EXPANSION CARDS PART 1:

(OF A 3 PART SERIES)

PCI

The expansion slots available on motherboards allow for a variety of upgrades in a computer system, but matching the appropriate card to an available slot needs to be addressed before making any purchasing decisions. The most common types of expansion cards for modern computer systems can be broken down into three formats: PCI, AGP, and PCI Express. Each of these formats will be addressed separately in this three part series of Tech Tips, starting with PCI.

The letters “PCI” stand for Peripheral Component Interconnect, and is the term used to describe a bus that connects components directly to the system’s memory and to the system’s processor through the “frontside bus.” When discussing communications on a motherboard, the term “bus” has nothing to do with the big yellow thing that takes the kids to school. There may be several buses in a computer, and like the PCI bus, they are all responsible for managing the communication “traffic” from different devices to the

processor.

The frontside bus is a high speed connection that manages the processor's communication with items such as hard drives, memory, and PCI devices, while not burdening the processor with all of the management responsibilities.

First developed by Intel in the early 1990s, PCI was spawned from even earlier (and slower) bus architectures such as ISA (Industry Standard Architecture) and VL-Bus (VESA Local), which were common back in the 1980s and 1990s.

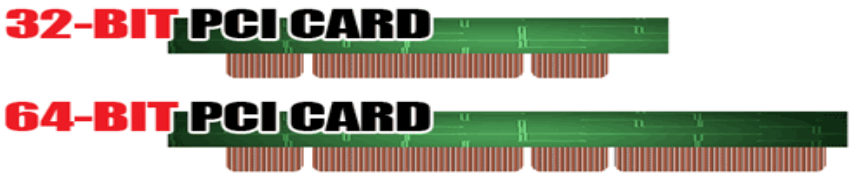
The original specifications for the PCI Bus had a speed of 33 MHz, with a 32-bit bus width, and a maximum bandwidth of 132 MB per second. There have been a few revisions to the PCI standard which have significantly increased these specifications, taking it to 66 MHz, 64-bit, and 512 MB per second, respectively. The 32-bit and 64-bit versions have different physical features, and most motherboards only offer 32-bit connections. The original power specification had PCI devices operating on 5V DC, and with the revisions came the capability for devices to continue using 5V, as well as

now being able to operate on 3.3V DC.

A simple explanation of 32-bit and 64-bit can be had by continuing the analogy of buses and traffic. Think of each bit as a lane of traffic on the communication path. Think of a 32-bit bus as having 32 lanes of traffic, and a 64-bit bus having 64 lanes of traffic. Just as a greater number of cars can travel simultaneously on a road with more lanes, more data can be transferred on a bus with a larger bit count.

Motherboards can support multiple slots sharing one PCI Bus, and although not particularly common, can include more than one PCI bus. Depending on the form factor size of the motherboard, and other features that may be taking up space on the board, one can expect to have one to six PCI slots on a typical motherboard. For example, the mATX format Chaintech MK8M800 VIA K8M800 Socket 754 Motherboard features just two 32-bit PCI slots, while the ATX formatAOpen AX4GE Max Intel 845GE Socket 478 features six 32-bit PCI slots.

A 32-bit PCI card features 124 pins for mating with a slot on a system's motherboard, and will fit into either a 32-bit or 64-bit slot (although data transfer will be 32-bit in either type of slot).



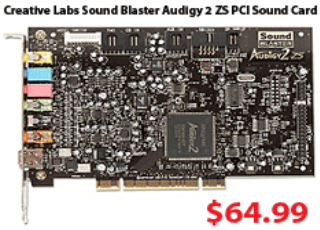
A 64-bit PCI card features 184 pins for mating with the appropriate slot on a system's motherboard, but can generally fit into a 32-bit slot as well, as long as features on the motherboard do not interfere. When installed in a 32-bit slot, data transfer on a 64-bit card will be limited to 32-bit.

The Intel STL2 Dual Socket 370 Server Board is a good reference for comparing 32-bit and 64-bit PCI slots. Looking at the lower left corner of the motherboard shows four 32-bit PCI slots and two 64-bit PCI slots.

Subsequent installments in this series of Tech Tips will look at AGP and PCI Express, each of which has its own unique physical features. Although the different format PCI cards may be interchangeable, PCI, AGP, and PCI Express cards do not work (or fit) in any other type of slot.

Most PCI cards will be of the 32-bit variety, and the selection of items available is fairly extensive. Graphics cards, sound cards, network cards, RAID controllers, TV tuners, modems, and USB/Firewire controllers are all common items that may be added to a system through the use of a PCI card.

Many of the items listed in the previous paragraph can be found integrated on modern motherboards, but these onboard devices offer no upgrade ability. PCI devices provide plug and play installation, allowing a user to install (or remove) a device with ease. For example, an inexpensive2-channel sound card may be good enough for someone initially, but down the road they may decide that something like the 7.1 channel Sound Blaster Audigy 2offers the sound quality they really want. Upgrading is a matter of powering down the system, swapping the cards, rebooting, and installing the new software/drivers (OK, perhaps a bit over simplified). The good thing about PCI cards is that, even if you do have a board with built-in feature (such as built-in sound mentioned above), your motherboard's BIOS will usually lets you disable that feature if you did want to add an upgraded card (such as the Audigy sound card mentioned in the example above), or the card can complement the feature already built-in (such as an IDE RAID card).



The one area that drove the development of AGP is the performance of PCI based graphics cards. The demands of fast-paced video games, and other graphically intensive applications, require a great deal of bandwidth, which just wasn't available on the PCI Bus. Considering that all of the devices on

the PCI Bus share the bandwidth available, an even faster, dedicated bus was required to handle just the graphics data. PCI graphics cards are still available though, and make for an easy way to add a second display to a system currently operating on an AGP or PCI Express graphics card.

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