

Streaming I/O (User Pointers)

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

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

Input and output devices support this I/O method when the `V4L2_CAP_STREAMING` flag in the `capabilities` field of struct `:c:type:`v4l2_capability`` returned by the `ref`VIDIOC_QUERYCAP`` ioctl is set. If the particular user pointer method (not only memory mapping) is supported must be determined by calling the `ref`VIDIOC_REQBUFS`` ioctl with the memory type set to `V4L2_MEMORY_USERPTR`.

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This I/O method combines advantages of the read/write and memory mapping methods. Buffers (planes) are allocated by the application itself, and can reside for example in virtual or shared memory. Only pointers to data are exchanged, these pointers and meta-information are passed in struct `:c:type:`v4l2_buffer`` (or in struct `:c:type:`v4l2_plane`` in the multi-planar API case). The driver must be switched into user pointer I/O mode by calling the `ref`VIDIOC_REQBUFS`` with the desired buffer type. No buffers (planes) are allocated beforehand, consequently they are not indexed and cannot be queried like mapped buffers with the `ref`VIDIOC_QUERYBUF <VIDIOC_QUERYBUF>`` ioctl.

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Example: Initiating streaming I/O with user pointers

```
struct v4l2_requestbuffers reqbuf;

memset (&reqbuf, 0, sizeof (reqbuf));
reqbuf.type = V4L2_BUF_TYPE_VIDEO_CAPTURE;
reqbuf.memory = V4L2_MEMORY_USERPTR;

if (ioctl (fd, VIDIOC_REQBUFS, &reqbuf) == -1) {
    if (errno == EINVAL)
        printf ("Video capturing or user pointer streaming is not supported\\n");
    else
        perror ("VIDIOC_REQBUFS");

    exit (EXIT_FAILURE);
}
```

Buffer (plane) addresses and sizes are passed on the fly with the `ref`VIDIOC_QBUF <VIDIOC_QBUF>`` ioctl. Although buffers are commonly cycled, applications can pass different addresses and sizes at each `ref`VIDIOC_QBUF <VIDIOC_QBUF>`` call. If required by the hardware the driver swaps memory pages within physical memory to create a continuous area of memory. This happens transparently to the application in the virtual memory subsystem of the kernel. When buffer pages have been swapped out to disk they are brought back and finally locked in physical memory for DMA. [1]

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Filled or displayed buffers are dequeued with the `ref`VIDIOC_DQBUF <VIDIOC_QBUF>`` ioctl. The driver can unlock the memory pages at any time between the completion of the DMA and this ioctl. The memory is also unlocked when `ref`VIDIOC_STREAMOFF <VIDIOC_STREAMON>`` is called, `ref`VIDIOC_REQBUFS``, or when the device is closed. Applications must take care not to free buffers without dequeuing. Firstly, the buffers remain locked for longer, wasting physical memory. Secondly the driver will not be notified when the memory is returned to the application's free list and subsequently reused for other purposes, possibly completing the requested DMA and overwriting valuable data.

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For capturing applications it is customary to enqueue a number of empty buffers, to start capturing and enter the read loop. Here the application waits until a filled buffer can be dequeued, and re-enqueues the buffer when the data is no longer needed. Output applications fill and enqueue buffers, when enough buffers are stacked up output is started. In the write loop, when the application runs out of free buffers it must wait until an empty buffer can be dequeued and reused. Two methods exist to suspend execution of the application until one or more buffers can be dequeued. By default `ref`VIDIOC_DQBUF <VIDIOC_QBUF>`` blocks when no buffer is in the outgoing queue. When the `O_NONBLOCK` flag was given to the `ref`func`open()` function, `ref`VIDIOC_DQBUF`

`<VIDIOC_QBUF>` returns immediately with an `EAGAIN` error code when no buffer is available. The `ref:select()` `<func-select>` or `c:func:poll()` function are always available.

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To start and stop capturing or output applications call the `ref:VIDIOC_STREAMON <VIDIOC_STREAMON>` and `ref:VIDIOC_STREAMOFF <VIDIOC_STREAMON>` ioctl.

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Note

`ref:VIDIOC_STREAMOFF <VIDIOC_STREAMON>` removes all buffers from both queues and unlocks all buffers as a side effect. Since there is no notion of doing anything "how" on a multitasking system, if an application needs to synchronize with another event it should examine the struct `c:type:v4l2_buffer` timestamp of captured or outputted buffers.

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Drivers implementing user pointer I/O must support the `.ref: VDIIOC_REQBUFS <VDIIOC_REQBUFS>`, `.ref: VDIIOC_QBUF <VDIIOC_QBUF>`, `.ref: VDIIOC_DQBUF <VDIIOC_QBUF>`, `.ref: VDIIOC_STREAMON <VDIIOC_STREAMON>` and `.ref: VDIIOC_STREAMOFF <VDIIOC_STREAMON>` ioctls, the `:c:func: select()` and `:c:func: poll()` function. [2]

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- [1] We expect that frequently used buffers are typically not swapped out. Anyway, the process of swapping, locking or generating scatter-gather lists may be time consuming. The delay can be masked by the depth of the incoming buffer queue, and perhaps by maintaining caches assuming a buffer will be soon enqueued again. On the other hand, to optimize memory usage drivers can limit the number of buffers locked in advance and recycle the most recently used buffers first. Of course, the pages of empty buffers in the incoming queue need not be saved to disk. Output buffers must be saved on the incoming and outgoing queue because an application may share them with other processes.
- [2] At the driver level `:c:func: select()` and `:c:func: poll()` are the same, and `:c:func: select()` is too important to be optional. The rest should be evident.

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