Displaying Stereoscopic 3D (S3D) with Intel HD Graphics Processors for Software Developers

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1 Introduction

The purpose of this document is to give an overview and description of the Stereoscopic 3D (S3D) Application Programming Interface (API) for Intel HD Graphics hardware.

The target audience of this document is software developers wanting to utilize S3D in their Windows 7 applications.

The S3D API for Intel graphics hardware is implemented in a static C++ library, included in the Intel Media SDK v3.0 package, available at no charge from http://software.intel.com/en-us/articles/media/.

This document does not describe how to encode, or decode video (movie) data that contains two (2) images (left & right eyes). This document simply describes a method to get the S3D-capable monitor (or TV) to “display” the two images needed to present a perceived 3D image.
2 S3D Overview

2.1 Stereoscopic Display

Stereoscopic 3D (S3D) imagery (a.k.a. Stereoscopy) is, of course, two (2) 2D images (one for each eye) giving the illusion of depth.

PCs have a long history of displaying S3D images. This has generally been achieved by various proprietary methods.

The following is a few legacy solutions used in the past, and some problems/side-effects of those solutions:

- The PC can use a normal 2D display and **directly** control a pair of glasses (a.k.a. "Active Glasses"), which can block one eye from seeing an image, then alternate to block the other eye for the next image.

  **Problems:**
  
  - Each eye only sees half of the images it would normally see. If the display is presenting 60 frames-per-second, each eye only sees 30 frames per second. *(This can increase headaches, etc.)*
  - Users cannot connect multiple S3D sources *(game consoles, Bluray players, cameras, etc.)* to their display.

- The PC can rely on a proprietary display that controls what the user sees. There are many types of these displays. One popular type is a polarized display that uses passive "polarized glasses". Others require no glasses by projecting two images, *(requiring the user to place their eyes in exactly the right spot).*

  **Problems:**
  
  - Dozens of types of displays.
  - Users must manually switch their display between normal "2D" and one of several possible "3D" modes.
  - Users cannot connect multiple S3D sources *(game consoles, Bluray players, cameras, etc.)* to their display.

With newer display link technologies (like HDMI 1.4 or eDP 1.1, etc), devices *(PCs, Bluray players, game consoles, etc.)* can now **automatically** switch the display between normal "2D" and "3D".
This document describes a software interface that developers can use to utilize the newer “automatic” switching to/from 3D modes when displaying with Intel HD Graphics processors.

Once the display is in 3D, an application can utilize the powerful Intel Media SDK to prepare the left & right images or it can directly utilize Microsoft DXVA APIs to generate the two images. An application could also generate its own left & right images (for example a ‘game’).

2.2 Scope & Assumptions

The following is a list of limitations and restrictions to consider for S3D support.

1. Windows* 7 only. Supports windowed or full screen usage models.
2. Direct3D 9 Overlay swap chain usage is required.
3. HDMI 1.4, special eDP, or similar based monitors/TVs.
4. The host application should not send S3D content when the display is set to 2D mode or vice versa. Changing between 2D/S3D display mode involves an OS mode set operation.
5. The cursor will only display in left image.
6. Requires creation (& use of) a Microsoft DXVA video processing device, even if DXVA decoding is not used.
3 Setting an S3D mode

3.1 Display

Summary

Only HDMI 1.4 based monitors or special embedded Display Port (eDP) 1.1a displays are supported.

Details

An API to allow an application to set a S3D display mode is included in (provided by) the Intel Media SDK; However, it can be used by itself (as a stand-alone library). The library is a simple 32-bit Win32 static library. The Intel® Media SDK 3.0 beta is available from: http://software.intel.com/en-us/articles/intel-media-sdk-30-beta
### 3.2 IGFXS3DControl Class

**Summary**

The IGFXS3DControl C++ class (included in the Intel Media SDK), contains the methods and structures needed to control S3D display modes.

**C++ Header File:**
```
samples\sample_common\igfx_s3dcontrol.h
```

**Library File <32-bit or 64-bit>:**
```
samples\sample_common\lib\win32\igfx_s3dcontrol.lib  or
samples\sample_common\lib\x64\igfx_s3dcontrol.lib
```

Typical steps to use this class are as follows ...

An application:

1. Creates an instance of `IGFXS3DControl::`
2. Determines what screen resolutions and refresh rates are currently possible by calling `->GetS3DCaps()`
3. Switches the TV/Monitor to 3D via `->SwitchTo3D()`
4. Creates a Direct3D9 device (with `D3DSWAPEFFECT_OVERLAY`)
5. Calls `DXVA2CreateDirect3DDeviceManager9()`
   a. Calls `->SetDevice()`
6. Calls `DXVA2CreateVideoService`
   a. Calls `->SelectLeftView()` then `CreateVideoProcessor()`
   b. Calls `->SelectRightView()` then `CreateVideoProcessor()`
7. Acquires the render target via `target GetBackBuffer()`
8. Renders left eye
   a. Using the left VideoProcessor, calls `->VideoProcessBlt()`
9. Renders right eye
   a. Using the right VideoProcessor, calls `->VideoProcessBlt()`
   b. Calls `->Present()`
10. Repeats steps 10 & 11 as appropriate
11. Calls `->SwitchTo2D()`
12. Deletes instance of `IGFXS3DControl::`

### 3.3 Typical modes returned by driver

Table below shows the typical modes supported by the display driver for switching to automatic S3D.
### Setting an S3D mode

<table>
<thead>
<tr>
<th>Mode</th>
<th>1080p24</th>
<th>1080p23</th>
<th>720p50</th>
<th>720p59</th>
<th>720p60</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HDMI 1.4a S3D display</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eDP 120Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>All modes*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: For non-native modes default S3D behavior is to scale OS mode to native mode of panel.*
4 Reference Documents / Links


