Welcome to COMPSCI111/111G

Summer School 2016

Today's class

- Introduction to COMPSCI111/111G
  - People
  - Assessment
  - Labs
  - Test and exam
- Introduction to hardware
- Bits, bytes and digital information

Lecturers

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- We all have an open door policy. Visit anytime or email for an appointment

Course coordinator and lab supervisor

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Need to talk to someone? We are here to listen and help! Come and talk to us!

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Marks for COMPSCI111/111G

- Theory: exam and test
- Practical: labs
- Need to pass half of the theory **and** half of the practical in order to pass the course

Exam (60%)	Test (20%)	Labs (20%)

Test

- Wednesday 27 January, 11.30am-12.30pm F&PA Auditorium
- The test will cover lectures 1-14 and labs 1-5

Labs

- An opportunity to practise what you learn in lectures
  - 2 compulsory 3-hour labs each week
  - 9 labs worth 20% of final mark
  - 10% of each lab's mark is given for arriving on time
  - Hand in lab assignment before start of next lab
- Before labs start on Thursday please:
  - Buy a lab manual from UBS
  - Find the First Floor Teaching Lab (FTL - 303S-175)
  - Make sure you have a USB drive

Exam

- Date and location will be announced by the Exams Office

Class representative

AUSA REPRESENTATION

CLASS REP

Places to find information

- Canvas and email announcements
- The course website: www.cs.auckland.ac.nz/courses/compsci111ssc
- You need to purchase a **2016 Summer School lab manual** from UBS
- Coursebook; available on the home page of the course website
- The Computer Science student forum: http://forums.cs.auckland.ac.nz
- Any of the COMPSCI111/111G teaching staff ☺
  - Please use your University email account when emailing us

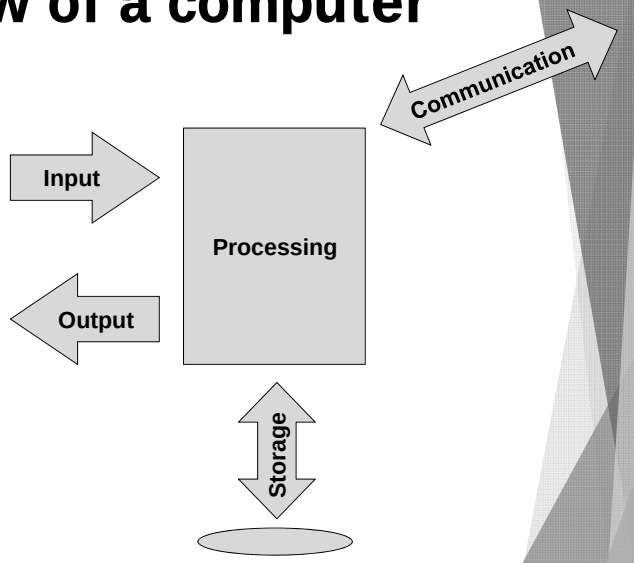
Computer Hardware

Lecture 1 – COMPSCI111/111G SS 2016

Today's lecture

- Identifying the key components in a computer
- Understanding how these components work
- Using this knowledge to understand computer specs

Overview of a computer



Computer hardware

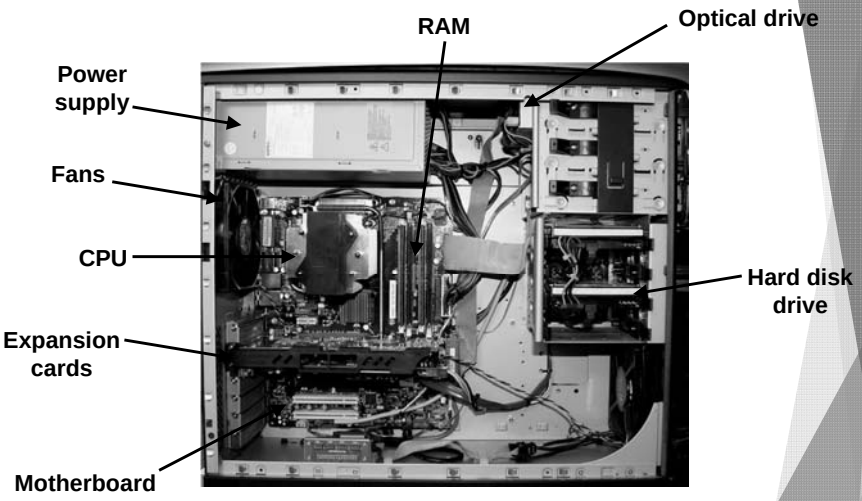
- "Those parts of the system that you can hit with a hammer (not advised) are called hardware"
- Key design principle of **modularity**

Form factors

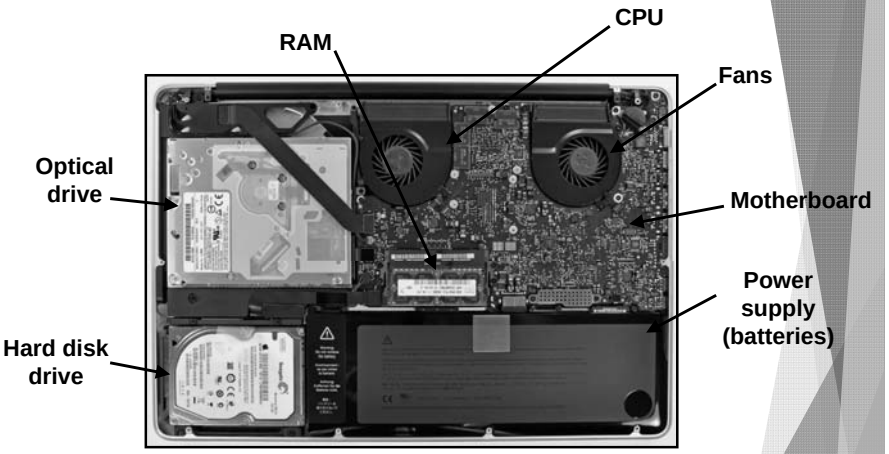
- System units come in lots of different **form factors**

All-in-one PC

Inside the system unit



Inside a laptop

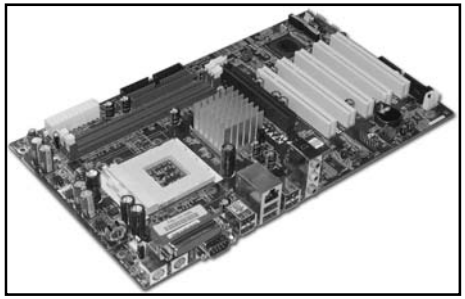


Power supply unit

- Converts AC voltage to DC voltage for use within the computer

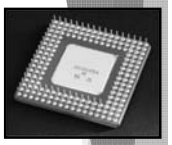
Motherboard

- The main circuit board to which all components are connected, allowing them to communicate with each other

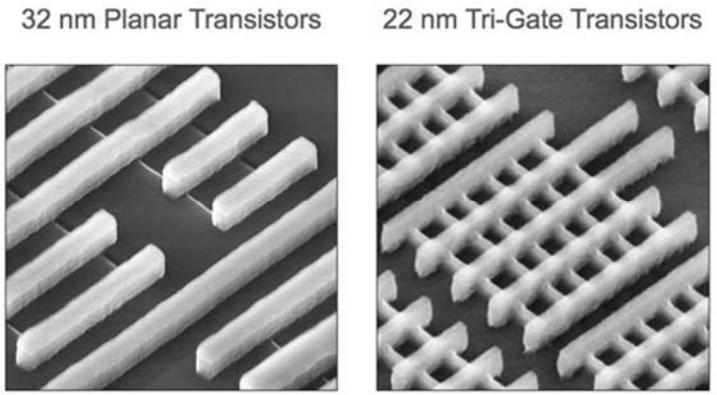


Central processing unit (CPU)

- The ‘brain’ of a computer. Processes data in a computer using its **instruction set**
- Performance measured in **instructions per second**
- Clock speed (measured in **Hertz** [**Hz**]) measures the speed at which electrical signals pass through the processor
- CPUs must be kept cool, generally using a heatsink and fan



CPUs - transistors

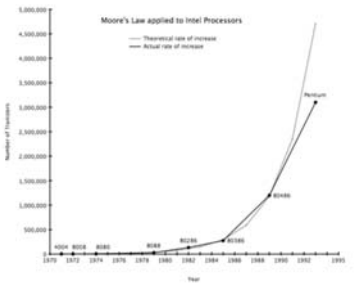


CPUs – Moore’s Law

- Gordon Moore (Intel co-founder) stated in a 1965 paper:
  ‘*The number of transistors on a single integrated circuit doubles approximately every 18 months, while the price remains the same.*’
- So…
  - In 3 years, CPUs will be 4 times faster
  - In 15 years, CPUs will be 1000 times faster

CPUs - Moore’s Law

- Moore’s Law has been an important guide for many aspects of the tech industry, especially in CPU manufacture
- We’re finding it more difficult to keep up with Moore’s Law as we reach the limits of our fabrication technology



CPUs – other measures

- Power efficiency and heat are just as important as clock speed
- Modern CPUs have multiple cores, increasing their processing capacity
- New kinds of processors, such as **system on chip (SoC)** are commonly used in mobile and embedded devices

Wirth's Law

- Niklaus Wirth stated in 1995 that 'software gets slower more rapidly than hardware gets faster'

Primary memory

- Used to store data for quick access by CPU
- Main form of primary memory is **Random Access Memory (RAM)**
- RAM is **volatile memory**
- More RAM improves a computer's speed by providing more quick access memory
- Capacity is measured in bytes, clock speed measured in Hz
- Many types of RAM; common type is DDR3 SDRAM

Secondary memory

- Used to store files for repeated access over time
- Also known as **non-volatile storage**; the storage medium retains its contents without electricity
- Many forms of secondary storage:
  - Hard disk drive (HDD)
  - Solid state drive (SSD)
  - CDs, DVDs, Blu-ray
  - USB drives, external HDDs

Hard Disk Drive (HDD)

- Stores data on spinning magnetic disks. Data is read and written by moving heads
- Advantages:
  - Cheap storage medium
  - Widely used and supported
  - Can have very large capacity drives
  - Long operating life
- Disadvantages:
  - Noisy operation
  - Can consume more power than SSDs
  - Fragile, needs to be handled carefully

Solid State Drive (SSD)

- Stores data on flash memory, the same technology used by USB drives
- Advantages:
  - Silent operation
  - Higher read/write rates when compared to HDDs
  - Low power usage
  - More durable
  - Use less space
- Disadvantages:
  - Costlier than HDDs
  - Can wear out faster than HDDs

Memory capacity

Measured in bytes

Plain Text (approx.)

– 1 byte	1 character - using ASCII standard for encoding
– 1 KB	13 lines/1000 characters in our course notes
– 1 MB	300 pages
– 1 GB	175 phone books

Music (approx.)

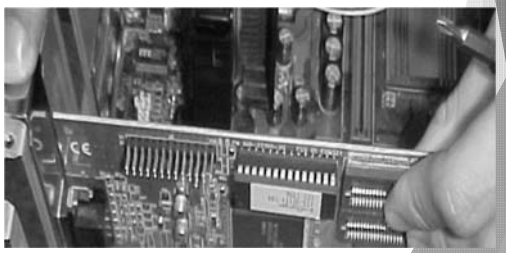
– 1 GB	2 hours

DVD (approx.)

– 1 GB	20 minutes

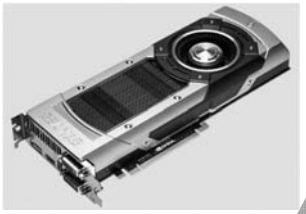
Expansion cards

- Additional circuit board that provides extra functionality
- Examples: sound card, graphics card, network card
- Plugged into motherboard using slots that follow certain standards:
  - ISA
  - PCI-E
  - AGP



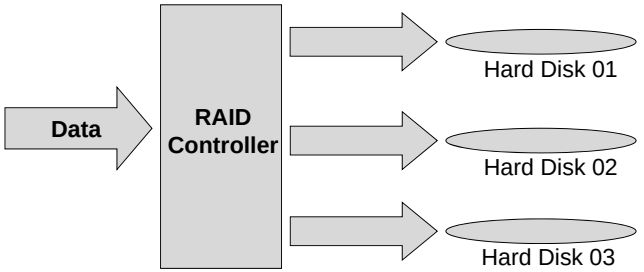
Graphics card

- Used to perform graphics processing and run the computer's monitors
- Consists of:
  - GPU (built-in/discrete)
  - Video memory
  - Heatsink and fan
  - Ports



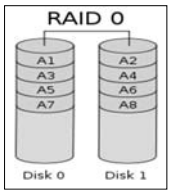
Redundant Array of Independent Disks (RAID)

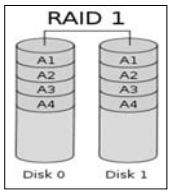
- RAID pools HDDs/SSDs together to form a larger, more reliable data storage mechanism
- Each RAID configuration has its own strengths and drawbacks
- RAID is commonly used in servers



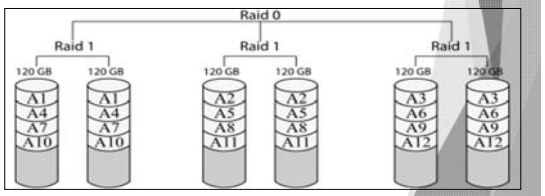
RAID configurations

- Numerous configurations, we're focusing on two:
  - RAID 0 – data stripes used to increase speed
  - RAID 1 – data redundancy used to increase reliability
- RAID 10 combines RAID 0 and RAID 1 together





RAID 10



Input devices

- Peripherals that enables the user to provide information to the computer
- Common input devices:
  - Keyboard
  - Mouse
  - Webcam
- Other input devices:
  - Voice recognition
  - Biometric scanners
  - RFID tags

Output devices

- Peripherals that present information processed by the computer to the user
- Output devices include:
  - Computer monitor
  - Printer
  - Speakers
  - Touchscreens
- New forms of output include:
  - Virtual reality

Connectors and buses

- All peripherals are connected to the motherboard via ports
- Ports form part of a **bus**
- Wired connections:
  - USB (Universal Serial Bus)
  - Firewire and Thunderbolt high speed buses
  - Ethernet
  - VGA, DVI and HDMI for monitors
- Wireless connections:
  - Wi-Fi
  - Bluetooth

Computer specs

- How much primary memory does this computer have?
- How many cores does the processor have?
- Does this computer have a motherboard?
- Does this computer have a graphics card?

Inspiron M301z
Get extra memory & power for faster multitasking on the move

- AMD Athlon™ II Neo K345 Dual-Core Processor
- Genuine Windows® 7 Home Premium 64bit (English)
- 4GB (2 X 2 GB) 2 DIMM DDR3 1333Mhz (operating at 800MHz)
- 320GB 7200RPM Hard Drive
- 13.3 HD WLED True Life (1366x768)
- Integrated ATI Mobility Radeon™ HD 4225

Online Price..... $1,099[5]

Summary

- Computers process input from the user and other sources and provide output
- Computer systems are designed using the principle of modularity
- System units are made up of a number of components working together:
  - Power supply
  - Motherboard
  - CPU
  - Primary and secondary memory
  - Connectors and buses