



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

- ▶ Damir Azhar

- ▶ damir.azhar@auckland.ac.nz
- ▶ 303S, Level 3, room 390

- ▶ Reuel Baptista

- ▶ reuel.baptista@auckland.ac.nz
- ▶ 303S, Level 5, room 567

- ▶ Paul Ralph

- ▶ p.ralph@auckland.ac.nz
- ▶ 303S, Level 4, room 492

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

Course coordinator and lab supervisor

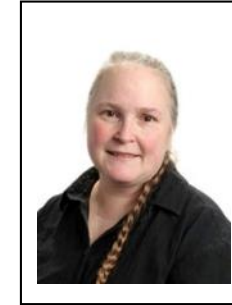
- ▶ Ann Cameron
 - ▶ 303S, Level 4, room 479
 - ▶ a.cameron@auckland.ac.nz
 - ▶ Open door policy. Visit anytime or email for appointment
- ▶ Contact Ann if you have questions about the course or labs

Computer Science Support Network

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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



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

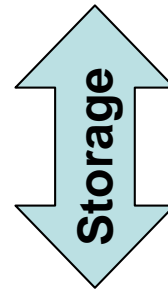
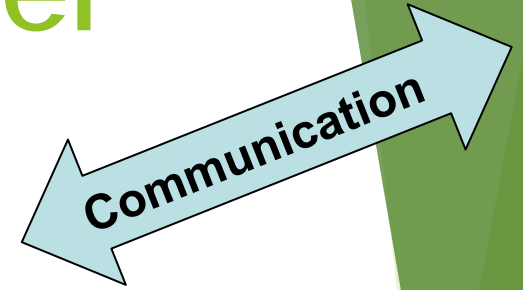
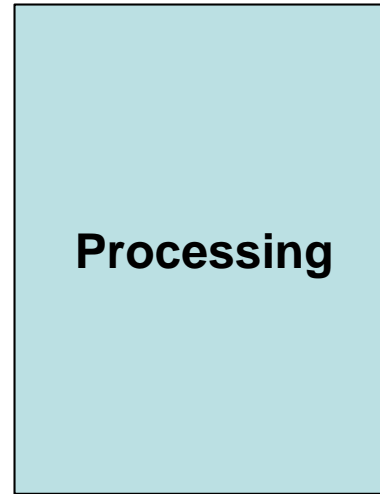
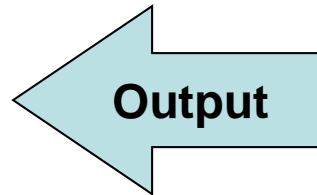
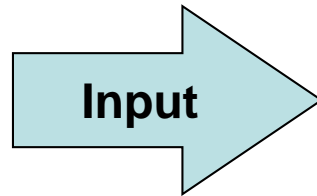
Computer Hardware

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



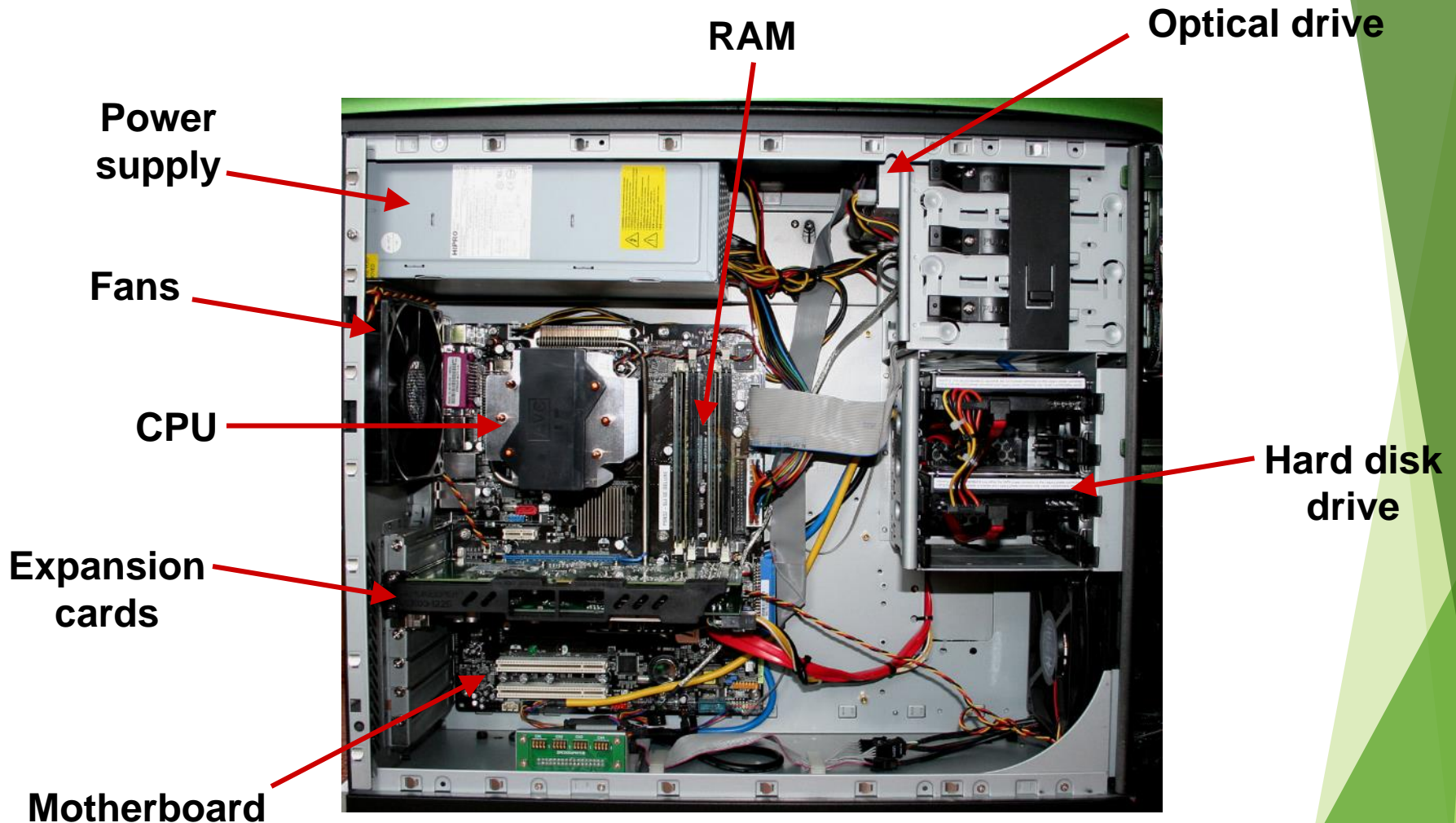
Tower

Desktop

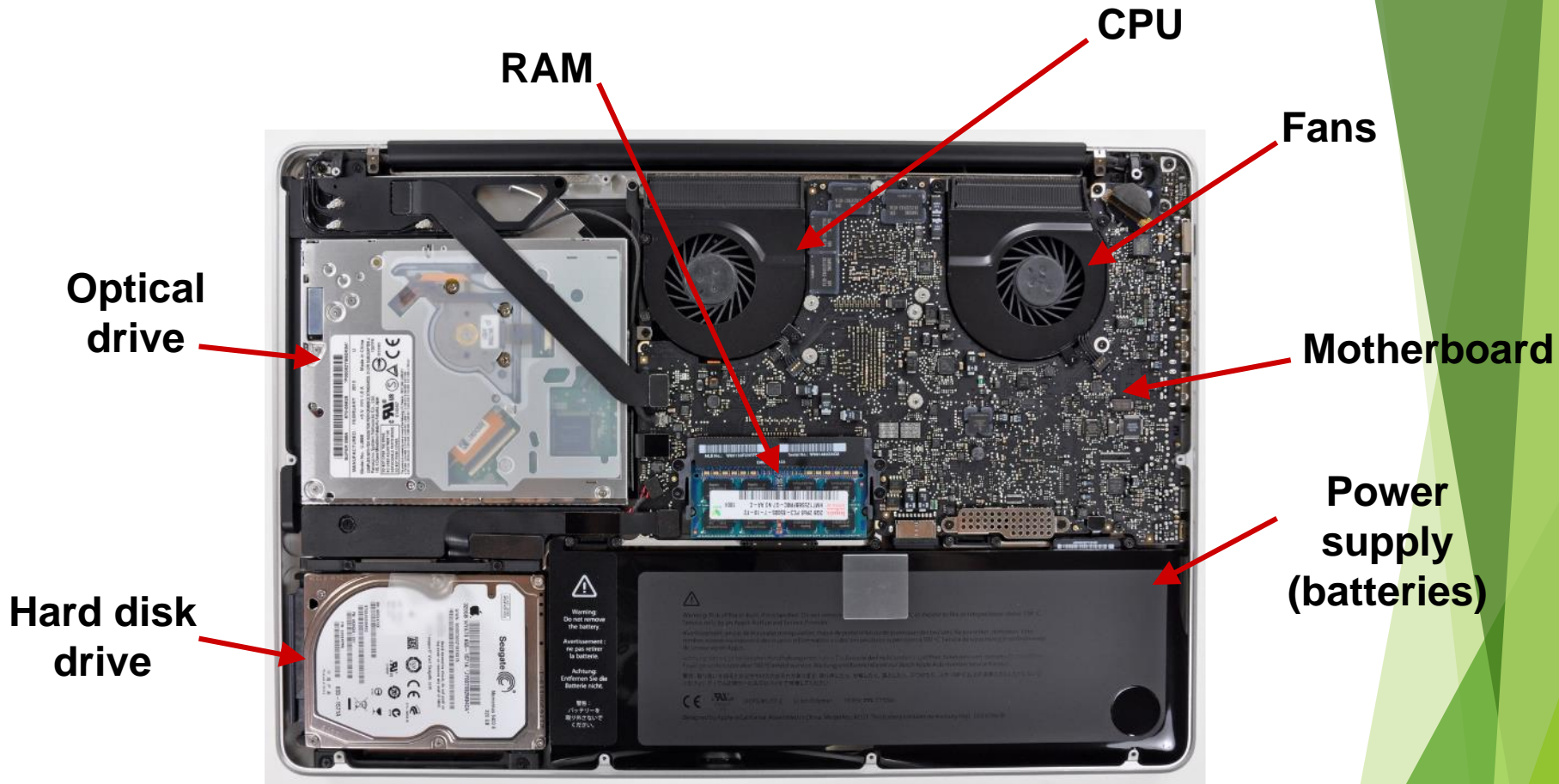
SFF
Small Form
Factor

USFF
Ultra Small
Form Factor

Inside the system unit



Inside a laptop



Power supply unit

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



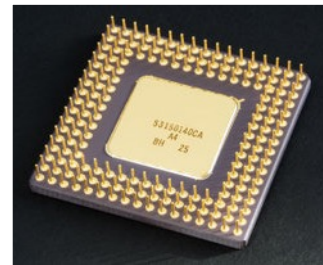
Motherboard

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



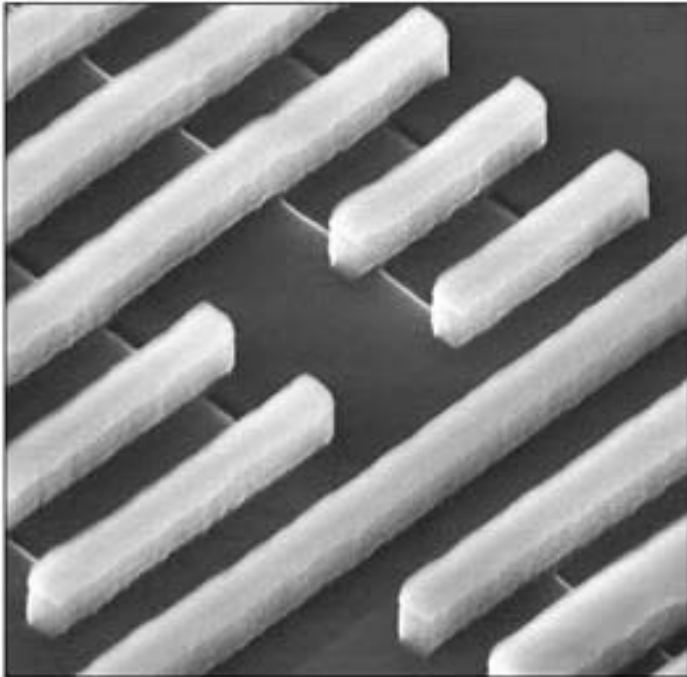
Central processing unit (CPU)

- ▶ 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

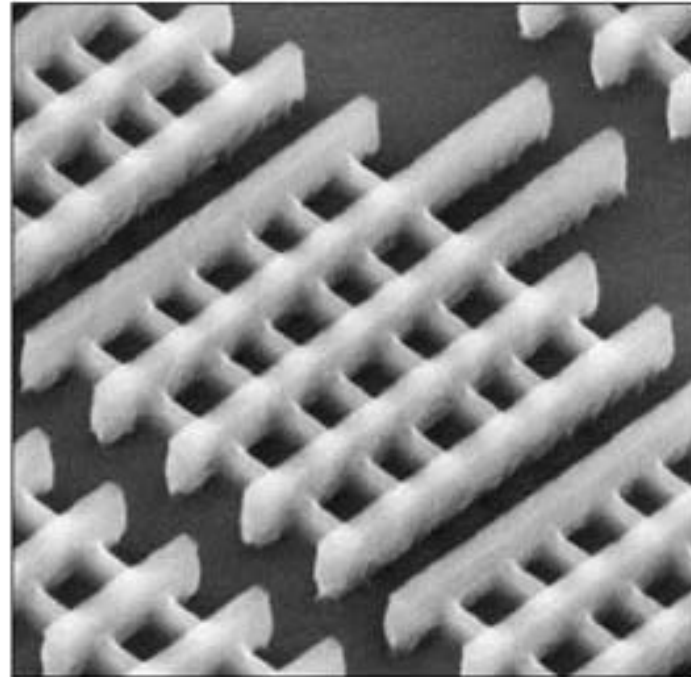


CPU - transistors

32 nm Planar Transistors



22 nm Tri-Gate Transistors

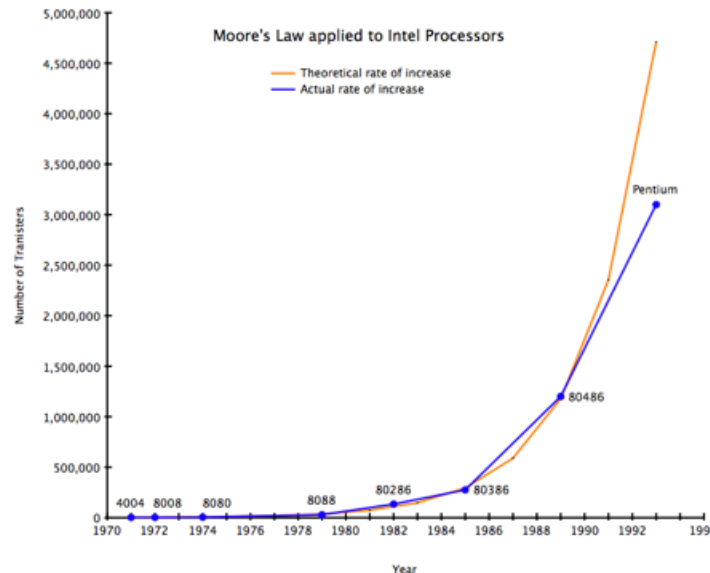


CPUs - Moore's Law

- ▶ 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 KB
- 1 MB
- 1 GB

1 character - using ASCII standard for encoding
13 lines/1000 characters in our course notes
300 pages
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



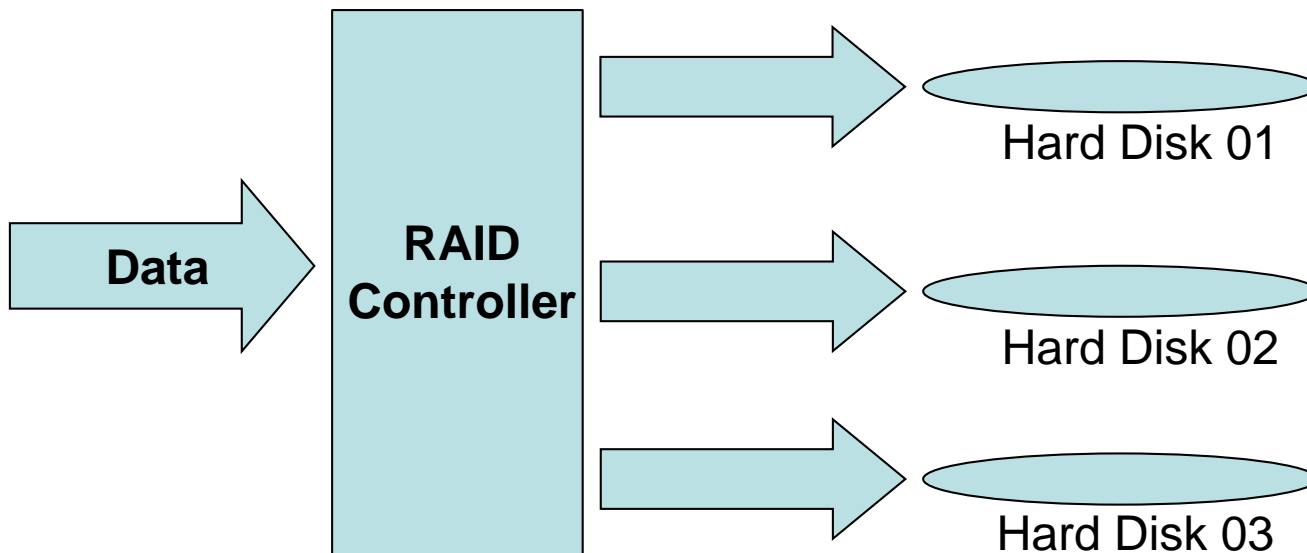
Graphics card

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



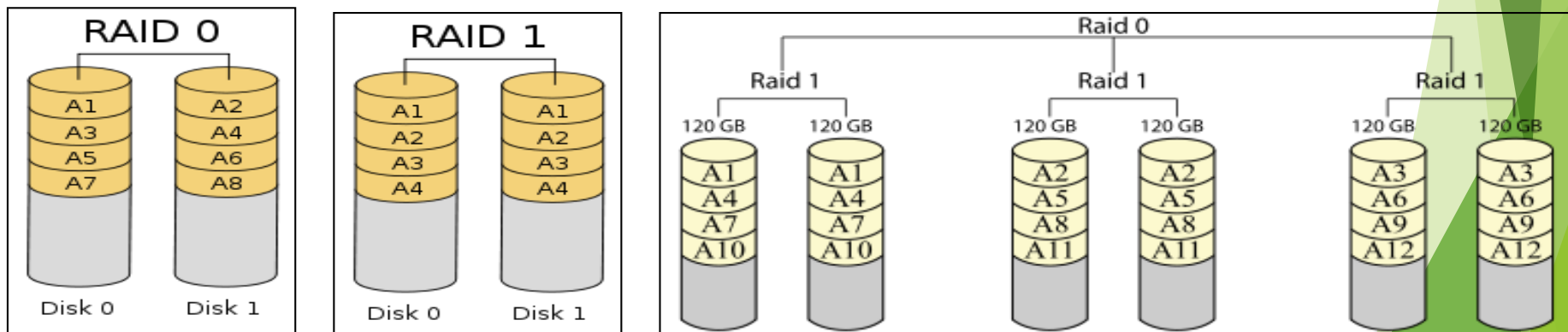
Redundant Array of Independent Disks (RAID)

- ▶ 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



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..... **\$1,099⁵**

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

