

# CS100: CPADS

## Video

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# Graphics Cards

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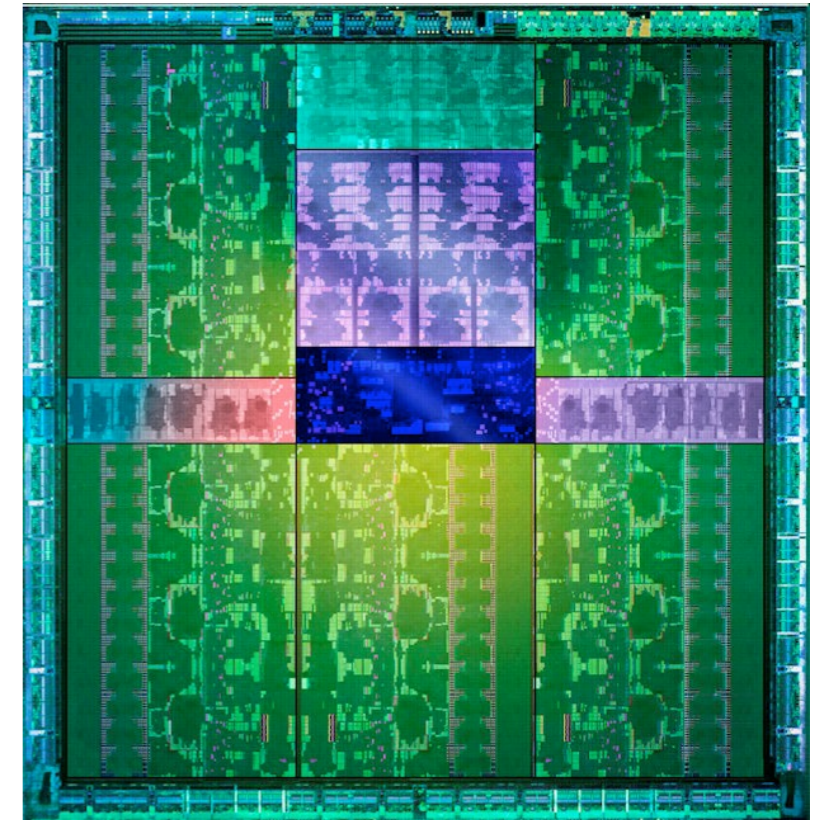
- **Many companies make graphics cards**
  - ASUS, MSI, EVGA, XFX, etc.  
(and apparently none of them use lowercase letters in their name)
- **Most companies that make graphics cards, don't actually make the graphics chip (the GPU)**
  - Different companies design the GPU  
(just like Dell/HP/Sony don't make CPUs)
- **Graphics cards come in a wide range of prices and capabilities**
  - Higher performance = \$\$\$



# GPU (Graphics Processing Unit)

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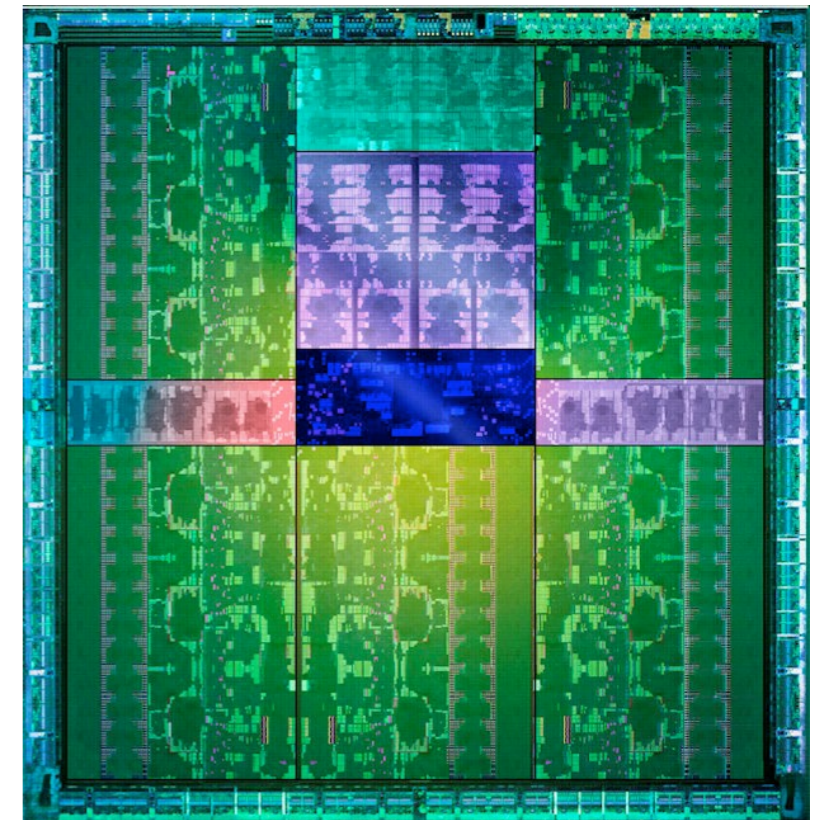
- **A processor designed specifically to accelerate graphics processing**
  - Parallel architecture
  - Several times more transistors than typical CPUs
    - NVIDIA's GK110 GPU include 7.1 **BILLION** transistors
    - Intel Core i7 Quad contains about 750 Million transistors
  - More performance = more parallelism = more transistors = more \$\$\$
  - Designed to support particular versions of DirectX and OpenGL (related to card family)



# GPU (Graphics Processing Unit) (Cont.)

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- **Performance of GPU is typically measured in billions or trillions of FLOPS (i.e. gigaflops/terraflops) by manufacturer**
- **Benchmarks are typically reported in FPS (Frames Per Second)**
- **Only a few companies that make GPUs**
  - NVIDIA, AMD, Matrox, Intel



# Video Memory

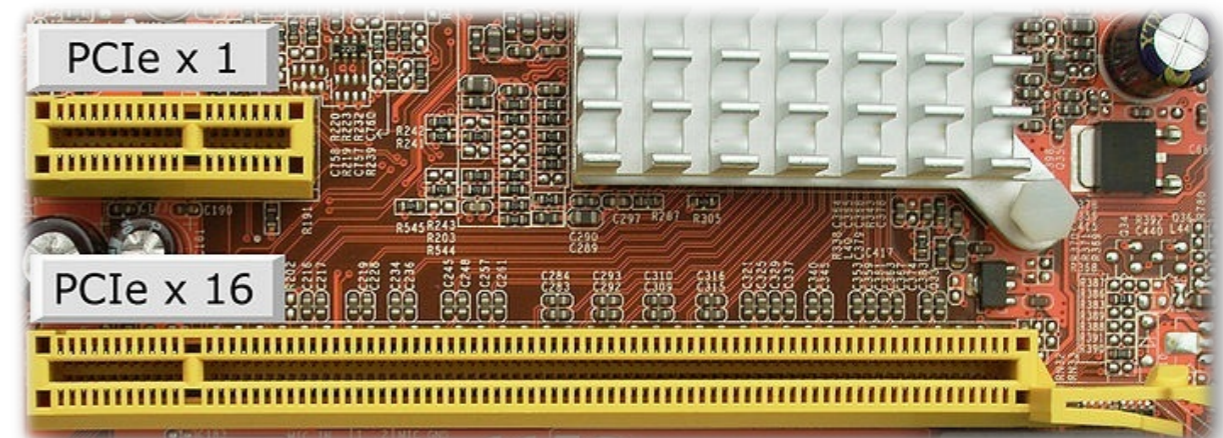
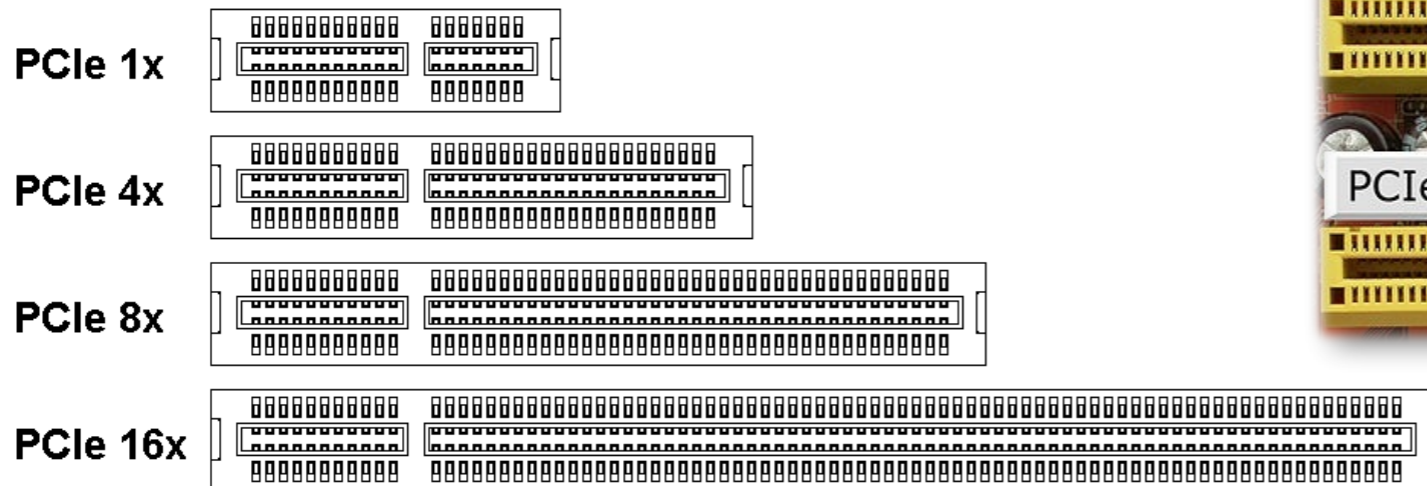
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- **Graphics cards contain their own memory**
  - Older cards use standard DDR/DDR2
  - GDDR3/GDDR4/GDDR5 for more powerful/modern graphics cards
- **Memory sizes range from 64 MB – 6 GB**
  - More memory = higher resolutions at greater color depth

# Graphics Card Interfaces : PCIe

- **PCI Express (PCIe)**

- ~2004 - ??
- Many versions and speed ratings (x1, x4, x8, x16)
  - v1.x | 250 MB/s (Per Lane)
  - v3.0 | 1000 MB/s (Per Lane)
- e.g. x16 Slot in PCIe v3.0  
 $16 \text{ Lanes} * 1000 \text{ MB/s/lane} = 16,000 \text{ MB/s} = 16 \text{ GB/s}$



# Scalability: SLI / CrossFire

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- **Idea:** when one graphics card isn't powerful enough ... add more!
- **NVIDIA and ATI (now AMD) each have their own technology that allows multiple graphics cards to be linked together**
  - NVIDIA calls it SLI
  - ATI (now AMD) calls it CrossFire
- **Some graphics cards may even have dual GPUs on a single card, combine two of these to get a Quad SLI beast**
- **Requirements:**
  - Motherboard must support SLI/CrossFire
    - Motherboard chipset must support it
    - Must have multiple PCIe x16 slots (one for each graphics card)

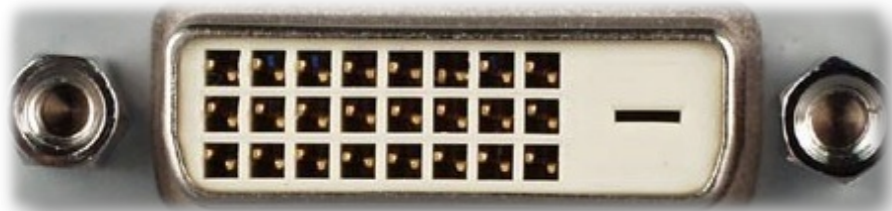


# Graphics Card Connectors

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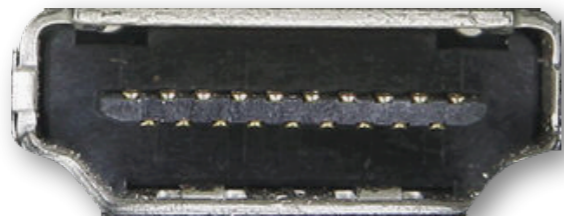
VGA - Analog (old school)



DVI - Analog/Digital



Displayport - Digital



HDMI - Digital  
(includes HDCP)