AMD CROSSFIRE

PREPARED FOR DR. ADAM HOOVER'S ECE468

EMBEDDED COMPUTING

SUBMITTED BY

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MARCH 13, 2013

INTRODUCTION

Crossfire is a technology developed by AMD that allows for distributed graphics computing across multiple GPUs. First introduced in 2005, this technology is incorporated into a wide range of GPU products licensed and sold by AMD, both recreational and professional. The individual computing power of the GPUs are combined (minus overhead) allowing for speeds faster than that of even top-of-the-line graphics cards. This technology does have its limitations, but provides an affordable solution to upgrading a computer as well as a way to maximize performance with the fastest technology. Crossfire works by using Alternate Frame Rendering (AFR) between the connected GPUs. Each graphics card will render an output frame in a round-robin fashion, with support up to four cards. Since frames are still rendered by GPUs individually, the video ram of each card is not additive in Crossfire. A program that needs 2GB of VRAM to run properly will not work with two 1GB cards. Frames rendered by GPUs not connected to the output display are transmitted to via PCI-Express or a proprietary hardware bridge and stored in a buffer until their turn to output. Hybrid Crossfire (or Dual Crossfire) works in a similar fashion, but data is processed by the integrated GPU of an AMD processor and transmitted to the discrete graphics card.

ANALYSIS

Typical performance gains in a homogenous Crossfire setup are 70-80% boost from the second GPU and less from each successive card. This can create very powerful rendering capability and surpass the output of even the most powerful singular GPUs. In some hybrid Crossfire schemes, improvements of over 100% have been seen in midrange cards with the addition of the integrated GPU. This creates systems that maximize performance per cost instead of just raw power. In either case, Crossfire is meant for systems that place greater demand on graphics processing. This primarily falls into either video gaming or professional graphics environment (CAD, Adobe products, etc). It is also very beneficial when using large display resolutions such as 4k or an Eyefinity configuration.

With the array of benefits associated with the technology, Crossfire does have drawbacks. Crossfire is not meant for regular computer usage and will not improve the performance of CPU based tasks. Even for graphical programs, the performance of the technology is dependent upon the applications using it. Some programs may not see any gains at all. Also, graphical performance can actually be lessened when using low display resolutions compared to a single GPU. Another particular problem in the technology is a phenomenon known as micro-stuttering. It occurs when the time between frames output to the monitor

vary significantly even with a constant average frame rate. This is usually due to improper load balancing between the GPUs and results in an unsmooth image. This micro-stuttering is one area where AMD falls short of its direct competitor, Nvidia. The latter has a technology called Scalable Link Interface (SLI) that is analogous to Crossfire. Although SLI does not see the same 70-80% average boost with the addition of the second card, it has far less micro- stutter. This can be seen in Figure 1. Crossfire, however, is more flexible than SLI when combining GPUs.

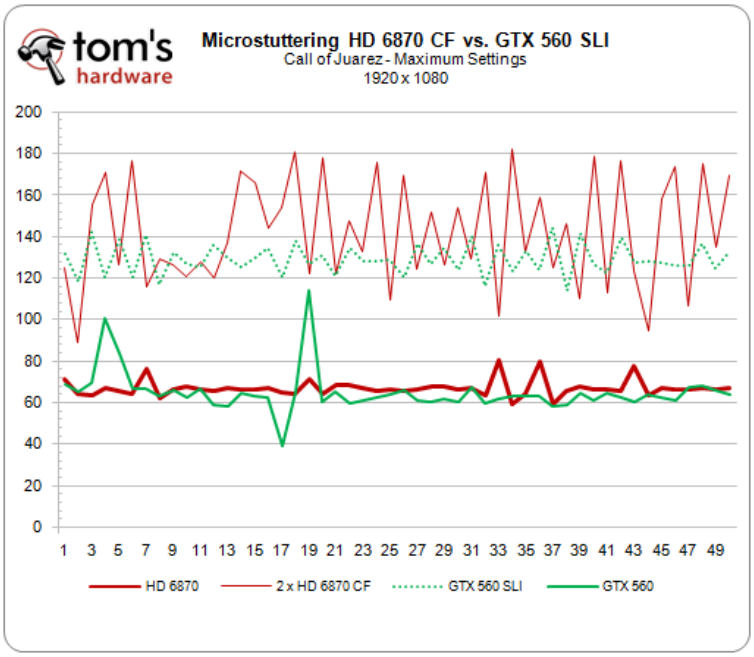

Figure 1: Comparison of AMD HD 6870 Crossfire and Nvidia GTX 560 SLI

CONCLUSION

Crossfire is not appropriate for every application. It has issues rendering low-resolution, problems with micro-stuttering, and it is non-beneficial for CPU intensive applications. Despite all this, Crossfire will continue to be a viable solution for upgrading under-performing systems or for building a new top-of-the-line machine.

BIBLIOGRAPHY

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