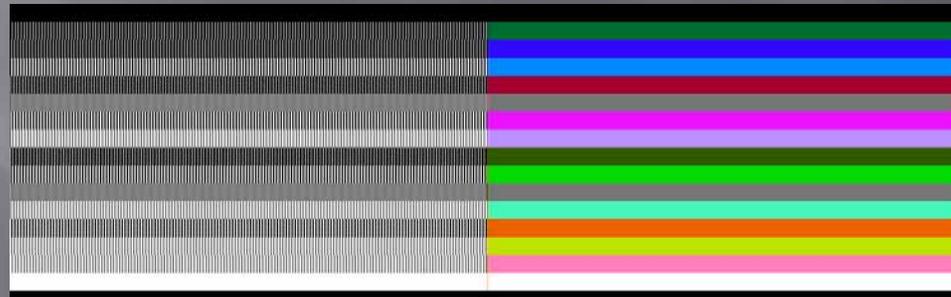


PC VIDEO

Yesterday, Today, and tomorrow
We explore where video on the PC
started, the state of video today, and
where we will go in the future.

In the beginning...

- ▣ The first IBM-PC had monochrome video output (green or amber text on a black background)
- ▣ CGA came out with the IBM-AT. This added color of up to 640x200 resolution, and 16 colors.



In the beginning (cont.)

- ▣ EGA and VGA resolutions soon followed with a maximum resolution of 640x480x256k colors. The video still depended upon the CPU to do the video processing.
- ▣ In 1991, S3 Graphics introduced the S3 86C911, which its designers named after the Porsche 911 as an indication of the performance increase it promised.
- ▣ Video cards started to use alternate interface bus technology. This is useful for streaming data faster than the standard 8 and 16 bit ISA bus could carry.

Interface Bus Technology

Bus	Width (bits)	Clock rate (MHz)	Bandwidth (MB/s)	Style
ISA XT	8	4,77	8	Parallel
ISA AT	16	8,33	16	Parallel
MCA	32	10	20	Parallel
EISA	32	8,33	32	Parallel
VESA	32	40	160	Parallel
PCI	32 - 64	33 - 100	132 - 800	Parallel
AGP 1x	32	66	264	Parallel
AGP 2x	32	66	528	Parallel
AGP 4x	32	66	1000	Parallel
AGP 8x	32	66	2000	Parallel
PCIe x1	1	2500 / 5000	250 / 500	Serial
PCIe x4	1 × 4	2500 / 5000	1000 / 2000	Serial
PCIe x8	1 × 8	2500 / 5000	2000 / 4000	Serial
PCIe x16	1 × 16	2500 / 5000	4000 / 8000	Serial
PCIe x16 2.0	1 × 16	5000 / 10000	8000 / 16000	Serial

Interface Bus Technology (cont.)

- ▣ ISA Bus (8 and 16 bit slots)

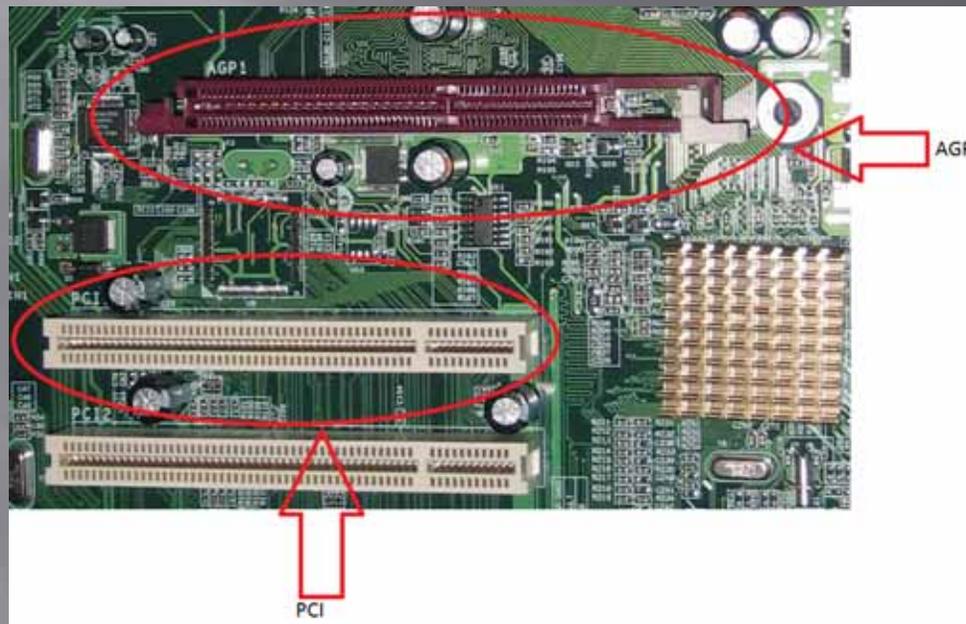


- ▣ VESA Bus added 32-bit interface at the end



Interface Bus Technology (cont.)

- PCI introduced a standard for 32-bit bus.



- AGP provided enhanced bandwidth dedicated to video processing.

Interface Bus Technology (cont.)

- ▣ AGP video card



- ▣ PCI video card



PCI EXPRESS® PCI Express

- ❑ Conceptually, the PCIe bus can be thought of as a high-speed serial replacement of the older PCI/PCI-X bus, an interconnect bus using shared address/data lines.
- ❑ A key difference between PCIe bus and the older PCI is the bus topology. PCI uses a shared parallel bus architecture, where the PCI host and all devices share a common set of address/data/control lines. In contrast, PCIe is based on point-to-point topology, with separate serial links connecting every device to the root complex (host).

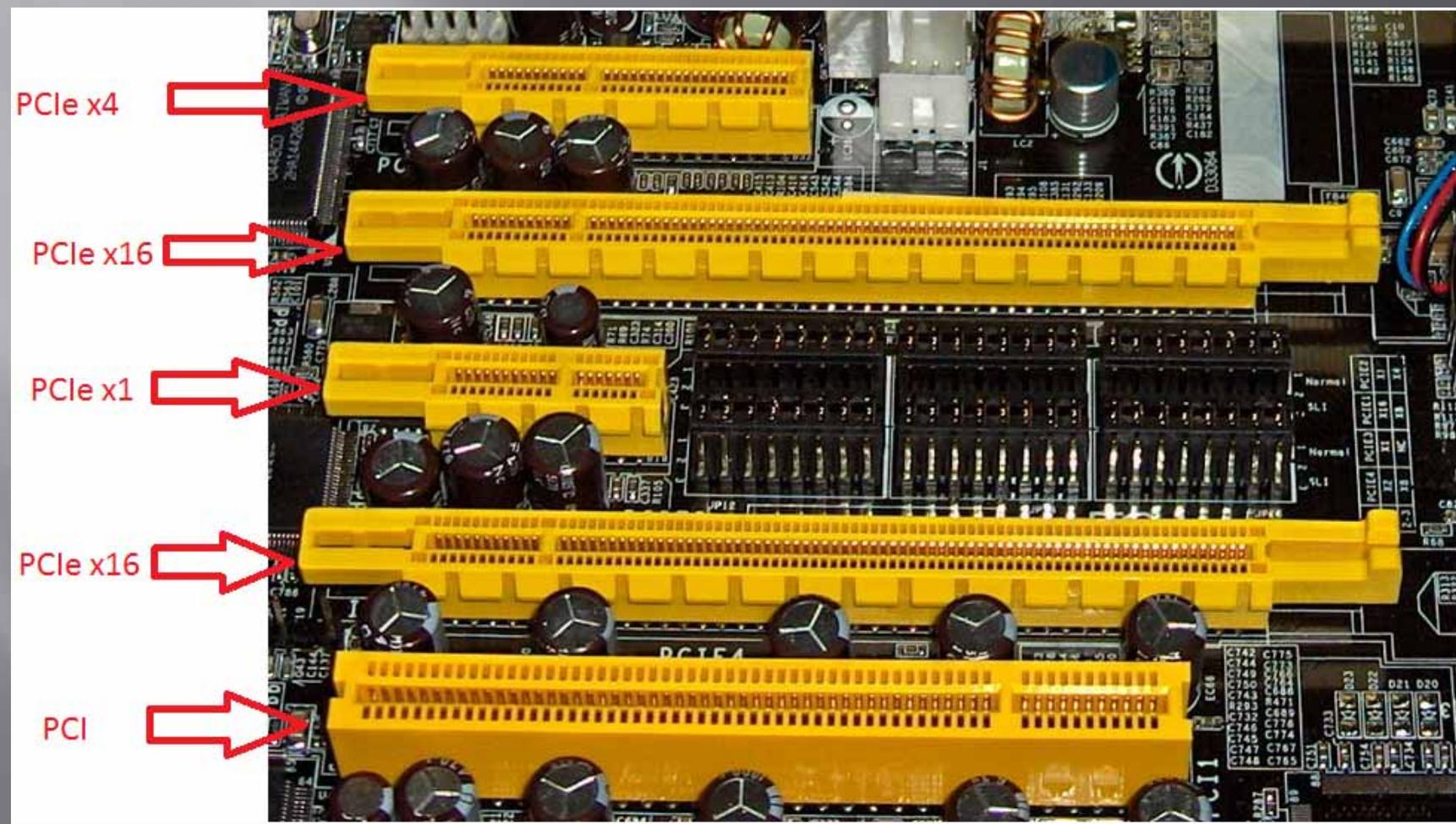


PCI Express

- The PCIe link between 2 devices can consist of anywhere from 1 to 32 lanes. In a multi-lane link, the packet data is striped across lanes, and peak data-throughput scales with the overall link width. The lanecount is automatically negotiated during device initialization, and can be restricted by either endpoint. For example, a single-lane PCIe (x1) card can be inserted into a multilane slot (x4, x8, etc.), and the initialization cycle will autonegotiate the highest mutually supported lanecount. The link can dynamically downconfigure the link to use fewer lanes, thus providing some measure of failure tolerance in the presence of bad/unreliable lanes. The PCIe standard defines slots and connectors for multiple widths: x1, x4, x8, x16, x32. This allows PCIe bus to serve both cost-sensitive applications where high throughput is not needed, as well as performance-critical applications such as 3D graphics, network (10 Gigabit Ethernet, multiport Gigabit Ethernet), and enterprise storage (SAS, Fibre Channel.)

PCI EXPRESS

PCI Express



Graphic Processing Unit (GPU)

- ▣ S3 911, 911A (June 10, 1991) - S3's first Windows accelerators (16/256-color, high-color acceleration). The 86C911 spawned a host of imitators: by 1995, all major PC graphics chip makers had added 2D acceleration support to their chips.
- ▣ Towards the end of 1996, the cost of EDO DRAM dropped significantly and 3Dfx was able to enter the consumer PC hardware market with aggressive pricing compared to previous 3D graphics solutions for computers. The Voodoo heralded a new era of high-performance and high-quality 3D graphics for gaming. Prior to it, games such as Doom and Quake had compelled video game players to move from their 80386s to 80486s, and then to the Pentium.

Graphic Processing Unit (GPU)

- ▣ Throughout the 1990's there were many GPU manufactures. By the early 2000's these were whittled down to two companies making discrete GPUs , Nvidia and ATI (later purchased by AMD).
- ▣ Today these two companies are in a game of one-ups-manship. When one company releases a GPU, the other company will soon follow with an improved model and it goes back and forth.

What should I buy?

- ▣ **Let your \$\$ be your guide...**
- ▣ There are many comparison charts out there. If you play the latest and greatest games, plan to spend over \$300 for a good graphics card.
- ▣ If you would like a nice upgrade to your system speed, without breaking the bank, there is a sweet spot around \$150-\$200.
- ▣ If you are a shoestring budget (who isn't now a day?) You can find a decent card for under \$100.

What is next?

- ▣ Integrated GPU into the CPU.
- ▣ More systems will have an integrated GPU as part of the CPU die. While the performance may not be as good as some high-end discrete GPUs, it will more the suffice for 95% of the computer users.
- ▣ Look for Sandy Bridge and Ivy Bridge chipsets for high performance integrated GPU.