

## Sample Extra Credit:

Article from Kim Komando Show Newsletter:  
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MY "KILLER TIP OF THE WEEK" IS JUST FOR YOU!

Q. I'm ready to buy a new computer. But I don't understand accelerated graphics ports. What do I need? What do the numbers (2X, 4X) mean?  
-- Calvin in Miami, listening on WIOD 610 AM

A. The Accelerated Graphics Port was introduced by Intel in 1996. It was an attempt to get around the video bottleneck on the motherboard.

The AGP is actually a slot on the motherboard. It is similar to the other slots, but shorter and offset. A video card fits into the AGP.

The AGP pipeline connects directly with the board's chipset, which controls how the hardware in the computer works together. The pipeline then runs from the chipset to the main system RAM and the microprocessor.

The video card sometimes stores texture information from 3D games in the RAM. Moving it rapidly from and to the video card is critical.

The numbers refer to the width of the pipeline. The original AGP ran at 66 MHz, and was 32 bits (four bytes) wide. That meant it could move 32 bits of data 66 million times per second.

The AGP today continues to run at 66 MHz. But a 2X AGP can send 32 bits twice in each of the 66 million ticks. A 4X AGP sends it four times, and an 8X, eight times. The fastest AGP today is 8X, which can move a total of 2.1 gigabytes of data per second. Both Apple and Intel-based manufacturers use AGP 8X in high-end machines.

Is AGP important to you? That depends on how you use your computer. Do you use mostly office programs, check your e-mail and surf the Net? If so, you don't need to worry about the latest technology. You're not taxing the video system.

If advanced games are important to you, or you do video or photo editing, a powerful video card is required. They almost invariably require an accelerated graphics port, so you'll need AGP by default.

AGP 8X is expected to be the last iteration of the accelerated graphics port. PCI Express, a faster system now in development, is expected to replace it, along with the current PCI bus system.

Thanks for writing!  
Kim :)

**Reaction:**

I like this article for several reasons

First it explains how the AGP connects to the system:

*The AGP pipeline connects directly with the board's chipset, which controls how the hardware in the computer works together. The pipeline then runs from the chipset to the main system RAM and the microprocessor.*

Second, it explains how the multipliers are benchmarked (what they mean)

*The numbers refer to the width of the pipeline. The original AGP ran at 66 MHz, and was 32 bits (four bytes) wide. That meant it could move 32 bits of data 66 million times per second.*

*The AGP today continues to run at 66 MHz. But a 2X AGP can send 32 bits twice in each of the 66 million ticks. A 4X AGP sends it four times, and an 8X, eight times. The fastest AGP today is 8X, which can move a total of 2.1 gigabytes of data per second*

Third it talks about future technologies:

*AGP 8X is expected to be the last iteration of the accelerated graphics port. PCI Express, a faster system now in development, is expected to replace it, along with the current PCI bus system.*

The first section of the article I mentioned is a statement that agrees with Figure 5-15 of the text, and reinforces what you have already learned.

The second section specifically addresses throughput issues that are mentioned table 5-10. In addition it helps to explain how a 2X board would work: In a 2X AGP, the system sends 32 bits, twice a cycle. This is the same as what is done in Double Data Rate Ram technology in which one word of data is sent on the rising and falling edge of the clock signal. The article does not shed light on how 4X and 8X are achieved, but further research could be done at this point. (This is yet another opportunity for Extra Credit!)

The third section mentions changes coming in the future, the new PCI system in development. This represents another opportunity for research. Just searching on the term "PCI Express" in Explorer yielded an article in ExtremeTech, that explores what the technology may have to offer. Just a quick scan of the article shows the expected throughput of the new expansion system, as well as shedding light on how the speeds will be enhanced physically. The new standard will be built off of sets of serial connections. A 1X will have 1 set or 1 "lane", a 4X, will have four "lanes" and so on. The remainder of the signals will be for power, and control.

This article in PCI alone would be a source of several Extra Credit reports. The first could be simply translating the introduction into common English!