Building Your Own Computer

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IEEE Computer Society
June 3, 2015

My Uncle's Motto

If you are going to do a job
Do it right
Or don't do it at all

Table of Contents

Introduction

- Why do you want to build your own?

- Can be rewarding

- Can also be very frustrating

- Can save money

- Can cost money

- I built mine because:

  - Enjoyed doing it, feel accomplishment

  - Reliability

  - Cost

  - Performance

Advantages

- Build it the way that you want it
- Ability to add when new things available
- Repair it yourself
- Reliability
- Price
- Performance & features
- Pride
- Opportunity to learn

Disadvantages

- Can not blame someone else
- Can not just pick whole thing in and bring in for service
- Have to learn, gain skills
- Hard work
- Have to keep it away from know-it-alls
- Need to have time and patience

Where to Start

- Decide if this is a task that you would like to do

- Make specification list of what you want it to do (this is most important, do not just say that you want a killer machine)

    - Gaming

    - Mathematics (like me)

    - Impress people

    - Which programs are main ones used

- Decide on budget

    - Money

    - Time

Design Comes First

- What do you want it to do?
- What do you need it to do?
- What will you use it for?
- How long will you use it before replacing it?
- How many hours per day will it be on
- What functions will your most important programs use?

Considerations

- Think of the programs that you will be using
    - Will they utilize multiple cores?
    - Will they utilize GPGPU?
- Will it be a server or workstation?
- What Operating System?
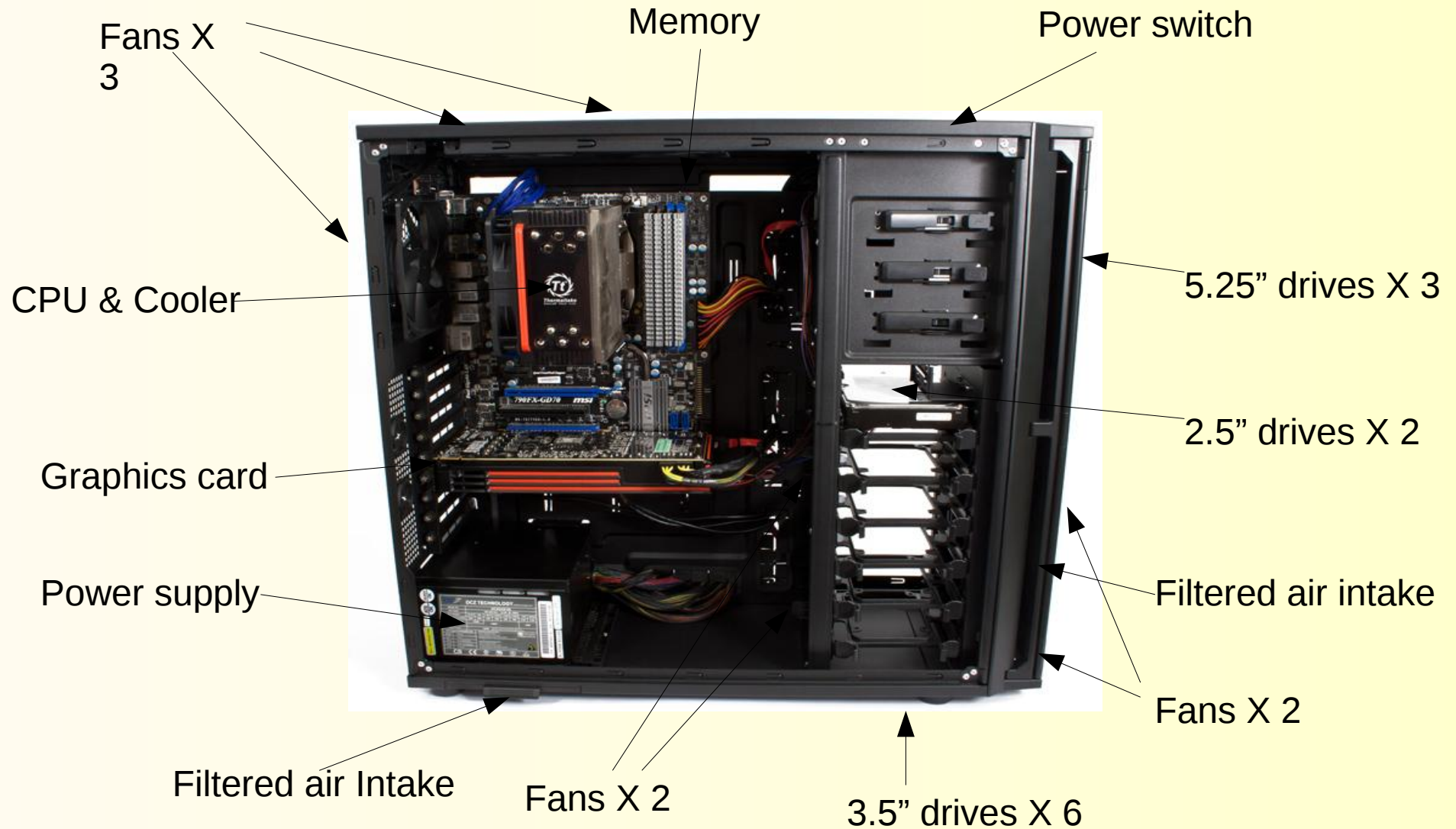- Virtual Machines? How many?

Material List

- Case

- Motherboard

- CPU and Cooler

- Power supply (PSU)

- Memory

- Graphics card (sometimes built into motherboard)

- Hard drive(s)

- Optical drives

- Other things (cables, hardware, cable ties, etc)

Product Specifications
Case

- The bigger cases are easier to work with, less cut hands, more room to grow

- Big cases take up more room at desk

- Big cases usually cost more

- Number of cooling fans

- What size motherboard

- How many drives

- Sound deadening

My Computer Case
Antec P-280

Fans X 3

Memory

Power switch

CPU & Cooler

5.25" drives X 3

2.5" drives X 2

Graphics card

Power supply

Filtered air intake

Filtered air Intake

Fans X 2

Fans X 2

3.5" drives X 6

My Case
Wiring Side

- Wiring on this side, hardware on other side
- Not only makes it neater, but gives airflow
- Need longer cables
- Only few cases have wiring side separate

Product Specifications
Motherboard

- Brand reputation and tech support

- Read reviews

    - Read between the lines

    - Not all products of a manufacturer are the same quality

- Which CPU – AMD or Intel

- Which socket

- How much Memory, what speed

- Specs for YOUR needs

- How many and what kind slots

- Drive ports

- I/O ports

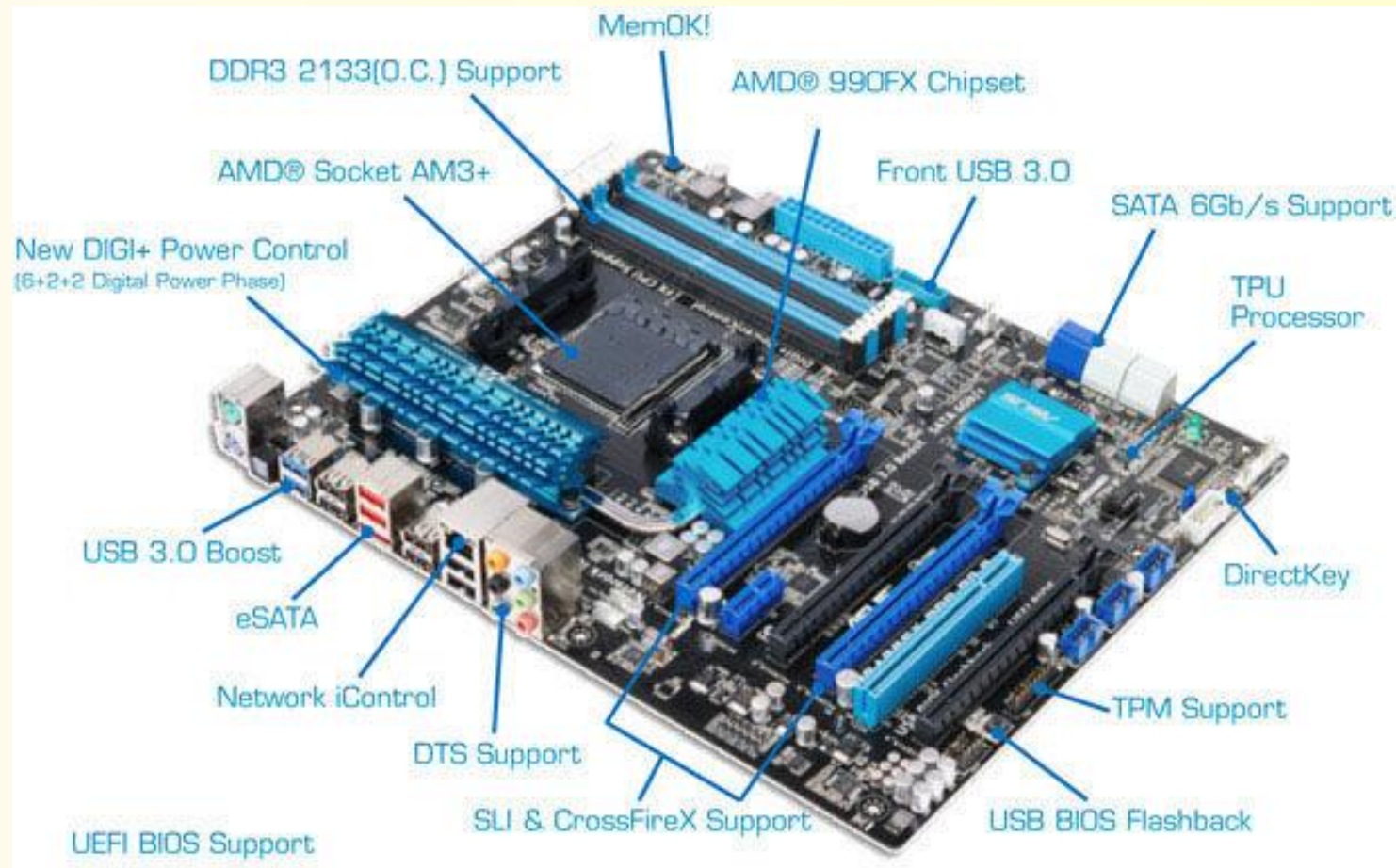- What kind of fans does it support

My Board
Asus M5A99FX Pro R2.0

- Features – Reliability- Warranty

- USB 3.0

- 7 SATA ports

- AMD AM3+ socket

- PWM fans

- 3 year warranty

- Intelligent processors

- Power control

Motherboard Layout

Product Specifications
CPU & Cooler

- Must match motherboard

- Socket type must match

- Best to buy CPU without fan and buy good heat stove

- Cooler fan must have same type connector as motherboard.

  – Newest have PWM (some two PWM sockets)

- Silver heat sink compound

- Watch for sales and match price

My CPU & Cooler
FX-8320 & N-212 Coolermaster

- I do math, need more cores

- AMD has most bang for $

- Intel is far more powerful

  - I can not afford

- You get what you pay for

- Cooler is stove pipe

  - Cheap insurance

- Use good compound

  - Arctic silver

Product Specifications
Power Supply

- Good brand reputation

- Read reviews

- Add up watts needed

- Get a little bigger for when you add

  - Look at power output not input

- Get high efficiency

  - Less heat

  - Lower electric bills

  - 80 plus gold certified

This one is 92% efficient

What Size Power Supply

Add up the watts

1) CPU   125 W

2) Motherboard   50 W

3) Graphics card 100 W

4) 3 hard drives   60 W

5) 3 DVD drives   75 W

6) 7 fans   70W

7) <u>Safety Margin 100 W</u>

8) Total   580 W

- I have 4 hard drives
- Antec 650 Gold
  - On sale
  - Rebate
- This is what I have and why

Product Specifications Memory

- Must match motherboard
    - DDR, DDR2, DDR3, etc
- Brand reputation
- Heat sinks needed?
- Know how much you will need
- Get bigger sticks to leave empty slots
- Speed to match CPU and motherboard
- Look for one day sales

Product Specifications
Graphics Card

- Will you be using GPGPU?

- Are you a gamer?

- Nvidia vs ATI vs AMD APU series

- Amount of memory vs programs in use

- Must have right kind of slot(s) on motherboard

- Power consumption

    – Some require extra cables from power supply

- Watch for sales with rebates

Product Specifications
Hard Drive(s)

- SSD is fast, but only so many writes before it fails. Good for OS – very fast

- Price pressure on hard drives reduced quality

- Look at warranty and MTBF

- How many hours on per day

  - Affects MTBF

- Mount size for case

- I like enterprise drives for reliability and performance

- Look for one day sales

Enterprise VS Regular HDD

- 5 year warranty

- 1,400,000 h MTBF

- Two bearings

- 128 MB Buffer

- SATA or SAS

- 24/7 usage

- 1E-15 error

- All of mine still work

- 1 year warranty

- Less hours per day

- One bearing

- 16 to 64 MB buffer

- SATA

- Many are 8 X 5 use

- 1E-14 error

- Newer ones all dead

Product Specifications
Optical Drive(s)

- CD/DVD/Blue ray

- ROM or R/W

- Number of slots in case

- Interface type ATA or SATA

- Brand reputation and reviews

- I like Asus and Pioneer

- LG and Samsung pretty good

- Watch for sales

Getting the Parts

- I am not trying to plug any company, this is just what I have done

- I get daily sale emails from Frys and Newegg

- Must have patience

- Also must buy misc cables on sale

- Good to also have screw kit

- Know which motherboard, get compatible parts

- Buy motherboard last but know which one

Tools That You Will Need

- Phillips Screwdrivers
    - Size #1 and #2
    - Magnetic tips preferred
- Small needle-nose pliers
- Flashlight
    - Headlamp makes life easier
- Sometimes a 6mm nutdriver
- Magnifying glass
- Lots of patience
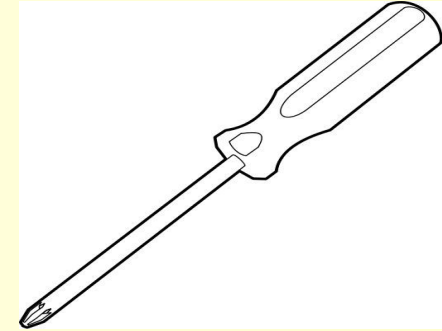
Read Instructions First

- First means <u>before</u> anything else

- Read multiple times

    - May need magnifying glass (small print)

- Understand what goes where

- Read it again!

- I speak from experience

- Put a big towel on the table where you will work

Install CPU & Cooler

- When buying, make sure has same type fan as motherboard requires (3 wire, 4 wire, PWM)

- Be very careful with pins, do not force or bend

- Use silver heat sink compound
    - Start in middle
    - Follow instructions with cooler

- Put in CPU, then cooler

- Plug in fan

Install CPU & Cooler

Do not touch pins!!!
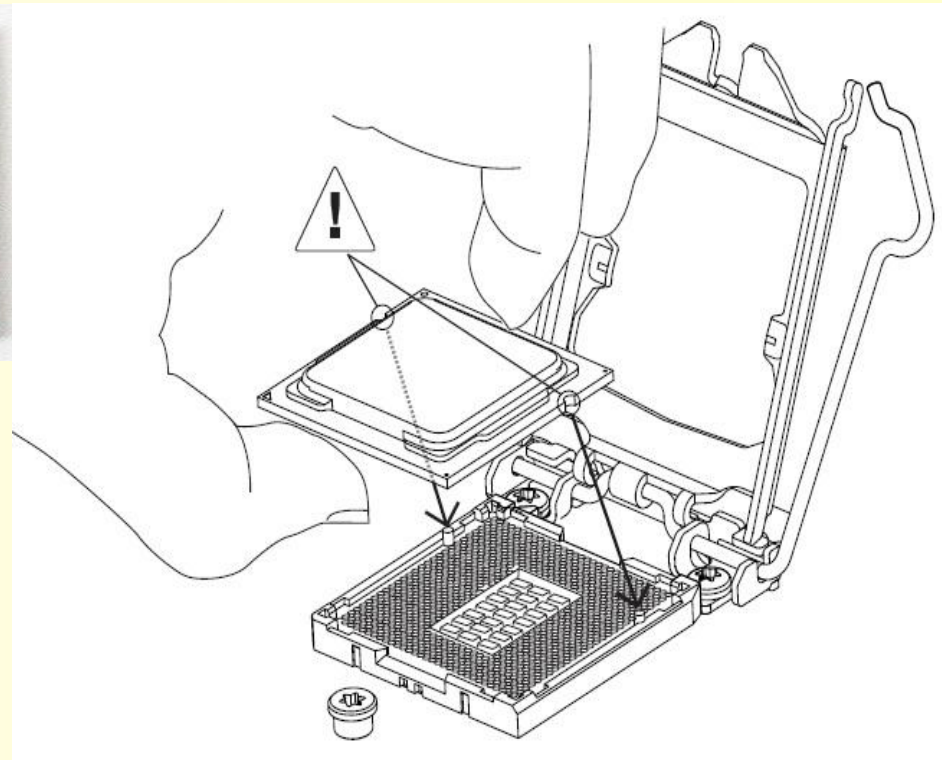
Hold by edges
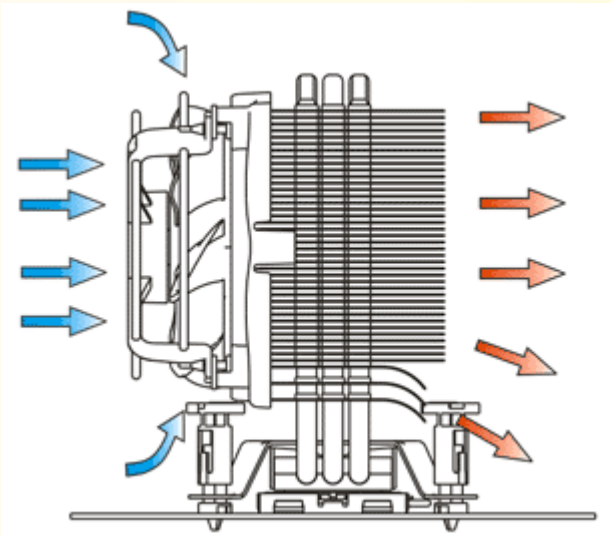
Heat stove cooler

Blows in direction with rest of case

Install Memory

- Best if all memory is the same brand & model

- Follow instructions with motherboard manual

- Watch which bank to install

- Make sure in right direction

- Make sure pushed in all the way

- Asus boards have special memory compatibility LED and switch "Memory OK!"
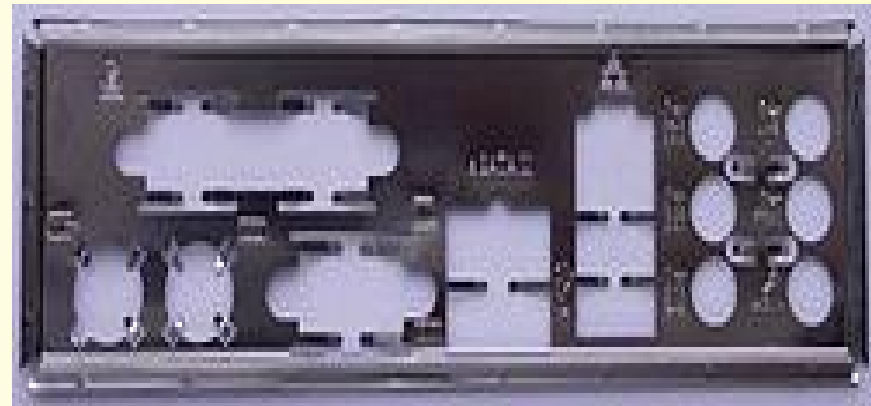
Installing Memory
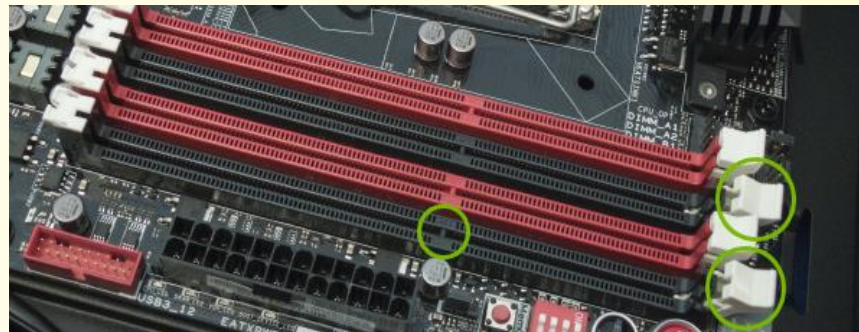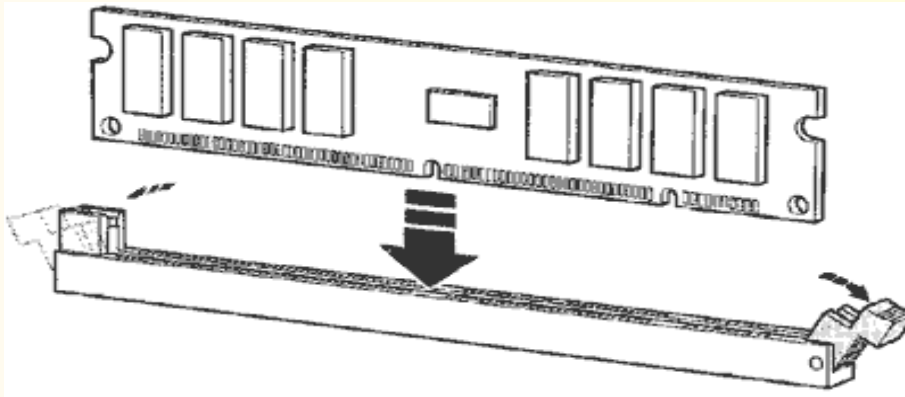
Put into Case

- Put I/O shield in for your motherboard
    - Comes with the motherboard
    - Be certain that it is properly snapped in
- Put in correct standoffs for your motherboard
- Line up rear connectors and screw holes
    - This is a be careful and look and look task
- Do NOT tighten any screws until all in place
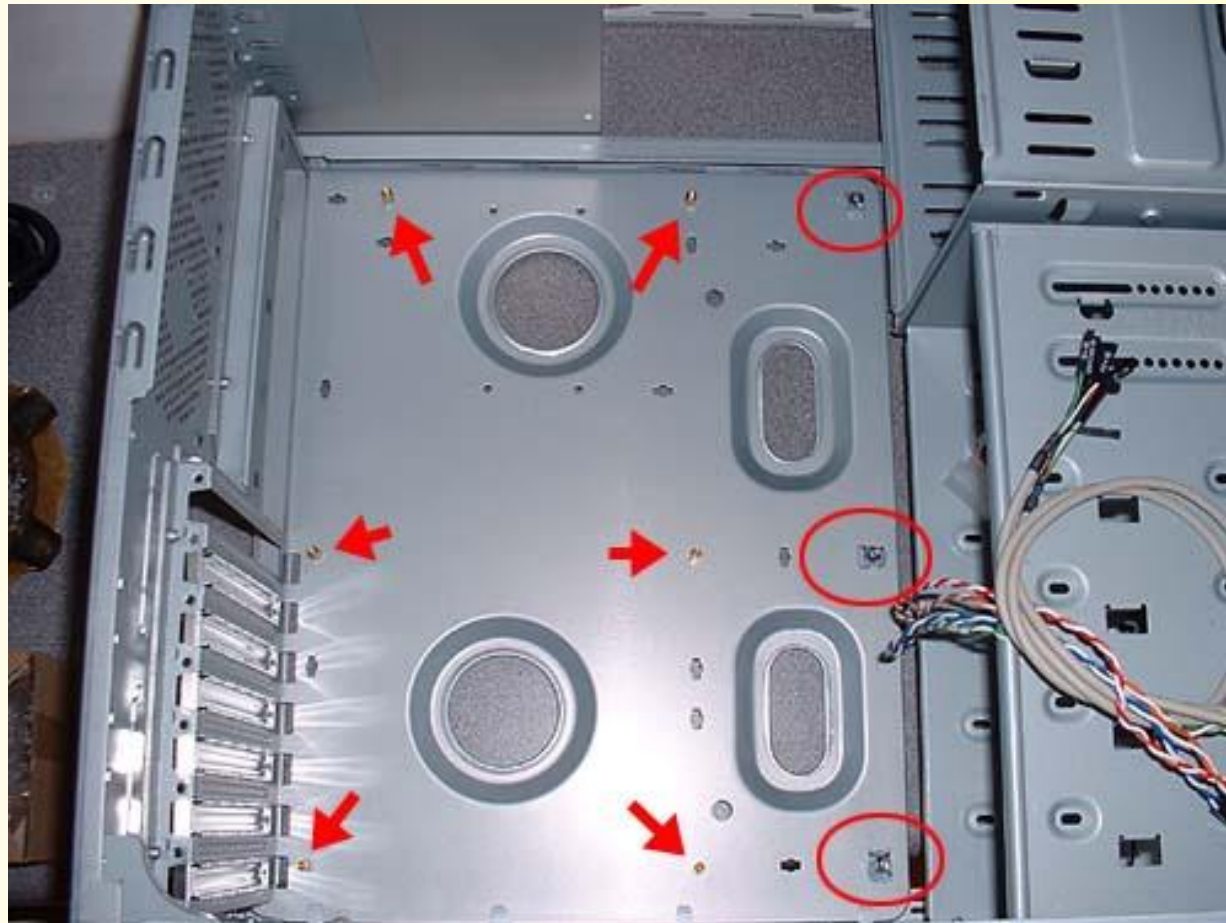
I/O Shield

Where it goes

The I/O shield

Installing the shield
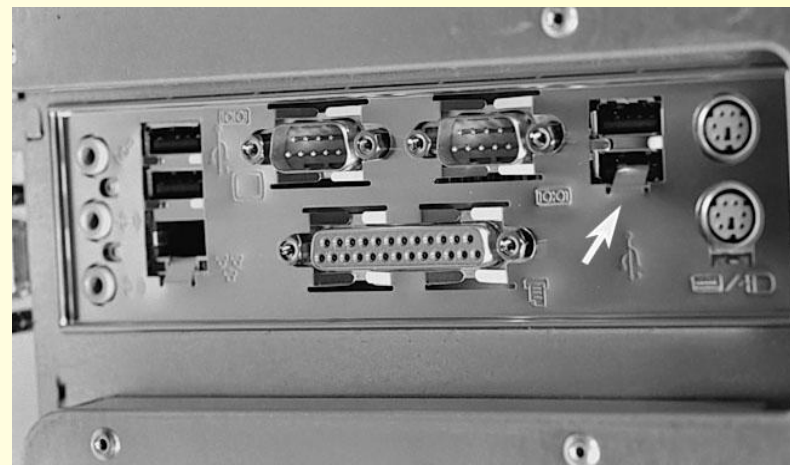
Installed wrong

Install Standoffs

Install Motherboard

Install Power Supply

- Fit PSU into place

- Put in 4 screws

  - Do not tighten until all in place

- Attach cables

  - Fans

  - Motherboard

  - Drives

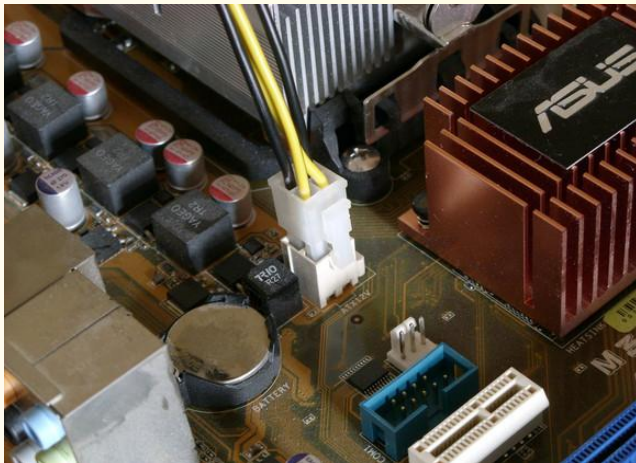- Neatness counts

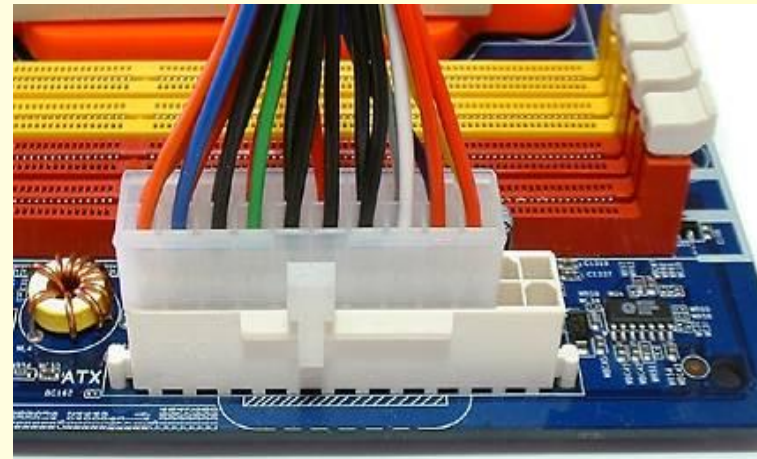# Mount PSU in Case

Attach Cables

- Wires to case LEDs and switches

- Follow manual

- Read labels

- Watch polarity (black negative, red positive)

Motherboard Cables

This is for the CPU
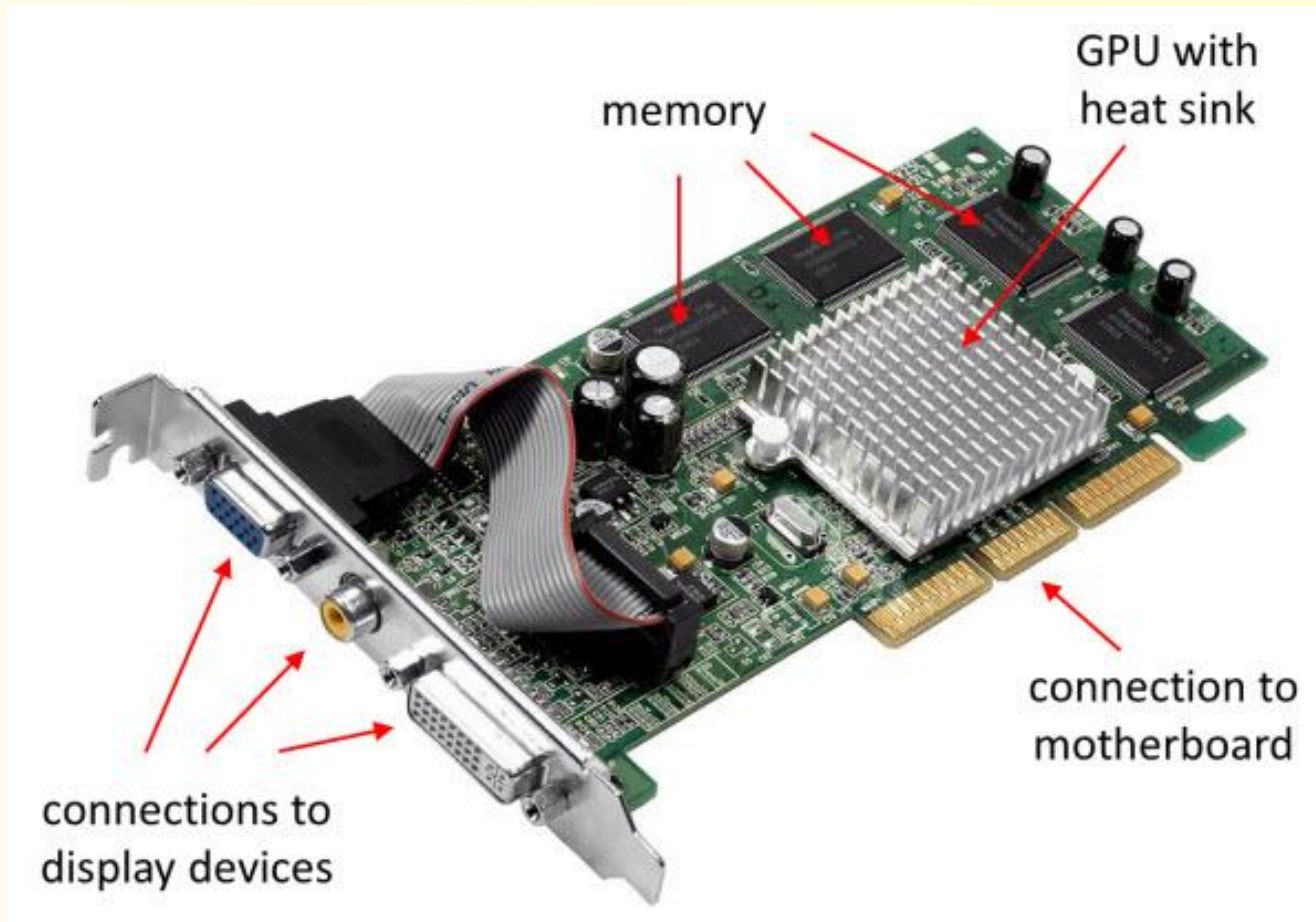Mine had 2 of these plugs
Next to each other

This is the main motherboard power
Notice that he has an old style 20 pin
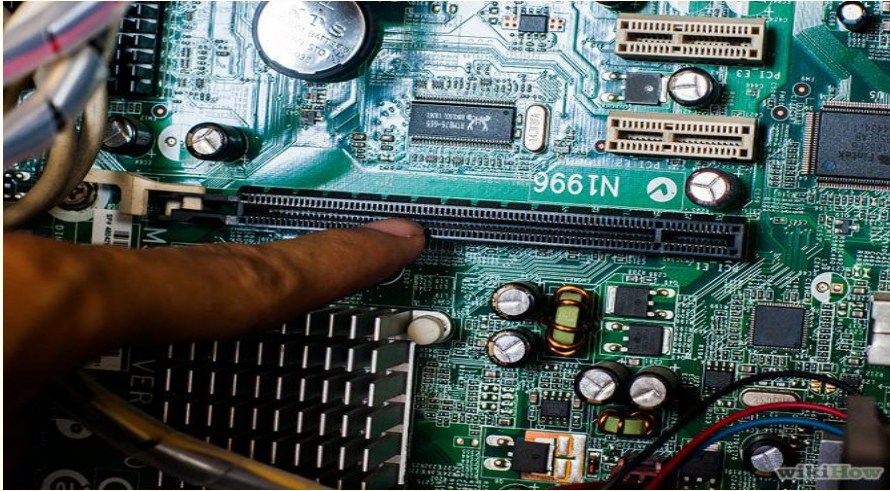When it really needs the 24 pin

Install Graphics Card

- Find correct socket(s)
- Remove mounting screw
- Do not touch wires
- Push into socket
- Put in mounting screw
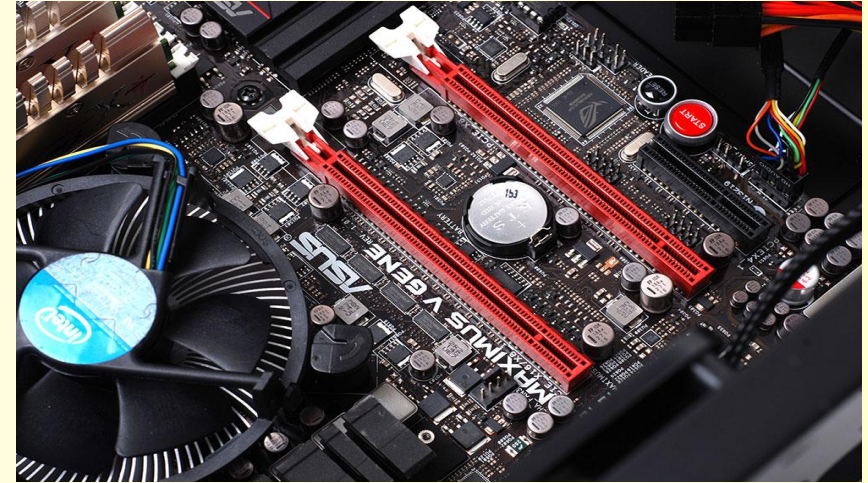- Some cards will need cable from power supply

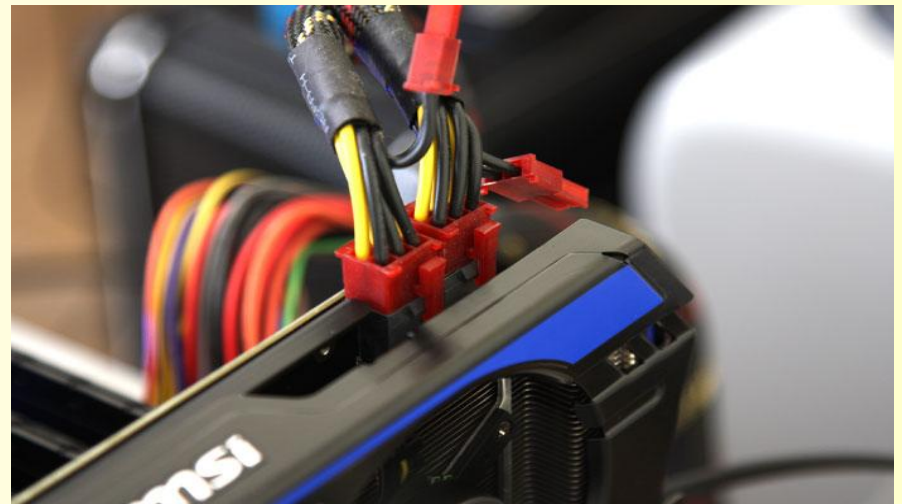# Graphics Card

Install Graphics Card

Single PCIE X4 slot

Dual PCIE X16 slots
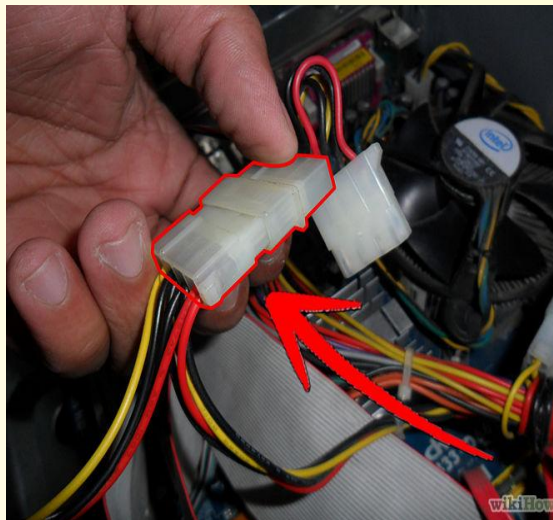

Installing card

Plugging in PCIE power

Install Drives

- Some cases do not require screws
- Better cases mount hard drives in soft bushings
- Follow instructions
- Drives MUST be horizontal
- After all drives in places
- Attach cables
- Route them neatly, no contortions on wires

Attach Cables to Drives

Power to Fans

- CPU cooler fan has special plug on board

- Many boards have special plug for chassis fans

- Other fans plug in like this picture

- Fans plugged into motherboard are speed controlled

Finish Assembly

- Listen
  - Noises
  - Fans not running or running full speed
  - Things hitting
- Smells
- Feel heat

Installing the Operating System

- Make sure that BIOS now set to boot first on DVD drive.

    – Change later

- Put in the OS Install disk

- Follow instructions

- Watch for any problems

    – Mark them down

    – Look them up and fix them

Problems

- Bad mobo
    - This drove me nuts, OS would stop at same place on install

- Bad fan
    - Might make noise
    - Might not spin and cause overheating

- Bad memory
    - Smart to run Memtest86
    - Free download, also on Suse install disk

- Antec, Asus, & Gigabyte all have US tech support

My Experience

- Opensuse 9.2 to 13.2 (over the years)
- Many programs
- Runs fast, uses all the cores
- Have 6 desktops now
- Very happy

My Old Machine
For Sale

- Antec P180 case
  - Drives in a drawer
- Asus M3N78Pro MoBo
- AMD Phenom quad core
- Asus Cooler
- 8 GB RAM
- Nvidia graphics
- $350

Contacts

- Dr Brad Morantz
  - www.machine-cognition.com
- Antec.com
- Asus.com
- Frys.com
- Gigabyte.com
- Newegg.com