Packed YUV formats

Similarly to the packed RGB formats, the packed YUV formats store the Y, Cb and Cr components consecutively in memory. They may apply subsampling to the chroma components and thus differ in how they interlave the three components.

Note

- In all the tables that follow, bit 7 is the most significant bit in a byte.
- 'Y', 'Cb' and 'Cr' denote bits of the luma, blue chroma (also known as 'U') and red chroma (also known as 'V') components respectively. 'A' denotes bits of the alpha component (if supported by the format), and 'X' denotes padding bits.

4:4:4 Subsampling

These formats do not subsample the chroma components and store each pixels as a full triplet of Y, Cb and Cr values.

The next table lists the packed YUV 4:4:4 formats with less than 8 bits per component. They are named based on the order of the Y, Cb and Cr components as seen in a 16-bit word, which is then stored in memory in little endian byte order, and on the number of bits for each component. For instance the YUV565 format stores a pixel in a 16-bit word [15:0] laid out at as $[Y'_{4-0} Cb_{5-0} Cr_{4-0}]$, and stored in memory in two bytes, $[Cb_{2-0} Cr_{4-0}]$ followed by $[Y'_{4-0} Cb_{5-3}]$.

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]pixfmt-packed-yuv.rst, line 42`)

Unknown directive type "tabularcolumns".

```
.. tabularcolumns:: |p{3.5cm}|p{0.96cm}|p{0.52cm}|p{0.52cm}|p{0.52cm}|p{0.52cm}|p{0.52cm}|p{0.52cm}|p{0.52cm}|p{0.52cm}|p
```

System Message: ERROR/3 (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]pixfmt-packed-yuv.rst, line 44`)

Unknown directive type "flat-table".

```
.. flat-table:: Packed YUV 4:4:4 Image Formats (less than 8bpc)
    :header-rows:  2
    :stub-columns: 0

    * - Identifier
      - Code

      - :cspan:`7` Byte 0 in memory

      - :cspan:`7` Byte 1

    * -
      -
      - 7
      - 6
      - 5
      - 4
      - 3
      - 2
      - 1
      - 0

      - 7
      - 6
      - 5
      - 4
      - 3
      - 2
      - 1
      - 0

    * .. _V4L2-PIX-FMT-YUV444:

      - ``V4L2_PIX_FMT_YUV444``
      - 'Y444'

      - Cb\ :sub:`3`
      - Cb\ :sub:`2`
      - Cb\ :sub:`1`
      - Cb\ :sub:`0`
      - Cr\ :sub:`3`
      - Cr\ :sub:`2`
      - Cr\ :sub:`1`
      - Cr\ :sub:`0`

      - a\ :sub:`3`
      - a\ :sub:`2`
      - a\ :sub:`1`
      - a\ :sub:`0`
      - Y'\ :sub:`3`
      - Y'\ :sub:`2`
      - Y'\ :sub:`1`
      - Y'\ :sub:`0`

    * .. _V4L2-PIX-FMT-YUV555:

      - ``V4L2_PIX_FMT_YUV555``
      - 'YUVO'

      - Cb\ :sub:`2`
      - Cb\ :sub:`1`
      - Cb\ :sub:`0`
      - Cr\ :sub:`4`
      - Cr\ :sub:`3`
      - Cr\ :sub:`2`
      - Cr\ :sub:`1`
      - Cr\ :sub:`0`

      - a
      - Y'\ :sub:`4`
      - Y'\ :sub:`3`
      - Y'\ :sub:`2`
      - Y'\ :sub:`1`
      - Y'\ :sub:`0`
      - Cb\ :sub:`4`
      - Cb\ :sub:`3`

    * .. _V4L2-PIX-FMT-YUV565:

      - ``V4L2_PIX_FMT_YUV565``
      - 'YUVP'

      - Cb\ :sub:`2`
      - Cb\ :sub:`1`
```

```
  - Cb\ :sub:`0`
  - Cr\ :sub:`4`
  - Cr\ :sub:`3`
  - Cr\ :sub:`2`
  - Cr\ :sub:`1`
  - Cr\ :sub:`0`

  - Y'\ :sub:`4`
  - Y'\ :sub:`3`
  - Y'\ :sub:`2`
  - Y'\ :sub:`1`
  - Y'\ :sub:`0`
  - Cb\ :sub:`5`
  - Cb\ :sub:`4`
  - Cb\ :sub:`3`
```

Note

For the YUV444 and YUV555 formats, the value of alpha bits is undefined when reading from the driver, ignored when writing to the driver, except when alpha blending has been negotiated for a :ref:`Video Overlay <overlay>` or :ref:`Video Output Overlay <osd>`.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]pixfmt-packed-yuv.rst, **line 150);** *backlink*

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System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]pixfmt-packed-yuv.rst, **line 150);** *backlink*

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The next table lists the packed YUV 4:4:4 formats with 8 bits per component. They are named based on the order of the Y, Cb and Cr components as stored in memory, and on the total number of bits per pixel. For instance, the VUYX32 format stores a pixel with Cr_{7-0} in the first byte, Cb_{7-0} in the second byte and Y'_{7-0} in the third byte.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]pixfmt-packed-yuv.rst, **line 162)**

Unknown directive type "flat-table".

```
.. flat-table:: Packed YUV Image Formats (8bpc)
    :header-rows: 1
    :stub-columns: 0

    * - Identifier
      - Code
      - Byte 0
      - Byte 1
      - Byte 2
      - Byte 3

    * .. _V4L2-PIX-FMT-YUV32:

      - ``V4L2_PIX_FMT_YUV32``
      - 'YUV4'

      - A\ :sub:`7-0`
      - Y'\ :sub:`7-0`
      - Cb\ :sub:`7-0`
      - Cr\ :sub:`7-0`

    * .. _V4L2-PIX-FMT-AYUV32:

      - ``V4L2_PIX_FMT_AYUV32``
      - 'AYUV'

      - A\ :sub:`7-0`
      - Y'\ :sub:`7-0`
      - Cb\ :sub:`7-0`
      - Cr\ :sub:`7-0`

    * .. _V4L2-PIX-FMT-XYUV32:

      - ``V4L2_PIX_FMT_XYUV32``
      - 'XYUV'

      - X\ :sub:`7-0`
      - Y'\ :sub:`7-0`
      - Cb\ :sub:`7-0`
      - Cr\ :sub:`7-0`

    * .. _V4L2-PIX-FMT-VUYA32:

      - ``V4L2_PIX_FMT_VUYA32``
      - 'VUYA'

      - Cr\ :sub:`7-0`
      - Cb\ :sub:`7-0`
      - Y'\ :sub:`7-0`
      - A\ :sub:`7-0`

    * .. _V4L2-PIX-FMT-VUYX32:

      - ``V4L2_PIX_FMT_VUYX32``
      - 'VUYX'

      - Cr\ :sub:`7-0`
      - Cb\ :sub:`7-0`
      - Y'\ :sub:`7-0`
      - X\ :sub:`7-0`

    * .. _V4L2-PIX-FMT-YUV24:

      - ``V4L2_PIX_FMT_YUV24``
      - 'YUV3'

      - Y'\ :sub:`7-0`
      - Cb\ :sub:`7-0`
      - Cr\ :sub:`7-0`
      - -\
```

Note

- The alpha component is expected to contain a meaningful value that can be used by drivers and applications.
- The padding bits contain undefined values that must be ignored by all applications and drivers.

4:2:2 Subsampling

These formats, commonly referred to as YUYV or YUY2, subsample the chroma components horizontally by 2, storing 2 pixels in 4 bytes.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]pixfmt-packed-yuv.rst, **line 251**)

Unknown directive type "tabularcolumns".

```
.. tabularcolumns:: |p{3.4cm}|p{1.2cm}|p{0.8cm}|p{0.8cm}|p{0.8cm}|p{0.8cm}|p{0.8cm}|p{0.8cm}|p{0.8cm}|
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]pixfmt-packed-yuv.rst, **line 253**)

Unknown directive type "flat-table".

```
.. flat-table:: Packed YUV 4:2:2 Formats
    :header-rows: 1
    :stub-columns: 0

    * - Identifier
      - Code
      - Byte 0
      - Byte 1
      - Byte 2
      - Byte 3
      - Byte 4
      - Byte 5
      - Byte 6
      - Byte 7
    * .. _V4L2-PIX-FMT-UYVY:

      - ``V4L2_PIX_FMT_UYVY``
      - 'UYVY'

      - Cb\ :sub:`0`
      - Y'\ :sub:`0`
      - Cr\ :sub:`0`
      - Y'\ :sub:`1`
      - Cb\ :sub:`2`
      - Y'\ :sub:`2`
      - Cr\ :sub:`2`
      - Y'\ :sub:`3`
    * .. _V4L2-PIX-FMT-VYUY:

      - ``V4L2_PIX_FMT_VYUY``
      - 'VYUY'

      - Cr\ :sub:`0`
      - Y'\ :sub:`0`
      - Cb\ :sub:`0`
      - Y'\ :sub:`1`
      - Cr\ :sub:`2`
      - Y'\ :sub:`2`
      - Cb\ :sub:`2`
      - Y'\ :sub:`3`
    * .. _V4L2-PIX-FMT-YUYV:

      - ``V4L2_PIX_FMT_YUYV``
      - 'YUYV'

      - Y'\ :sub:`0`
      - Cb\ :sub:`0`
      - Y'\ :sub:`1`
      - Cr\ :sub:`0`
      - Y'\ :sub:`2`
      - Cb\ :sub:`2`
      - Y'\ :sub:`3`
      - Cr\ :sub:`2`
    * .. _V4L2-PIX-FMT-YVYU:

      - ``V4L2_PIX_FMT_YVYU``
      - 'YVYU'

      - Y'\ :sub:`0`
      - Cr\ :sub:`0`
      - Y'\ :sub:`1`
      - Cb\ :sub:`0`
      - Y'\ :sub:`2`
      - Cr\ :sub:`2`
      - Y'\ :sub:`3`
      - Cb\ :sub:`2`
```

Color Sample Location: Chroma samples are :ref:`interstitially sited<yuv-chroma-centered>` horizontally.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]pixfmt-packed-yuv.rst, **line 324**); *backlink*

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4:1:1 Subsampling

This format subsamples the chroma components horizontally by 4, storing 8 pixels in 12 bytes.

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]pixfmt-packed-yuv.rst, **line 339**)

Unknown directive type "tabularcolumns".

```
.. tabularcolumns:: |p{2.9cm}|p{0.8cm}|p{0.5cm}|p{0.5cm}|p{0.5cm}|p{0.5cm}|p{0.5cm}|p{0.5cm}|p{0.5cm}|p{0.5cm}|p{0.5cm}|p
```

System Message: ERROR/3 (D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]pixfmt-packed-yuv.rst, **line 341**)

Unknown directive type "flat-table".

```
.. flat-table:: Packed YUV 4:1:1 Formats
    :header-rows: 1
```

```
        :stub-columns: 0

        * - Identifier
          - Code
          - Byte 0
          - Byte 1
          - Byte 2
          - Byte 3
          - Byte 4
          - Byte 5
          - Byte 6
          - Byte 7
          - Byte 8
          - Byte 9
          - Byte 10
          - Byte 11
        * .. _V4L2-PIX-FMT-Y41P:

          - ``V4L2_PIX_FMT_Y41P``
          - 'Y41P'

          - Cb\ :sub:`0`
          - Y'\ :sub:`0`
          - Cr\ :sub:`0`
          - Y'\ :sub:`1`
          - Cb\ :sub:`4`
          - Y'\ :sub:`2`
          - Cr\ :sub:`4`
          - Y'\ :sub:`3`
          - Y'\ :sub:`4`
          - Y'\ :sub:`5`
          - Y'\ :sub:`6`
          - Y'\ :sub:`7`
```

Note

Do not confuse `V4L2_PIX_FMT_Y41P` with :ref:`V4L2_PIX_FMT_YUV411P <V4L2-PIX-FMT-YUV411P>`.
Y41P is derived from "YUV 4:1:1 **packed**", while YUV411P stands for "YUV 4:1:1 **planar**".

> **System Message: ERROR/3** (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]pixfmt-packed-yuv.rst, line 383`); *backlink*
>
> Unknown interpreted text role "ref".

Color Sample Location: Chroma samples are :ref:`interstitially sited<yuv-chroma-centered>` horizontally.

> **System Message: ERROR/3** (`D:\onboarding-resources\sample-onboarding-resources\linux-master\Documentation\userspace-api\media\v4l\[linux-master][Documentation][userspace-api][media][v4l]pixfmt-packed-yuv.rst, line 387`); *backlink*
>
> Unknown interpreted text role "ref".