



White Paper | DisplayPort™ 1.2 Technology AMD FirePro™ V7900 and V5900 Professional Graphics

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Introduction

Display devices have always been a critical component of the workstation experience. Whether it is in the form of an external monitor or a notebook's embedded panel, display devices play a vital role in defining the user's visual experience.

The new DisplayPort™ 1.2 technology integrated into the AMD FirePro™ V5900 and V7900 professional graphics products delivers superb visual quality and impressive performance. DisplayPort 1.2, the latest version of the DisplayPort interface standard, boasts features such as higher bandwidth and display daisy-chaining capabilities. Combined, these features complement the AMD Eyefinity¹ multi-display technology very well.

This white paper provides an overview of the DisplayPort 1.2 technology integrated into the AMD FirePro™ V5900 and V7900 display engine. DisplayPort 1.2 capabilities, when combined with cutting-edge display devices, deliver the ultimate in productivity and visual experience.

DisplayPort™ 1.2

In 2006, PC and semi-conductor vendors (including AMD) collaborated in designing the next generation PC display interface, which would eventually be known as DisplayPort. DisplayPort was designed to replace DVI and VGA by offering features that are beneficial to both system integrators and end-users. It was also designed to be flexible and easily extensible for new features that the market will require in the future.

The first generation of DisplayPort provided over 10.8Gbps of raw bandwidth, which no other display interface could match. DisplayPort also supported very long non-active cables, optional latch designs for connectors and audio support. In addition, with DisplayPort, spread spectrum clocking can be enabled to reduce EMI, and source devices such as GPUs can operate in dual-mode. The latter is valuable for it allows the same connector to transport TMDS signals to support DVI and HDMI outputs using inexpensive level-shifting adapters.

The data link rates of DisplayPort 1.1a are fixed at either 1.62Gbps per lane or 2.7Gbps per lane, irrespective of the timing of the attached display device. This design only requires a single reference clock source to drive as many DisplayPort streams as there are display pipelines in the GPU. In contrast, DVI and HDMI both require a dedicated clock source per display timing. This unique DisplayPort feature allows for the most efficient multi-display design and complements AMD Eyefinity multi-display technology. Please refer to the AMD Eyefinity multi-display white paper for more information.

All the features of DisplayPort 1.1a proved that it was the superior PC display interface. To further enhance the DisplayPort interface, the same group of companies collaborated once more to define the next version of DisplayPort, which paved the way for DisplayPort 1.2.

In early 2010, the DisplayPort 1.2 specification was ratified in VESA. This new revision of the standard adds support for new and exciting features, including High Bit-rate audio, even higher bandwidth, and multi-streaming capabilities.

Just as AMD was the first to integrate DisplayPort technology into professional graphics with the ATI FirePro™ 2260, the AMD FirePro™ V7900 and V5900 professional graphics integrate support for the new revision 1.2 of the standard. Table 1 below is a simplified comparison of display interface capabilities integrated into these professional graphics:



¹AMD Eyefinity technology works with applications 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. AMD Eyefinity technology can support up to 8 displays using a single enabled AMD FirePro™ 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. SLS ("Single Large Surface") functionality requires an identical display resolution on all configured displays.

	DisplayPort 1.2	DisplayPort 1.1a	SL-DVI	DL-DVI	HDMI 1.4a ²
Bandwidth	21.6Gbps	10.8Gbps	4.95Gbps	9.9Gbps	6.75Gbps
Video Data Rate	17.28Gbps	8.64Gbps	3.96Gbps	7.92Gbps	5.4Gbps
Maximum Resolution Support @ 24bpp 60Hz	4096x2160	2560x2048	1920x1200	2560x1600	1920x1200
Audio Support	Yes	Yes	No	No	Yes
Embedded Application Support	Yes	Yes	No	No	No
In-band Stereo 3D signaling	Yes	Yes	No	No	Yes
Multi-stream support	Yes	No	No	No	No

Table 1: Display interface capabilities of the AMD FirePro™ V7900 and V5900

High Bit-rate 2

DisplayPort 1.2 supports up to twice the bandwidth of DisplayPort 1.1a. High Bit-rate 2 (HBR2) provides up to 5.4Gbps/lane of bandwidth, or up to 21.6Gbps in a full four-lane configuration. This lends itself very well to many applications that require ultra-high bandwidth.

Chart 1 illustrates the many types of display devices, ranging from very high resolutions to higher refresh rates and even high color depths that can be supported by the digital display interfaces integrated into the AMD FirePro V7900 and V5900.

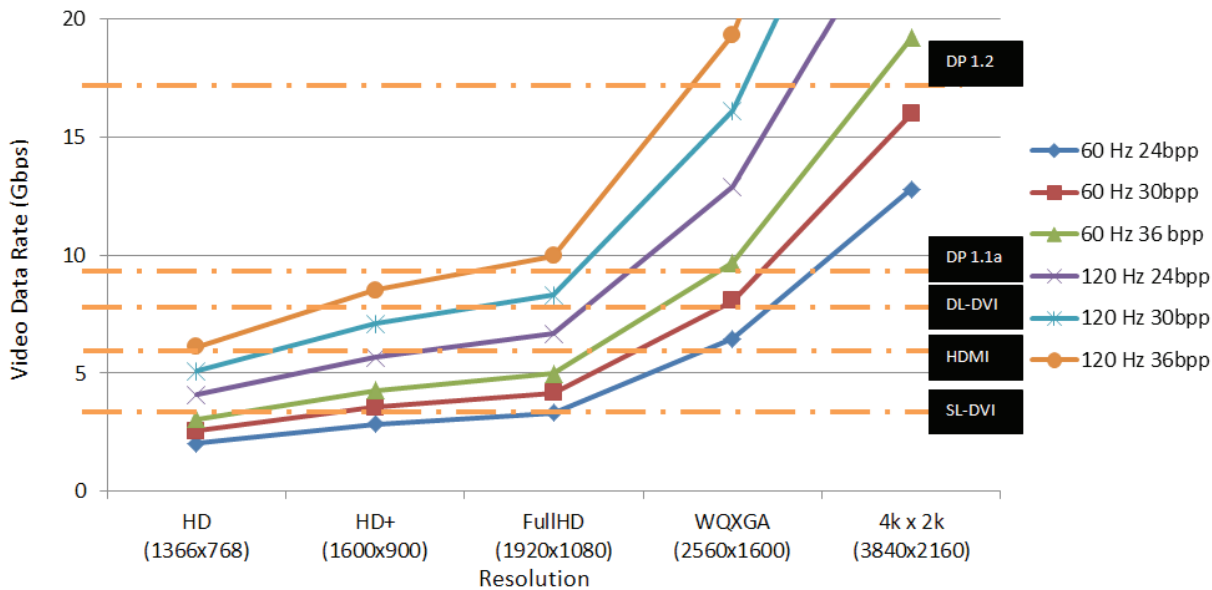


Chart 1: Comparison of video data rate versus resolution at different refresh rates and color depths

Chart 1 illustrates how DisplayPort 1.2 can easily support a multitude of display timings combining high resolutions, high refresh rates and high color depth. No other display interface can match this capability today.

² AMD FirePro V7900 and V5900 require a DisplayPort to HDMI adapter to support HDMI 1.4a output.

4k x 2k Resolution

Ultra-high resolution projectors have existed for years targeting professional applications. 4k TVs have also started appearing in many tradeshows and demonstration events. In the future, AMD envisions displays supporting significantly higher resolutions, well above WQXGA (2560x1600). There are different proposals for 4k resolutions such as 3840x2160 and 4096x2160, both well over 8MPixels. The only common display interface that can meet the high bandwidth requirement to drive such displays and support a refresh rate of 60Hz is DisplayPort 1.2.

Although DisplayPort 1.2 HBR2 can easily accommodate resolutions up to 4096x2160 @ 60Hz, the AMD FirePro V7900 and V5900 are designed to support up to 4096x2160 @ 50Hz.

Stereoscopic 3D

Frame sequential 3D displays are those that display one view at a time (left or right) and require the use of liquid crystal shutter glasses. According to Stereo 3D experts, at least 60fps (or 60Hz) per eye is required for these types of displays to have a pleasant 3D experience. This means that the minimum total refresh rate required is 120Hz. Only DisplayPort 1.2 has enough bandwidth to drive display timings required for high resolution frame sequential 3D displays, and also remove the need for buffering.

Multi-Stream Transport

Leveraging the micro-packet architecture of DisplayPort, DisplayPort 1.2 adds the capability to address and drive several display devices through one DisplayPort connector. This feature has often been referred to as *daisy-chaining* or *addressable displays*.

Multi-Stream transport (MST) can be leveraged using two types of system design. Figure 1 illustrates how MST can be used with daisy-chainable displays. Each of the displays in the daisy-chain configuration, with the exception of the last display in the chain, must have DisplayPort 1.2 receiver(s) and transmitter(s) in order to receive and send the video stream that is addressed to itself and the others down the chain. Once the monitor extracts the video and audio stream addressed to it, it will then transmit the rest of the video and audio streams down the chain. Each daisy-chainable monitor must have knowledge of the entire chain.

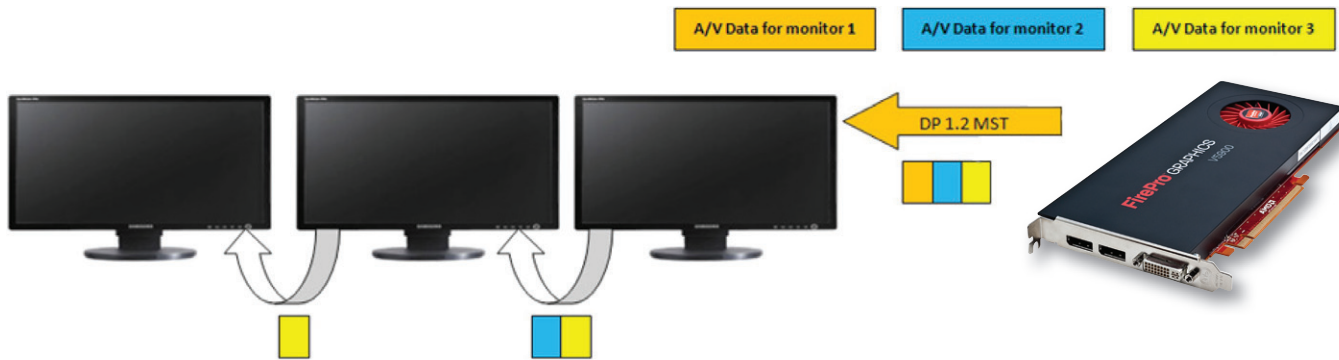


Figure 1: Daisy-chaining monitors

Figure 2 illustrates the alternate method of utilizing MST to drive multiple displays through the use of MST hub or splitter devices. The hub device receives a DisplayPort 1.2 MST signal from the source and splits out the video streams independently to each display device. Using this type of configuration also allows the use of non DisplayPort 1.2 displays. To support non DisplayPort outputs, such as VGA, DVI or HDMI, the hub or splitter must have the capability to convert the DisplayPort signal to the other types of display interface signals.

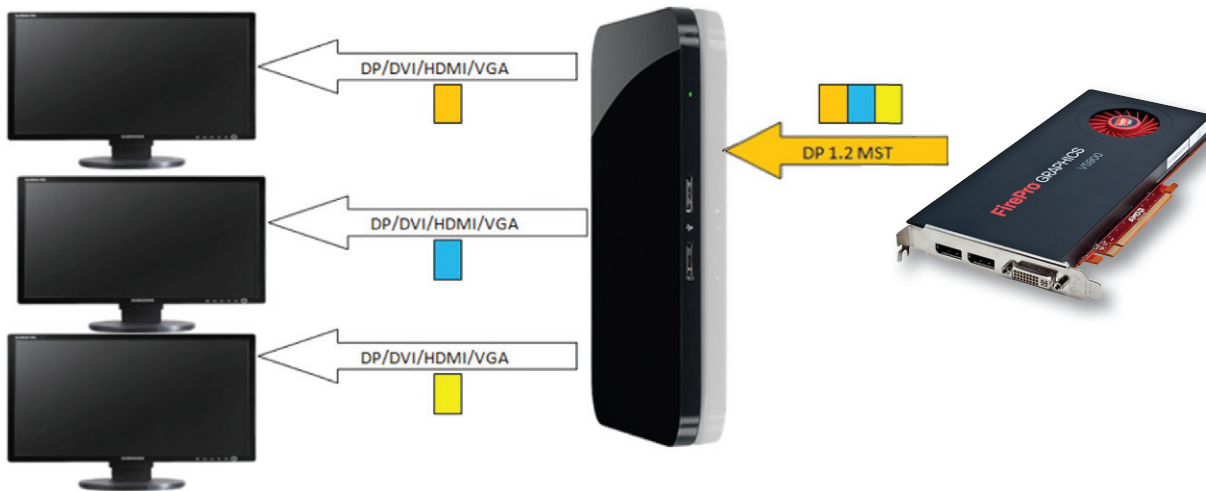


Figure 2: Using MST hub or splitter

The number of display devices, and also the timings at which each display device can be driven will depend on the available bandwidth. Table 2 lists the multi-display configurations possible with HBR and HBR2 bandwidth.

	HBR	HBR2
1366x768 @ 60Hz, 24bpp	Up to 5	Up to 6 ⁵
1600x900 @ 60Hz, 24bpp	Up to 3	Up to 6 ⁵
1920x1080 @ 60Hz, 24bpp	Up to 2	Up to 4
2560x1440 @ 60Hz, 24bpp	1	Up to 2

Table 2: Comparison of DisplayPort bandwidth vs. number of displays

In 2009, AMD first announced AMD Eyefinity multi-display technology. This differentiating feature has been well received by reviewers and end-users alike. While the appeal in professional graphics is mainly the ability for users to dramatically increase their productivity through multi-monitor configurations, it is also extremely useful for ultra-wide screen and high-resolution computing usage scenarios. The AMD FirePro™ V7900 and V5900 will be the first AMD FirePro graphics cards to extend the capabilities of AMD Eyefinity multi-display technology with DisplayPort 1.2 MST.

Using daisy-chainable displays or MST hubs significantly extends the number of display configurations possible with a reference board design that has at least one DisplayPort 1.2 connector. For example, with the ATI FirePro™ V9800, six-display configurations are only possible using six DisplayPort 1.1a connectors.

⁵ HBR2 bandwidth can support more than six displays with this specific timing, but the AMD FirePro V7900 and V5900 support up to a maximum of six independent displays.

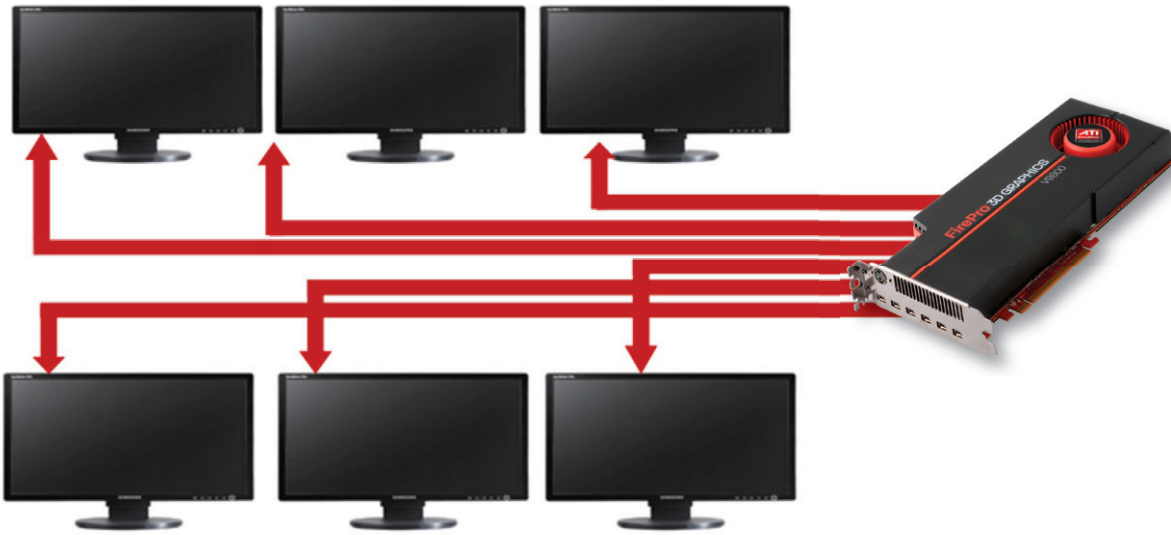


Figure 3: ATI FirePro™ V9800 driving six displays with six mini-DP connectors

As an example of how to combine MST and AMD Eyefinity multi-display technology, consider Figure 4. Using an MST hub, which is expected to be available in Q4 2011, even the ATI FirePro V5900 can drive up to six displays using only two DisplayPort connectors. This provides an upgrade path for end-users who have three monitors today, but may want to upgrade to five or six monitors in the future.

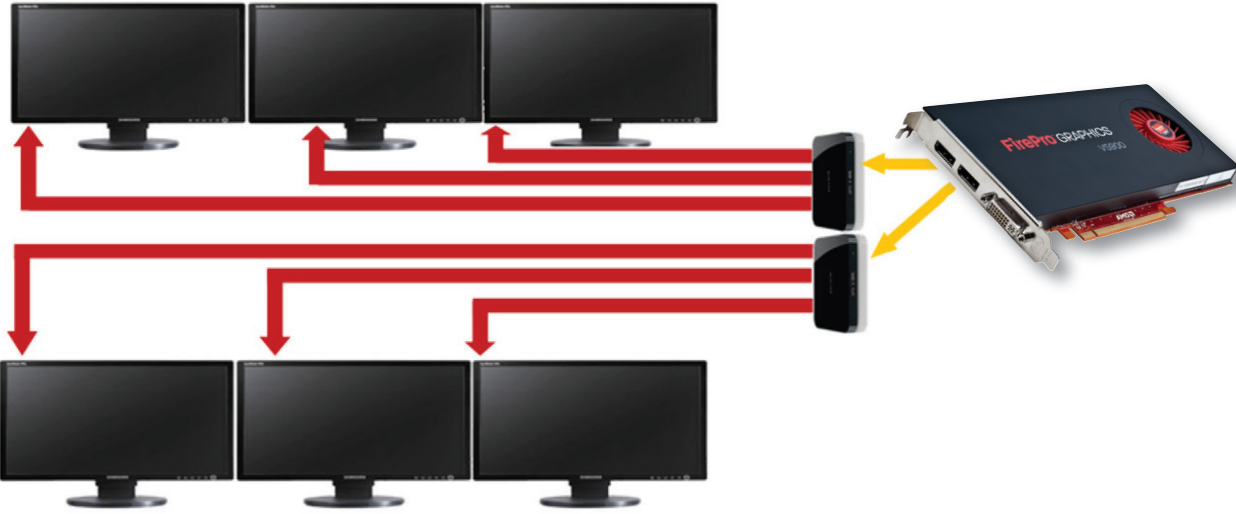


Figure 4: Using MST hub to drive six displays

Maximum AMD Eyefinity Multi-Display Technology Resolution

The ATI FirePro™ V9800 graphics products supported a maximum resolution of 8k pixels wide by 8k pixels high, using AMD Eyefinity multi-display technology to drive multiple monitors. The AMD FirePro™ V7900 and V5900 remove this limitation and support a maximum resolution of 16k pixels wide by 16k pixels high, which enables new usage scenarios. Figure 5 shows one example of a configuration using AMD Eyefinity multi-display technology that would not have been supported with previous generation graphics.

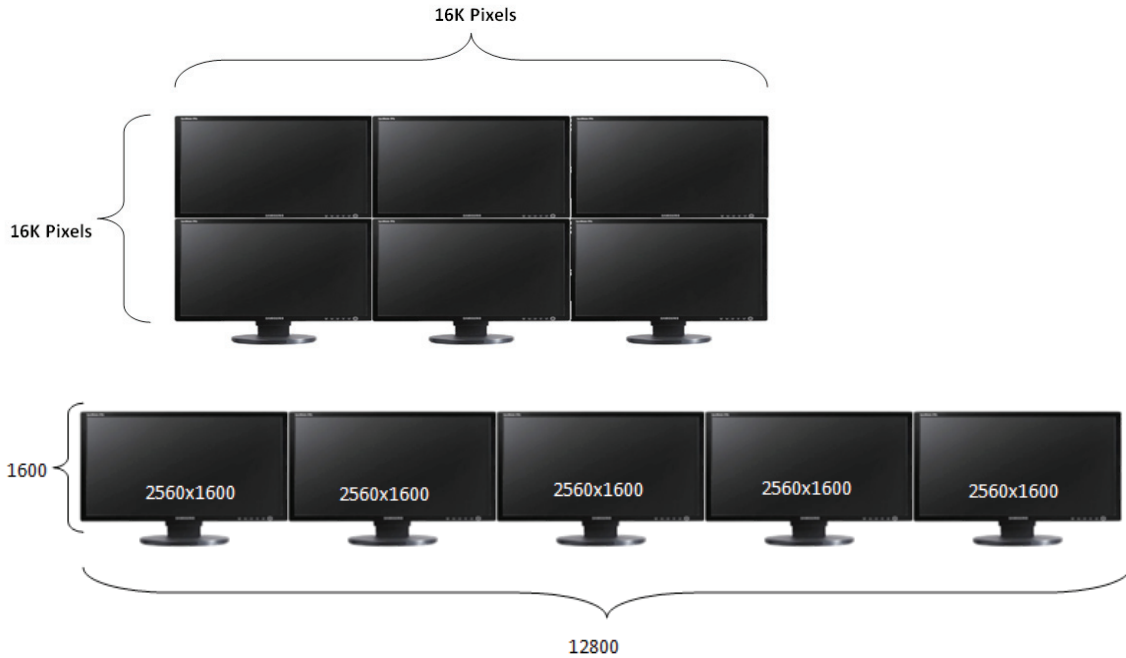


Figure 5: AMD Eyefinity technology configuration that exceeds 8kx8k limitation but is now supported by AMD FirePro V7900 and V5900 graphics

There are other possible configurations that can be supported by the AMD FirePro V7900 and V5900 professional graphics combined with DisplayPort 1.2 MST monitors, hubs and dongles. Please note that to take advantage of this feature, Windows® 7 Aero Glass must be disabled. In addition, only DirectX® 11 games allow resolutions above 8kx8k pixels.

High Bit-rate Audio

In 2009, AMD released the ATI FirePro™ V8850, V7750, V5750 and V3750 graphics products, which were the first to support audio through DisplayPort. Today, there are several DisplayPort monitors in the market that can take advantage of this feature, all of which have the option of attaching external speakers or a sound bar to the monitor.

Although DisplayPort 1.1a supports audio, the specification did not have provision to support High Bit-rate compressed audio formats, such as those found in Blu-ray movies. DisplayPort 1.2 adds this capability and the AMD FirePro V7900 and V5900 will be the first professional graphics products in the market to support High Bit-rate audio through DisplayPort. Table 3 lists the High Bit-rate audio formats found in premium content, now supported through DisplayPort 1.2.

	DTS-HD Master Audio	Dolby TrueHD	PCM 7.1ch
Bit-rate	Up to 24 Mbps	Up to 18 Mbps	Up to 36 Mbps
Bits/Sample	24 bits/sample	24 bits/sample	24 bits/sample
Sampling Rate	Up to 192 kHz	Up to 192 kHz	Up to 192 kHz
Channels	Up to 8	Up to 8	Up to 8

Table 3: Compressed and uncompressed audio formats supported through DisplayPort 1.2

This capability is attractive to HTPC enthusiasts who want the latest in audio technologies in the market.

AMD Advantage

AMD Eyefinity technology is far and away the best choice for multi-display environments. Today's competitive solutions offer a maximum of two display connections per graphics board. When compared to AMD's maximum of six display connections, there is no comparison, especially in view of the total solution cost.

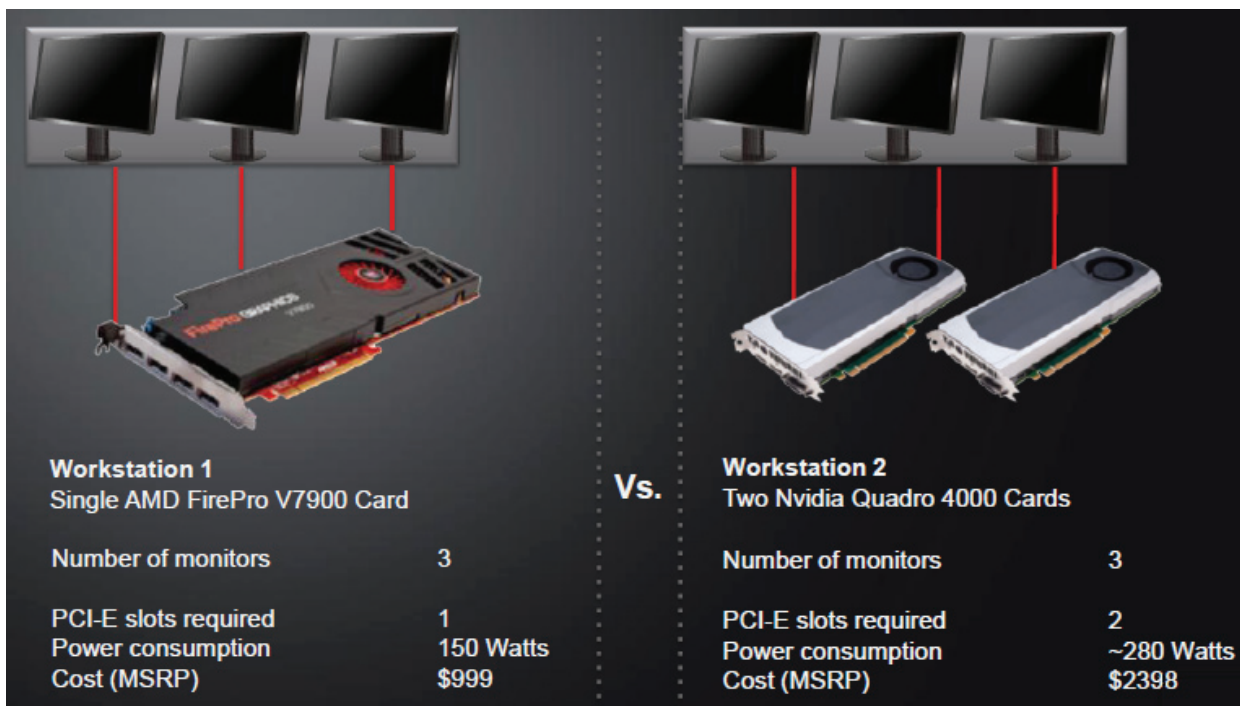


Figure 6: Competitive comparison between a single AMD FirePro™ V7900 driving three displays vs. two comparable NVIDIA cards being required to drive three displays.

AMD has a clear advantage in the solution cost and power requirements for multi-display solutions, especially when more than two monitors are required.

SUMMARY

AMD is a recognized industry leader in display technologies, providing innovation through introduction of new technologies and display interfaces in our products. The AMD FirePro™ V7900 and V5900 are the first professional graphics products to support DisplayPort 1.2 Multi-Streaming and HBR2. AMD continually leads the industry with advanced new display technologies including the first to support DVI, Dual-Link DVI, HDMI, DisplayPort, AMD Eyefinity technology, and now DisplayPort 1.2.

The AMD FirePro V7900 and V5900 combine DisplayPort 1.2 and AMD Eyefinity multi-display technology to deliver the productivity edge you expect with the most flexible and expansive multi-display experience. DisplayPort 1.2 greatly enhances AMD's multi-display leadership with Multi-Streaming Transport and enables Ultra-High bandwidth applications with HBR2, such as FullHD 120Hz stereoscopic 3D and multiple monitors per display connector, with higher resolution and refresh rates than ever before possible from a PC display technology.

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