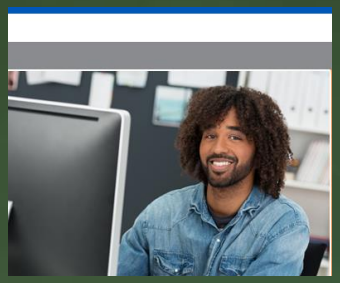
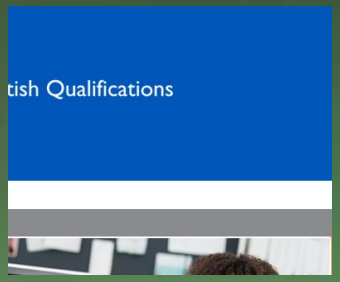
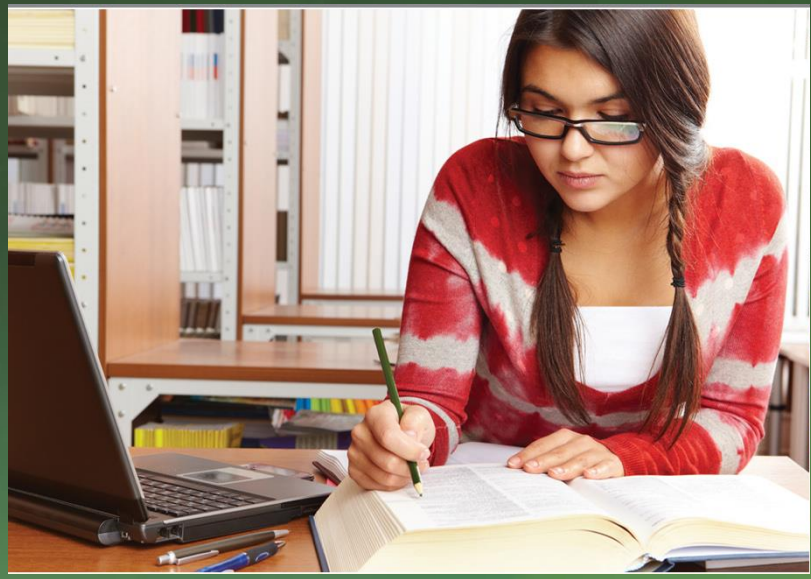
Awarding Great British Qualifications







Computer Systems

Topic 5: Alternative Operating Systems

Learning Outcomes

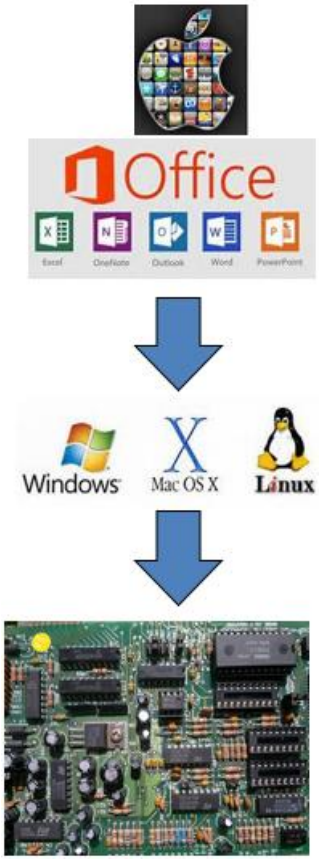
By the end of this topic, students will be able to:

- Compare different types of computer systems
- Build and configure a computer system to meet a design specification

What is an Operating System?

- An ‘Operating System’ (OS or O/S) is…
  - A very complex piece of software that controls a computer and its resources (CPU, memory, disk etc.)
  - A ‘resource manager’ for the computer
  - A piece of ‘systems software’ that looks ‘inwards’ to the host computer it controls
  - A software ‘platform’ on which other applications run
  - See:
    - https://www.computerhope.com/jargon/o/os.htm
    - http://computer.howstuffworks.com/operating-system.htm

What is an Operating System?



Applications

Operating System

Computer Hardware

Operating System Types

- There are four categories of OS:
  - Real-Time Operating System
    - Designed for industrial and embedded applications
    - Designed to precisely control industrial processes
    - Designed for machines, not interacting with humans
    - Hence, little user interface capacity
    - Example: **VxWorks**
    - https://www.windriver.com/products/vxworks/
  - Single-User, Single-Task
    - As it says, supports one user doing one task (at a time)
    - Example: **Palm OS** (for handheld devices)
    - https://www.palmsource.com/palmos/

Operating System Types

- There are four categories of OS:
  - Single-User, Multi-task
    - Classic PC/laptop operating system
    - Allows one user to have multiple applications running together
    - Examples: **Microsoft Windows, Apple MacOS**
    - https://www.microsoft.com/en-gb/windows/
    - https://www.apple.com/uk/macos/catalina/
  - Multi-User
    - Supports a community of parallel users (at same time)
    - Operating system allocates resources and balances workload
    - Example: Unix and Linux
    - http://www.unix.org/what_is_unix.html
    - https://www.linux.com/what-is-linux

Operating System Locations

- Operating systems are found on:
  - Mainframes
  - Servers
  - Desktops
  - Laptops
  - Netbooks
  - Handheld devices
  - Industrial equipment and processes

Operating systems control complexity. If device function is predictable, fixed and relatively simple – like a microwave or washing machine - there is no need for an OS – the logic can be hardwired into the actual machine hardware. OS is software - so it can support extensions/modifications and be reinstalled without throwing away the actual computer itself.

Operating System API

- As already stated, the primary function of an OS is managing the computer hardware
- A second major task is to provide a consistent ‘platform’ or ‘interface’ to external applications – like a game, database or spreadsheet – so app developers can have confidence their app will run on any computer being controlled by that OS
- This is known as an API
- - **Application Program Interface**

Operating System API

External Applications

(Databases, games, word-processors, spreadsheets, calendars etc.)

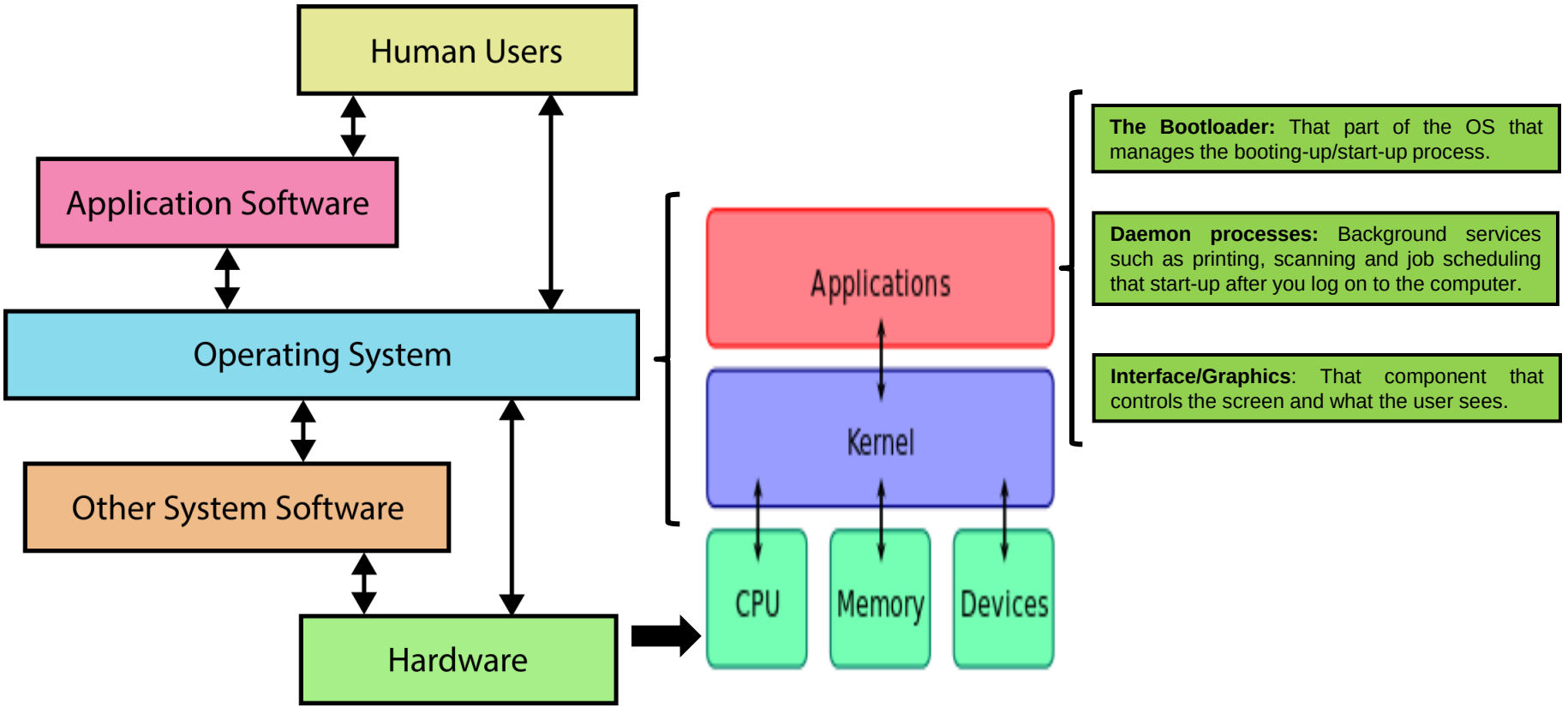
Application Program Interface (API)

(A known, consistent & uniform ‘platform’ or ‘blanket’ *provided by operating system*)

Complex Hardware

(Variable CPU architecture, memory structure, disk size etc.)

Operating System Components



Operating System Examples

- Microsoft Windows
  - Everyone's favourite! Been around along time…
  - https://www.computerhope.com/history/windows.htm
- Apple MacOS
  - Used only on Apple desktops and laptops
  - https://www.computerhope.com/history/macos.htm
- Apple IOS
  - Used for iPhone, iPad and iPod
  - https://www.computerhope.com/jargon/i/ios.htm

Operating System Examples

- LINUX
  - Open-source, free software
  - UNIX-like: been around since 1991
  - Used on any device in different ‘distributions’
    - Debian
    - Fedora
    - Ubuntu
    - And many, many other flavours
  - https://www.computerhope.com/jargon/l/linux.htm
  - https://www.linuxfoundation.org/

Operating System Examples

- UNIX
  - Been around even longer than MS Windows (1960s)
  - Designed as a multi-user, multi-tasking OS
  - Like Linux, now has many ‘flavours’ available:
    - Solaris (Sun workstation version – also called SunOS)
    - Ultrix (DEC VAX version – now obsolete)
    - BSD (Berkeley Software Distribution - University of California)
    - System V (AT&T)
    - HP-UX (Hewlett-Packard Unix)
    - And many, many other flavours
  - https://www.computerhope.com/jargon/u/unix.htm

Operating System Examples

- Android
  - Developed in 2003
  - Now owned by Google
  - Open source (Linux-based)
  - Used for mobile devices
  - Main competitor to Apple IOS platform
  - https://www.computerhope.com/jargon/a/android.htm
  - https://www.android.com/

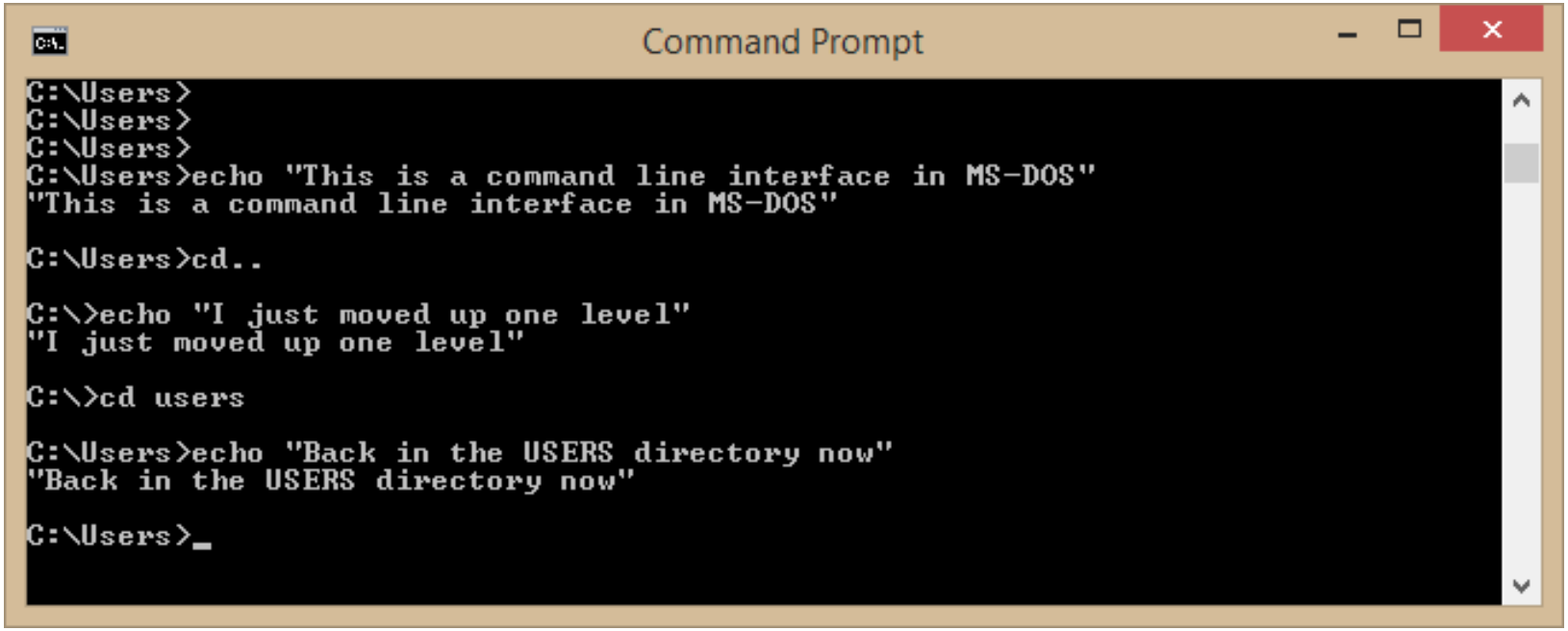
What is a User Interface?

- A ‘User Interface’ (UI) is:
  - Where a machine meets the external world
  - The machine in our case is a computer
  - The external world in our case will be a human user
  - Hence the phrase ‘HCI’ (Human-Computer Interface)
  - Also the older phrase ‘MMI’ (Man-Machine Interface)
  - Relates to topics such as:
    - User Experience (UX)
    - Accessibility (Supporting disabled users)
    - Ergonomics (Human efficiency at work)

User Interface: Command Line

- Command Line
  - Can be quite daunting to inexperienced users
  - Demands in-depth technical knowledge of commands
  - Aimed at technical or specialist end-users
  - Easy to make mistakes, hard to fix or edit commands
  - No ‘point & click’ environment – all commands typed
  - Does not demand a lot of system resources
  - Often used in Unix and Linux environments
  - Used in MS-DOS before MS-Windows arrived
  - See next slide…

User Interface: Command Line



User Interface: Menu-Driven

- One step on from a basic ‘command line’
  - Saves inexperienced users remembering commands
  - Avoids resulting errors and frustration!
  - Don’t type, simply move up/down list and select
  - If too many sub-menus, can be irritating and slow
  - Useful for general users when faced with a known and fixed set of options to choose from
  - See next slide…

User Interface: Menu-Driven

http://www.bbc.co.uk/education/guides/zwb4jxs/revision/2

User Interface: Graphical

- Much more intuitive, attractive and user-friendly
- Supports ‘cut and paste’ and ‘drag and drop’ features
- Can be demanding on system resources
- Called ‘GUI’ (Graphical User Interface)
- Uses ‘WIMP’ components:
  - Windows
  - Icons
  - Menus
  - Pointers

User Interface: Graphical

User Interface: Web

- A natural extension of the GUI concept
- Highly customizable with lots of built-in functionality and design opportunities
- Provides end-user with a rich, intuitive hyper-connected experience
- Spawned a whole family of technologies:
  - HTML coding
  - CSS styling
  - Scripting languages

User Interface: Web

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User Interface: Voice

- Voice recognition (in both directions)
  - Now becoming established - probably the most natural way for human's to interact
  - Now we have voice recognition for:
    - Authoring (dictating text rather than typing)
    - Instructing (speaking commands, not typing or clicking)
    - Searching (asking questions to our computers and phones)
    - Listening (letting the satnav or computer talk to us!)

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INTRODUCING amazon echo

User Interface: Touch

- After typing, clicking and talking, the other way to interact with your computer is…to touch it!
  - Like speaking, very intuitive – can touch an image on screen
  - Useful for people with different languages – like tourists
  - No technical knowledge needed - like commands or menu options
  - Can be an issue for disabled users (see ‘Peripherals’ lecture)
  - Often used in public settings and private computers

Interface Guidelines

- There are four closely-related concepts:
  - **UX** (User Experience)
    - The *total* experience for a user (interface, organization etc.)
  - **UI** (User Interface)
    - The user's experience of just the *interface* (all aspects)
  - **Usability**
    - The *ease/enjoyment* of using the interface (for all users)
  - **Accessibility**
    - The *ease/enjoyment* of using the interface (for disabled users)

https://www.nngroup.com/articles/definition-user-experience/

Interface Guidelines

- There are several well-established guidelines on what makes a ‘good’ interface
- See the following guidelines from a world-leader in interface design:
  - https://www.nngroup.com/articles/ten-usability-heuristics/

Virtualization

- What about having one interface inside another interface?
- **Virtualization** is a growing trend which allows a ‘virtualised’ computer/interface to exist within a host ‘physical’ computer/interface
- For example, you could be running a (physical) Microsoft Windows computer while working on a (virtual) Linux computer running inside the Windows machine!
- See:
  https://www.vmware.com/uk/solutions/virtualization.html

Virtualization

References

- https://www.computerhope.com/jargon/o/os.htm
- http://computer.howstuffworks.com/operating-system.htm
- https://www.nngroup.com/

Awarding Great British Qualifications

Topic 5 – Alternative Operating Systems

Any Questions?