3 - Trends

Introduction

- Predicting the future – always dangerous!
  - Wearables, Fridge-front displays, WAP ...
- Computing and IT (C&IT) now
  - Illustration of some key points
  - Some emerging technologies
  - How C&IT is changing society

Technologies

Hardware trends

- Production trends
  - Smaller, cheaper, faster, greater capacity
  - Lower energy requirements
  - More portable
- Hotter!

- THG_CPU_Cooling.avi

Moore's Law

- Gordon Moore, chairman of Intel, 1965
- Observed that number of transistors had doubled every ~1.5 years (1% per week)
- Predicted the rate would continue
- Has done for 40 years – limits in ~5 years
- 3 month delay -> lags expectation by 10%
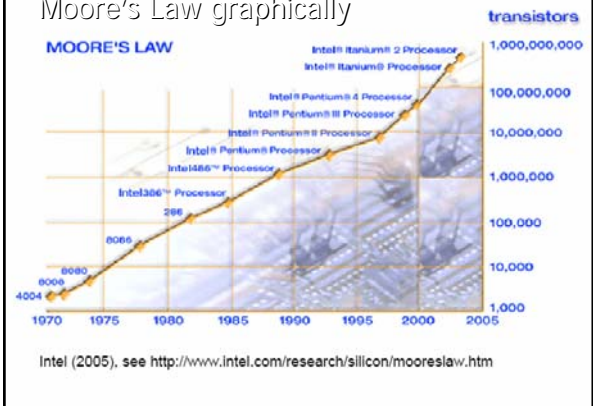- Predicting trends is important!

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Moore's Law

- Growth in hard disk storage has kept up
- Memory speeds have not
  - Double every ~6 years
  - System speeds are variable
- Consequences of law for production
  - Chips take ~3 years to produce
  - Value of chip depends on time of market entry

Moore's Law graphically

Intel (2005), see http://www.intel.com/research/silicon/mooreslaw.htm

Exponential Growth

- Moore's law shows *exponential growth*
- When the rate of change of a quantity is proportional to its size, it is growing exponentially.
- Other examples:
  - Savings accounts with compound interest
  - Breeding rabbits with no limits

Beating the limitations

- *Multithreaded* chips have multiple processing cores, processing different jobs (threads).
  - One core stalls waiting for data -
  - Second core can work on another job instead.
  - This is an example of *parallel processing*.
  - Also increased *cacheing* and *pipelining*
  - Quantum chips – many years off yet.
- Optic chips manipulate light. Both kinds of chip are the focus of current research, and will take a while to develop.

Displays

- Digital storage is replacing paper to a degree
- Paper becomes an *interface* rather than a *storage medium*.
- Flat screens have already replaced CRTs.
- Flexible displays next - electronic paper being developed by Xerox, Philips, Fujitsu
- 3D displays: "2½D" - displays that give the appearance of 3D
  - Holograms, lenticular screens
- Genuine 3D feasible but huge data issues

Flexible displays

Systems

Future technologies

- Multipurpose machine become less dominant
  - Dedicated hardware: mobiles, games consoles, iPods, set-top boxes ...
- Smart networks: GRID, anti-virus, searching...
- Changing human-computer-world interactions
  - Sensors
  - Smart environments
  - User interface *modalities* – voice, gesture ...

Some emerging technologies

- TV over *IP* (Internet), Cellphone TV
- Wearables (well ...)
- Access anywhere files, applications
  - Application Service Provider
  - Service-Orientated Architecture
- GRID
- RFID – Radio Frequency ID tags
- Speckled computing – "smart dust"
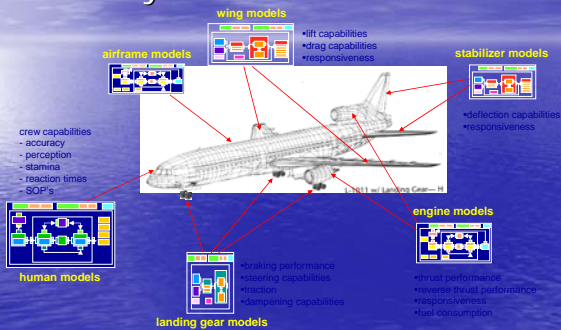 - E.g. dampen building vibration in earthquakes

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The Biological Connection

- Using knowledge of biological systems to understand computers
- Using computers to understand biological systems
- Genomics, gene mapping
- Bio sensors

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whole-system simulations

wing models
- lift capabilities
- drag capabilities
- responsiveness

airframe models

stabilizer models
- deflection capabilities
- responsiveness

crew capabilities
- accuracy
- perception
- stamina
- reaction times
- SOP's

human models

engine models
- thrust performance
- reverse thrust performance
- responsiveness
- fuel consumption

- braking performance
- steering capabilities
- traction
- dampening capabilities

landing gear models

NASA Information Power Grid: coupling all sub-system simulations

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Future IT @ Edinburgh

- Use biological minds to understand computer thinking and *vice versa*
- Sense perception
  - Computer vision and visualisation
  - Computer speech processing & generation
- Reasoning
  - Natural language control of computers
  - Computer reasoning and expert systems
- E-science
- Surf http://www.inf.ed.ac.uk/research/

Societies

Communication

- IT has changed how we communicate
  - Printing press, telegrams, telephone
- IT is changing communication now
  - Email, Text messaging
  - Chatrooms, messenger
  - Blogs, Wikis
  - People think and organise differently

- Computers are becoming ubiquitous
- So is electronic communication
  - Is this good for society?
- Computers are evolving; we aren't!
  - Immediate effect – profits from services not hardware
  - Rental replacing ownership of media

Source: Gartner Group

Societal effects

- Talk of recording everything
  - You can replay any part of your life
  - So can someone else
- Development includes taking risks
  - Making mistakes and getting away with them
- What kind of society when everything you do can be dissected with hindsight?

Key points

- Trends
  - Moore's Law: exponential growth
  - Faster, smaller, quicker, for how long?
  - Smart networks
- IT is a force of change in society
  - Understood through IT Concepts
  - Internet, Networks, Communications, Algorithms, Databases,...
- The computer literate will be better equipped to adapt to a changing world, changing jobs