Gaming With ATI Eyefinity Technology: A Primer

Introduction

With the launch of the ATI Radeon™ HD 5000 series graphics cards and the introduction of ATI Eyefinity technology, AMD has enabled a new level of immersion for Direct3D and OpenGL games.[1] At launch, the majority of games worked well "out of the box" with ATI Eyefinity and were showcased at various events, in presentations and in reviews. Other games may have issues dealing with the new aspect ratios and distortion caused by the monitor bezels which may impact the presentation of the game. All games and/or gaming engines can benefit from being made "ATI Eyefinity Ready" and AMD wants to help the ISV community in this regard. This document discusses the concepts that are important to address as well as the support that AMD provides in the form of APIs and technical knowledge.

Resolutions, Configurations & Aspect Ratios

As mentioned, one of the biggest changes that ATI Eyefinity technology brings is the ability to render a very large number of pixels at very wide aspect ratios. The table below shows the most common ATI Eyefinity modes and the new aspect ratios they enable to illustrate how game developers can plan their gaming stage to both account for and take advantage of ATI Eyefinity.

A high end ATI Eyefinity graphics card capable of driving up to 6 displays at up to 2560x1600 per display can deliver a jaw dropping 7680x3200 pixels or almost 25 million pixels per frame.[2] Even the more typical 3x1 landscape configuration can display over 12 million pixels with an extremely wide aspect ratio of 48x9 (5.33:1). These new aspect ratios means game developers should consider rendering the peripheral view and/or using edges of the outer displays for less-frequently used HUDs, etc.

Display Grouping	Orientation	Maximum Resolution	Display Resolution	Aspect Ratio (4x3 displays)	Aspect Ratio (16x9 displays)
1x1	Landscape		2560x1600	4x3 (1.33:1)	16x9 (1.78:1)
2x1	Landscape	5120x1600	2560x1600	8x3 (2.67:1)	32x9 (3.56:1)
2x1	Portrait	3200x2560	1600x2560	6x4 (1.5:1)	18:16 (1.125:1)
1x2	Landscape	2560x3200	2560x1600	4x6 (0.67:1)	16x18 (0.89:1)
3x1	Landscape	7680x1600	2560x1600	12x3 (4:1)	48x9 (5.33:1)
3x1	Portrait	4800x2560	1600x2560	9x4 (2.25:1)	27x16 (1.69:1)
4x1	Landscape	7680x1200	1920x1200	16x3 (5.33:1)	64x9 (7.11:1)
4x1	Portrait	6400x2560	1600x2560	12x4 (3:1)	36x16 (2.25:1)
2x2	Landscape	5120x3200	2560x1600	4x3 (1.33:1)	16x9 (1.78:1)
3x2	Landscape	7680x3200	2560x1600	12x6 (2:1)	48x18 (2.67:1)

Sample ATI Eyefinity Modes and Aspect Ratios

The most common groupings we expect to see are the 3x1 landscape configuration mentioned earlier (for games where peripheral vision is a benefit) and the 3x1 portrait configuration with an aspect ratio

of essentially 16x9.5 which provides a high resolution at a fairly typical aspect ratio. The 4x1 configuration is less desirable because there is a vertical bezel in the center of vision. The 2x2 mode preserves the single display aspect ratio with a lot more pixels on screen; however this configuration has vertical and horizontal bezels in the center of vision. Finally, the 3x2 “king of the hill” mode will be a great showcase for games to show unprecedented levels of detail but the costs and complexities involved in building this configuration will likely make it appealing only to the ultimate gamer; it has a horizontal bezel in the center of vision.

Note: Currently ATI Eyefinity display modes currently force the individual displays to be in the same resolution, color depth and rotation angle.

Letting the User Select the Mode

Many modern games provide set-up options to control various game rendering settings, including the display mode, quality settings, etc. In some cases, the games include filters that allow the user to filter the available display modes based on typical aspect ratios (4:3, 16:10 and 16:9). We recommend “ATI Eyefinity Ready” games offer additional options that allow the user to easily identify and select ATI Eyefinity display modes from the game set-up screens. For example, current games allow the user to select “4:3” or “16:9” aspect ratios, this should be extended to allow the user to select ATI Eyefinity display modes. When the user selects this option, the resolutions list would be limited to available ATI Eyefinity display modes. Traditional Windows mode enumeration calls do not indicate which modes are ATI Eyefinity and which are not; AMD provides APIs that allow developers to make the determination.

AMD has also observed that many games start up in exclusive mode and select a standard aspect ratio (4:3 or 16:9) which causes the displays to change to cloned (Duplicated) mode, forcing the user to navigate to the games settings pages to change to the ATI Eyefinity display mode before starting to play. It would be preferable, when a game starts up, to detect the current display mode and if it is already an ATI Eyefinity display mode, select it as the starting mode for the game.

In all of these cases, AMD expects the user to enable and group displays using ATI Catalyst Control Center™, which will make the additional ATI Eyefinity modes available. AMD has provided the APIs (the latest update to the AMD Display Library SDK) to assist the game to determine which modes are available and which are ATI Eyefinity modes.

Portrait Modes

Historically, many games have not supported portrait modes as the narrow aspect ratio was inappropriate for traditional gaming. However, ATI Eyefinity combines three portrait displays to produce a compelling gaming environment as a result of its wide and tall field of view. It is therefore quite important that games not blindly filter out portrait modes but instead look to see if the available modes are using an aspect ratio appropriate for the title. In the case of three portrait displays, the game could preselect the ATI Eyefinity display mode to run the game.

Dealing with all those displays

Using a super wide aspect ratio mode introduces challenges when positioning the Heads-Up-Display (HUD) and game menus. For example, if a certain menu is positioned relative to the left edge of the display, that same menu may appear too far left of the "focus area" of the user. Game developers should be aware of where they are rendering the various overlays and take steps to ensure they remain useful. One option is to allow the player to configure where the HUDs go, or providing some useful presets and/or rules based on the number of displays in use.

For example, if the intent of the game is to place the HUD slightly to the left of the field of view, rather than left justifying the HUD, it makes sense to *right justify* the content in the *left display*. AMD provides APIs for determining the monitor viewport topology that will allow games to determine which pixels are being displayed on which physical displays thus allowing full control over where HUDs should be placed to provide the best user experience.

Gaming in a Window

For Windowed games, it is also important to think about ATI Eyefinity technology. When maximized a game must be able to deal with window sizes up to 8k x 8k pixels. If a user prefers "windowed" gaming, there is a good chance they have an additional display (or two) enabled as a "side car". The group of displays in ATI Eyefinity mode is used to play the game while the extra (extended) displays might be being used for web browsing, email and instant messaging.

Avoiding Bezels

It also important to consider where the display crossings are, that is where the bezels are. Moving or scaling menus and HUDs to avoid crossing bezel boundaries, allows the game to take full advantage of the visual immersion qualities of ATI Eyefinity. In general, game elements that are occluded by bezels should be nudged away from the bezel, including reticles (crosshairs), mirrors, binoculars, etc. For example, in a driving simulation, nudging the side mirrors slightly to avoid crossing bezels will make the experience significantly better, even if it slightly compromises the real-world geometry of the car. The same topology APIs mentioned early will provide the ability for the game to place critical visuals in safe areas.

The Main Display

In some cases, a game may infer that one display (the center one) of a grouping is likely the most important. ATI Catalyst Control Center will also allow the user to designate one display in an ATI Eyefinity grouping as the main display. Typically we would expect this display to be the one the user looks at most of the time and the other displays will be in the peripheral. AMD provides APIs to allow the game to determine which display has been designated as the main display. The game could use that information to create the following new options for the user:

- Place HUDs against bezel edges next to the main display so they are close to the main viewing area without obscuring it.

- Place transitional game start-up menus and intra-chapter transitional scenes on the main display in order to be in the center of focus.

Different games may use the main display information in different ways depending on the context of the game, and may provide in-game settings to change the behavior.

Bezel Compensation

One of the issues with modern displays, especially when used in an ATI Eyefinity display mode, is the thickness of the bezel and how that causes discontinuity in the way static objects cross the bezel gap and in the way that objects in motion transition from one display to the next. The eye predicts where and when the object should appear, if it is incorrect spatially or temporally, then the level of immersion in the 3D environment is compromised. AMD is currently working with display companies to encourage the development of thinner bezels but it will take time before the size of the bezel gaps is acceptably small.

To address this issue, the user can create and calibrate bezel compensated ATI Eyefinity display modes through ATI Catalyst Control Center. These modes will be configured to sacrifice the pixels that should be obscured by the display bezels. These pixels are rendered into the frame buffer but not scanned out to any of the displays in the grouping. The existence of bezel compensated modes is an important one for games to take into account. Note that to enable bezel compensation, the pixel densities of all monitors in the display group must be within a 5% tolerance of each other.

- When selecting a display mode for the game, it is beneficial for the user to understand which modes are bezel corrected and which are not. AMD has provided APIs to allow the game to identify and sort modes accordingly.
- Bezel corrected modes will push the aspect ratios slightly wider than discussed above as extra pixels are inserted into the gaps between the displays.
- Keeping HUDs and Menus from spanning a bezel gap is even more important as with bezel correction, pixels, and with them valuable in-game information will be lost. Here the topology APIs will allow the game to know which pixels are actually visible and avoid losing information to the bezels.

If the game separates bezel corrected modes from normal ATI Eyefinity display modes, it is recommended that the mode be displayed not as the true resolution, but as the sum of the visible pixels. For example, a 3x1 ATI Eyefinity display mode where each display is running 1920x1200 might have a bezel corrected resolution of 5936x1200, with 176 pixels behind the bezels. Rather than reporting that mode as 5936x1200, we recommend that the game report the number of visible pixels, which would be 5760x1200, but also indicate that it is bezel corrected. This approach will be consistent with what is shown in ATI Catalyst Control Center. (Note: *The Windows control panel is unaware of ATI Eyefinity display modes and/or bezel compensated display modes and will show all available modes using the full desktop resolution of – in this example - 5936x1200*)

Conclusion

ATI Catalyst Control Center provides the controls for creating, arranging and bezel compensation for ATI Eyefinity modes. AMD has provided APIs that allow games to discover that ATI Eyefinity display modes have been enabled and to determine their properties in terms of modes, arrangement, and bezel compensation. It is up to the game developers to take advantage of these APIs to fully exploit the potential of an ATI Eyefinity gaming rig.

AMD has ATI Eyefinity technology in its newest products and as a result there are working APIs in the driver for much of what has been discussed here. The APIs are included in the latest version of the AMD Display Library (ADL) SDK. The SDK can be accessed from the AMD Developer Central website:

http://developer.amd.com/gpu/ADLSDK/Pages/default.aspx

The SDK has been enhanced to:

- Enumerate ATI Eyefinity modes for both normal and bezel compensated conditions
- Discover the overall topology of an ATI Eyefinity display mode, including which pixels are visible and which ones are "behind the bezel"
- Identify the user's "Main Display"
- Determine the number of viewable pixels in an ATI Eyefinity display mode

How to Get Ready for ATI Eyefinity Technology

Review this document and review your in-development projects to see how ATI Eyefinity fits into your development plans. Contact AMD through your ISV Relations team to ask questions and make suggestions

If there is information not provided by the APIs, ask! In some cases the information may be available and just needs to be exposed through the API in order for a game to use it.

Finally, make sure your games work and work well with ATI Eyefinity and take advantage of what this amazing technology has to offer.

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1 ATI Radeon™ Premium graphics cards that support ATI Eyefinity technology consist of models ATI Radeon™ HD 5450 and higher. ATI Eyefinity technology works with games that support non-standard aspect ratios, which is required for panning across multiple displays. To enable more than two displays, additional panels with native DisplayPort™ connectors, and/or DisplayPort™ compliant active adapters to convert your monitor's native input to your cards DisplayPort™ or Mini-DisplayPort™ connector(s), are required. ATI Eyefinity technology can support up to 6 displays using a single enabled ATI Radeon™ graphics card with Windows Vista or Windows 7 operating systems - the number of displays may vary by board design and you should confirm exact specifications with the applicable manufacturer before purchase. Systems using multiple ATI Radeon™ graphics cards can support a maximum of 8 displays (total across all cards in system) with a maximum 6 of those displays being used together in a display group (also known as a single large surface mode).
2 Subject to monitor resolution. HD capable monitor required for HD playback.