STD_ATSC_16_VSB`) were defined. Note the `V4L2_STD_525_60` set now includes `V4L2_STD_NTSC_443`. See also :ref:`v4l2-std-id`.

   System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 725); *backlink*

   Unknown interpreted text role "ref".

3. The VIDIOC_G_COMP and VIDIOC_S_COMP ioctl were renamed to VIDIOC_G_MPEGCOMP and VIDIOC_S_MPEGCOMP respectively. Their argument was replaced by a struct v4l2_mpeg_compression pointer. (The VIDIOC_G_MPEGCOMP and VIDIOC_S_MPEGCOMP ioctls where removed in Linux 2.6.25.)

V4L2 spec erratum 2005-11-27

The capture example in :ref:`capture-example` called the :ref:`VIDIOC_S_CROP <VIDIOC_G_CROP>` ioctl without checking if cropping is supported. In the video standard selection example in :ref:`standard` the :ref:`VIDIOC_S_STD <VIDIOC_G_STD>` call used the wrong argument type.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 742); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 742); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 742); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 742); *backlink*

Unknown interpreted text role "ref".

V4L2 spec erratum 2006-01-10

1. The V4L2_IN_ST_COLOR_KILL flag in struct v4l2_input not only indicates if the color killer is enabled, but also if it is active. (The color killer disables color decoding when it detects no color in the video signal to improve the image quality.)
2. :ref:`VIDIOC_S_PARM <VIDIOC_G_PARM>` is a write-read ioctl, not write-only as stated on its reference page. The ioctl changed in 2003 as noted above.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 756); *backlink*

Unknown interpreted text role "ref".

V4L2 spec erratum 2006-02-03

1. In struct v4l2_captureparm and struct v4l2_outputparm the timeperframe field gives the time in seconds, not microseconds.

V4L2 spec erratum 2006-02-04

1. The clips field in struct v4l2_window must point to an array of struct v4l2_clip, not a linked list, because drivers ignore the struct v4l2_clip. next pointer.

V4L2 in Linux 2.6.17

1. New video standard macros were added: V4L2_STD_NTSC_M_KR (NTSC M South Korea), and the sets V4L2_STD_MN, V4L2_STD_B, V4L2_STD_GH and V4L2_STD_DK. The V4L2_STD_NTSC and V4L2_STD_SECAM sets now include V4L2_STD_NTSC_M_KR and V4L2_STD_SECAM_LC respectively.

2. A new V4L2_TUNER_MODE_LANG1_LANG2 was defined to record both languages of a bilingual program. The use of V4L2_TUNER_MODE_STEREO for this purpose is deprecated now. See the :ref:`VIDIOC_G_TUNER <VIDIOC_G_TUNER>` section for details.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 783); *backlink*

Unknown interpreted text role "ref".

V4L2 spec erratum 2006-09-23 (Draft 0.15)

1. In various places V4L2_BUF_TYPE_SLICED_VBI_CAPTURE and V4L2_BUF_TYPE_SLICED_VBI_OUTPUT of the sliced VBI interface were not mentioned along with other buffer types.
2. In :ref:`VIDIOC_G_AUDIO <VIDIOC_G_AUDIO>` it was clarified that the struct v4l2_audio mode field is a flags field.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 795); *backlink*

Unknown interpreted text role "ref".

3. :ref:`VIDIOC_QUERYCAP` did not mention the sliced VBI and radio capability flags.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 798); *backlink*

Unknown interpreted text role "ref".

4. In :ref:`VIDIOC_G_FREQUENCY <VIDIOC_G_FREQUENCY>` it was clarified that applications must initialize the tuner type field of struct v4l2_frequency before calling :ref:`VIDIOC_S_FREQUENCY <VIDIOC_G_FREQUENCY>`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 801); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 801); *backlink*

Unknown interpreted text role "ref".

5. The reserved array in struct v4l2_requestbuffers has 2 elements, not 32.
6. In :ref:`output` and :ref:`raw-vbi` the device file names /dev/vout which never caught on were replaced by /dev/video.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 809); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 809); *backlink*

Unknown interpreted text role "ref".

7. With Linux 2.6.15 the possible range for VBI device minor numbers was extended from 224-239 to 224-255. Accordingly device file names /dev/vbi0 to /dev/vbi31 are possible now.

V4L2 in Linux 2.6.18

1. New ioctls :ref:`VIDIOC_G_EXT_CTRLS <VIDIOC_G_EXT_CTRLS>`, :ref:`VIDIOC_S_EXT_CTRLS <VIDIOC_G_EXT_CTRLS>` and :ref:`VIDIOC_TRY_EXT_CTRLS <VIDIOC_G_EXT_CTRLS>` were added, a flag to skip unsupported controls with :ref:`VIDIOC_QUERYCTRL`, new control types `V4L2_CTRL_TYPE_INTEGER64` and `V4L2_CTRL_TYPE_CTRL_CLASS` (enum v4l2_ctrl_type), and new control flags `V4L2_CTRL_FLAG_READ_ONLY`, `V4L2_CTRL_FLAG_UPDATE`, `V4L2_CTRL_FLAG_INACTIVE` and `V4L2_CTRL_FLAG_SLIDER` (:ref:`control-flags`). See :ref:`extended-controls` for details.

    System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 819); *backlink*

    Unknown interpreted text role "ref".

    System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 819); *backlink*

    Unknown interpreted text role "ref".

    System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 819); *backlink*

    Unknown interpreted text role "ref".

    System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 819); *backlink*

    Unknown interpreted text role "ref".

    System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 819); *backlink*

    Unknown interpreted text role "ref".

    System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 819); *backlink*

    Unknown interpreted text role "ref".

V4L2 in Linux 2.6.19

1. In struct v4l2_sliced_vbi_cap a buffer type field was added replacing a reserved field. Note on architectures where the size of enum types differs from int types the size of the structure changed. The :ref:`VIDIOC_G_SLICED_VBI_CAP <VIDIOC_G_SLICED_VBI_CAP>` ioctl was redefined from being read-only to write-read. Applications must initialize the type field and clear the reserved fields now. These changes may *break the compatibility* with older drivers and applications.

    System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 833); *backlink*

    Unknown interpreted text role "ref".

2. The ioctls :ref:`VIDIOC_ENUM_FRAMESIZES` and :ref:`VIDIOC_ENUM_FRAMEINTERVALS` were added.

    System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst`, line 843); *backlink*

    Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 843); *backlink*

Unknown interpreted text role "ref".

3. A new pixel format `V4L2_PIX_FMT_RGB444` (:ref:`pixfmt-rgb`) was added.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 848); *backlink*

Unknown interpreted text role "ref".

V4L2 spec erratum 2006-10-12 (Draft 0.17)

1. `V4L2_PIX_FMT_HM12` (:ref:`reserved-formats`) is a YUV 4:2:0, not 4:2:2 format.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 854); *backlink*

Unknown interpreted text role "ref".

V4L2 in Linux 2.6.21

1. The `videodev2.h` header file is now dual licensed under GNU General Public License version two or later, and under a 3-clause BSD-style license.

V4L2 in Linux 2.6.22

1. Two new field orders `V4L2_FIELD_INTERLACED_TB` and `V4L2_FIELD_INTERLACED_BT` were added. See enum v4l2_field for details.
2. Three new clipping/blending methods with a global or straight or inverted local alpha value were added to the video overlay interface. See the description of the :ref:`VIDIOC_G_FBUF <VIDIOC_G_FBUF>` and :ref:`VIDIOC_S_FBUF <VIDIOC_G_FBUF>` ioctls for details.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 871); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 871); *backlink*

Unknown interpreted text role "ref".

A new `global_alpha` field was added to struct v4l2_window, extending the structure. This may **break compatibility** with applications using a struct v4l2_window directly. However the :ref:`VIDIOC_G/S/TRY_FMT <VIDIOC_G_FMT>` ioctls, which take a pointer to a struct v4l2_format parent structure with padding bytes at the end, are not affected.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 876); *backlink*

Unknown interpreted text role "ref".

3. The format of the `chromakey` field in struct v4l2_window changed from "host order RGB32" to a pixel value in the same format as the framebuffer. This may **break compatibility** with existing applications. Drivers supporting the "host order RGB32" format are not known.

V4L2 in Linux 2.6.24

1. The pixel formats V4L2_PIX_FMT_PAL8, V4L2_PIX_FMT_YUV444, V4L2_PIX_FMT_YUV555, V4L2_PIX_FMT_YUV565 and V4L2_PIX_FMT_YUV32 were added.

V4L2 in Linux 2.6.25

1. The pixel formats :ref:`V4L2_PIX_FMT_Y16 <V4L2-PIX-FMT-Y16>` and :ref:`V4L2_PIX_FMT_SBGGR16 <V4L2-PIX-FMT-SBGGR16>` were added.

> **System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 898); *backlink***
>
> Unknown interpreted text role "ref".

> **System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 898); *backlink***
>
> Unknown interpreted text role "ref".

2. New :ref:`controls <control>` V4L2_CID_POWER_LINE_FREQUENCY, V4L2_CID_HUE_AUTO, V4L2_CID_WHITE_BALANCE_TEMPERATURE, V4L2_CID_SHARPNESS and V4L2_CID_BACKLIGHT_COMPENSATION were added. The controls V4L2_CID_BLACK_LEVEL, V4L2_CID_WHITENESS, V4L2_CID_HCENTER and V4L2_CID_VCENTER were deprecated.

> **System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 901); *backlink***
>
> Unknown interpreted text role "ref".

3. A :ref:`Camera controls class <camera-controls>` was added, with the new controls V4L2_CID_EXPOSURE_AUTO, V4L2_CID_EXPOSURE_ABSOLUTE, V4L2_CID_EXPOSURE_AUTO_PRIORITY, V4L2_CID_PAN_RELATIVE, V4L2_CID_TILT_RELATIVE, V4L2_CID_PAN_RESET, V4L2_CID_TILT_RESET, V4L2_CID_PAN_ABSOLUTE, V4L2_CID_TILT_ABSOLUTE, V4L2_CID_FOCUS_ABSOLUTE, V4L2_CID_FOCUS_RELATIVE and V4L2_CID_FOCUS_AUTO.

> **System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 907); *backlink***
>
> Unknown interpreted text role "ref".

4. The VIDIOC_G_MPEGCOMP and VIDIOC_S_MPEGCOMP ioctls, which were superseded by the :ref:`extended controls <extended-controls>` interface in Linux 2.6.18, where finally removed from the videodev2.h header file.

> **System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 916); *backlink***
>
> Unknown interpreted text role "ref".

V4L2 in Linux 2.6.26

1. The pixel formats V4L2_PIX_FMT_Y16 and V4L2_PIX_FMT_SBGGR16 were added.
2. Added user controls V4L2_CID_CHROMA_AGC and V4L2_CID_COLOR_KILLER.

V4L2 in Linux 2.6.27

1. The :ref:`VIDIOC_S_HW_FREQ_SEEK` ioctl and the V4L2_CAP_HW_FREQ_SEEK capability were added.

> **System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 933); *backlink***

Unknown interpreted text role "ref".

2. The pixel formats `V4L2_PIX_FMT_YVYU`, `V4L2_PIX_FMT_PCA501`, `V4L2_PIX_FMT_PCA505`, `V4L2_PIX_FMT_PCA508`, `V4L2_PIX_FMT_PCA561`, `V4L2_PIX_FMT_SGBRG8`, `V4L2_PIX_FMT_PAC207` and `V4L2_PIX_FMT_PJPG` were added.

V4L2 in Linux 2.6.28

1. Added `V4L2_MPEG_AUDIO_ENCODING_AAC` and `V4L2_MPEG_AUDIO_ENCODING_AC3` MPEG audio encodings.
2. Added `V4L2_MPEG_VIDEO_ENCODING_MPEG_4_AVC` MPEG video encoding.
3. The pixel formats `V4L2_PIX_FMT_SGRBG10` and `V4L2_PIX_FMT_SGRBG10DPCM8` were added.

V4L2 in Linux 2.6.29

1. The `VIDIOC_G_CHIP_IDENT` ioctl was renamed to `VIDIOC_G_CHIP_IDENT_OLD` and `VIDIOC_DBG_G_CHIP_IDENT` was introduced in its place. The old struct `v4l2_chip_ident` was renamed to struct `v4l2_chip_ident_old`.
2. The pixel formats `V4L2_PIX_FMT_VYUY`, `V4L2_PIX_FMT_NV16` and `V4L2_PIX_FMT_NV61` were added.
3. Added camera controls `V4L2_CID_ZOOM_ABSOLUTE`, `V4L2_CID_ZOOM_RELATIVE`, `V4L2_CID_ZOOM_CONTINUOUS` and `V4L2_CID_PRIVACY`.

V4L2 in Linux 2.6.30

1. New control flag `V4L2_CTRL_FLAG_WRITE_ONLY` was added.
2. New control `V4L2_CID_COLORFX` was added.

V4L2 in Linux 2.6.32

1. In order to be easier to compare a V4L2 API and a kernel version, now V4L2 API is numbered using the Linux Kernel version numeration.
2. Finalized the RDS capture API. See :ref:`rds` for more information.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 980); *backlink*

Unknown interpreted text role "ref".

3. Added new capabilities for modulators and RDS encoders.
4. Add description for libv4l API.
5. Added support for string controls via new type `V4L2_CTRL_TYPE_STRING`.
6. Added `V4L2_CID_BAND_STOP_FILTER` documentation.
7. Added FM Modulator (FM TX) Extended Control Class: `V4L2_CTRL_CLASS_FM_TX` and their Control IDs.
8. Added FM Receiver (FM RX) Extended Control Class: `V4L2_CTRL_CLASS_FM_RX` and their Control IDs.
9. Added Remote Controller chapter, describing the default Remote Controller mapping for media devices.

V4L2 in Linux 2.6.33

1. Added support for Digital Video timings in order to support HDTV receivers and transmitters.

V4L2 in Linux 2.6.34

1. Added `V4L2_CID_IRIS_ABSOLUTE` and `V4L2_CID_IRIS_RELATIVE` controls to the :ref:`Camera controls class <camera-controls>`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1009); *backlink*

Unknown interpreted text role "ref".

V4L2 in Linux 2.6.37

1. Remove the vtx (videotext/teletext) API. This API was no longer used and no hardware exists to verify the API. Nor were any userspace applications found that used it. It was originally scheduled for removal in 2.6.35.

V4L2 in Linux 2.6.39

1. The old VIDIOC_*_OLD symbols and V4L1 support were removed.
2. Multi-planar API added. Does not affect the compatibility of current drivers and applications. See :ref:`multi-planar API <planar-apis>` for details.

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1025); *backlink*
>
> Unknown interpreted text role "ref".

V4L2 in Linux 3.1

1. VIDIOC_QUERYCAP now returns a per-subsystem version instead of a per-driver one.

   Standardize an error code for invalid ioctl.

   Added V4L2_CTRL_TYPE_BITMASK.

V4L2 in Linux 3.2

1. V4L2_CTRL_FLAG_VOLATILE was added to signal volatile controls to userspace.
2. Add selection API for extended control over cropping and composing. Does not affect the compatibility of current drivers and applications. See :ref:`selection API <selection-api>` for details.

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1045); *backlink*
>
> Unknown interpreted text role "ref".

V4L2 in Linux 3.3

1. Added `V4L2_CID_ALPHA_COMPONENT` control to the :ref:`User controls class <control>`.

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1052); *backlink*
>
> Unknown interpreted text role "ref".

2. Added the device_caps field to struct v4l2_capabilities and added the new V4L2_CAP_DEVICE_CAPS capability.

V4L2 in Linux 3.4

1. Added :ref:`JPEG compression control class <jpeg-controls>`.

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1061); *backlink*
>
> Unknown interpreted text role "ref".

2. Extended the DV Timings API: :ref:`VIDIOC_ENUM_DV_TIMINGS`, :ref:`VIDIOC_QUERY_DV_TIMINGS` and :ref:`VIDIOC_DV_TIMINGS_CAP`.

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1063); *backlink*
>
> Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1063); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1063); *backlink*

Unknown interpreted text role "ref".

V4L2 in Linux 3.5

1. Added integer menus, the new type will be V4L2_CTRL_TYPE_INTEGER_MENU.
2. Added selection API for V4L2 subdev interface: :ref:`VIDIOC_SUBDEV_G_SELECTION` and :ref:`VIDIOC_SUBDEV_S_SELECTION <VIDIOC_SUBDEV_G_SELECTION>`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1074); *backlink*

Unknown interpreted text role "ref".

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1074); *backlink*

Unknown interpreted text role "ref".

3. Added ``V4L2_COLORFX_ANTIQUE``, ``V4L2_COLORFX_ART_FREEZE``, ``V4L2_COLORFX_AQUA``, ``V4L2_COLORFX_SILHOUETTE``, ``V4L2_COLORFX_SOLARIZATION``, ``V4L2_COLORFX_VIVID`` and ``V4L2_COLORFX_ARBITRARY_CBCR`` menu items to the ``V4L2_CID_COLORFX`` control.
4. Added ``V4L2_CID_COLORFX_CBCR`` control.
5. Added camera controls ``V4L2_CID_AUTO_EXPOSURE_BIAS``, ``V4L2_CID_AUTO_N_PRESET_WHITE_BALANCE``, ``V4L2_CID_IMAGE_STABILIZATION``, ``V4L2_CID_ISO_SENSITIVITY``, ``V4L2_CID_ISO_SENSITIVITY_AUTO``, ``V4L2_CID_EXPOSURE_METERING``, ``V4L2_CID_SCENE_MODE``, ``V4L2_CID_3A_LOCK``, ``V4L2_CID_AUTO_FOCUS_START``, ``V4L2_CID_AUTO_FOCUS_STOP``, ``V4L2_CID_AUTO_FOCUS_STATUS`` and ``V4L2_CID_AUTO_FOCUS_RANGE``.

V4L2 in Linux 3.6

1. Replaced ``input`` in struct v4l2_buffer by ``reserved2`` and removed ``V4L2_BUF_FLAG_INPUT``.
2. Added V4L2_CAP_VIDEO_M2M and V4L2_CAP_VIDEO_M2M_MPLANE capabilities.
3. Added support for frequency band enumerations: :ref:`VIDIOC_ENUM_FREQ_BANDS`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1103); *backlink*

Unknown interpreted text role "ref".

V4L2 in Linux 3.9

1. Added timestamp types to ``flags`` field in struct v4l2_buffer. See :ref:`buffer-flags`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1109); *backlink*

Unknown interpreted text role "ref".

2. Added ``V4L2_EVENT_CTRL_CH_RANGE`` control event changes flag. See :ref:`ctrl-changes-flags`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1112); *backlink*

Unknown interpreted text role "ref".

V4L2 in Linux 3.10

1. Removed obsolete and unused DV_PRESET ioctls VIDIOC_G_DV_PRESET, VIDIOC_S_DV_PRESET, VIDIOC_QUERY_DV_PRESET and VIDIOC_ENUM_DV_PRESET. Remove the related v4l2_input/output capability flags V4L2_IN_CAP_PRESETS and V4L2_OUT_CAP_PRESETS.
2. Added new debugging ioctl :ref:`VIDIOC_DBG_G_CHIP_INFO`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1123); *backlink*

Unknown interpreted text role "ref".

V4L2 in Linux 3.11

1. Remove obsolete `VIDIOC_DBG_G_CHIP_IDENT` ioctl.

V4L2 in Linux 3.14

1. In struct v4l2_rect, the type of `width` and `height` fields changed from _s32 to _u32.

V4L2 in Linux 3.15

1. Added Software Defined Radio (SDR) Interface.

V4L2 in Linux 3.16

1. Added event V4L2_EVENT_SOURCE_CHANGE.

V4L2 in Linux 3.17

1. Extended struct v4l2_pix_format. Added format flags.
2. Added compound control types and :ref:`VIDIOC_QUERY_EXT_CTRL <VIDIOC_QUERYCTRL>`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1153); *backlink*

Unknown interpreted text role "ref".

V4L2 in Linux 3.18

1. Added `V4L2_CID_PAN_SPEED` and `V4L2_CID_TILT_SPEED` camera controls.

V4L2 in Linux 3.19

1. Rewrote Colorspace chapter, added new enum v4l2_ycbcr_encoding and enum v4l2_quantization fields to struct v4l2_pix_format, struct v4l2_pix_format_mplane and struct v4l2_mbus_framefmt.

V4L2 in Linux 4.4

1. Renamed `V4L2_TUNER_ADC` to `V4L2_TUNER_SDR`. The use of `V4L2_TUNER_ADC` is deprecated now.
2. Added `V4L2_CID_RF_TUNER_RF_GAIN` RF Tuner control.
3. Added transmitter support for Software Defined Radio (SDR) Interface.

Relation of V4L2 to other Linux multimedia APIs

X Video Extension

The X Video Extension (abbreviated XVideo or just Xv) is an extension of the X Window system, implemented for example by the XFree86 project. Its scope is similar to V4L2, an API to video capture and output devices for X clients. Xv allows applications to display live video in a window, send window contents to a TV output, and capture or output still images in XPixmaps [1]. With their implementation XFree86 makes the extension available across many operating systems and architectures.

Because the driver is embedded into the X server Xv has a number of advantages over the V4L2 :ref:`video overlay interface <overlay>`. The driver can easily determine the overlay target, i. e. visible graphics memory or off-screen buffers for a destructive overlay. It can program the RAMDAC for a non-destructive overlay, scaling or color-keying, or the clipping functions of the video capture hardware, always in sync with drawing operations or windows moving or changing their stacking order.

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1197); *backlink*
>
> Unknown interpreted text role "ref".

To combine the advantages of Xv and V4L a special Xv driver exists in XFree86 and XOrg, just programming any overlay capable Video4Linux device it finds. To enable it `/etc/X11/XF86Config` must contain these lines:

```
Section "Module"
    Load "v4l"
EndSection
```

As of XFree86 4.2 this driver still supports only V4L ioctls, however it should work just fine with all V4L2 devices through the V4L2 backward-compatibility layer. Since V4L2 permits multiple opens it is possible (if supported by the V4L2 driver) to capture video while an X client requested video overlay. Restrictions of simultaneous capturing and overlay are discussed in :ref:`overlay` apply.

> **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1217); *backlink*
>
> Unknown interpreted text role "ref".

Only marginally related to V4L2, XFree86 extended Xv to support hardware YUV to RGB conversion and scaling for faster video playback, and added an interface to MPEG-2 decoding hardware. This API is useful to display images captured with V4L2 devices.

Digital Video

V4L2 does not support digital terrestrial, cable or satellite broadcast. A separate project aiming at digital receivers exists. You can find its homepage at https://linuxtv.org. The Linux DVB API has no connection to the V4L2 API except that drivers for hybrid hardware may support both.

Audio Interfaces

[to do - OSS/ALSA]

Experimental API Elements

The following V4L2 API elements are currently experimental and may change in the future.

- :ref:`VIDIOC_DBG_G_REGISTER` and :ref:`VIDIOC_DBG_S_REGISTER <VIDIOC_DBG_G_REGISTER>` ioctls.

  > **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1251); *backlink*
  >
  > Unknown interpreted text role "ref".

  > **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1251); *backlink*
  >
  > Unknown interpreted text role "ref".

- :ref:`VIDIOC_DBG_G_CHIP_INFO` ioctl.

  > **System Message: ERROR/3** (D:\onboarding-resources\sample-onboarding-

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1254); backlink

Unknown interpreted text role "ref".

Obsolete API Elements

The following V4L2 API elements were superseded by new interfaces and should not be implemented in new drivers.

- VIDIOC_G_MPEGCOMP and VIDIOC_S_MPEGCOMP ioctls. Use Extended Controls, :ref:`extended-controls`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1264); backlink

Unknown interpreted text role "ref".

- VIDIOC_G_DV_PRESET, VIDIOC_S_DV_PRESET, VIDIOC_ENUM_DV_PRESETS and VIDIOC_QUERY_DV_PRESET ioctls. Use the DV Timings API (:ref:`dv-timings`).

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1267); backlink

Unknown interpreted text role "ref".

- VIDIOC_SUBDEV_G_CROP and VIDIOC_SUBDEV_S_CROP ioctls. Use VIDIOC_SUBDEV_G_SELECTION and VIDIOC_SUBDEV_S_SELECTION, :ref:`VIDIOC_SUBDEV_G_SELECTION`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]hist-v4l2.rst, line 1271); backlink

Unknown interpreted text role "ref".

[1] This is not implemented in XFree86.