

UNIT 23
OPERATING SYSTEMS & SYSTEM
ARCHITECTURE (ADVANCED)

AVCE Information and Communication Technology

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SECTION 1 INTRODUCTION

Electronic computers have come a long way since the first stored-program machine ran at Manchester University in 1948. That computer consisted of thousands of thermionic valves, miles of wire and filled a very large room. It executed very small programs very slowly (by modern standards). Semiconductor technology has replaced the valve and led to the desktop computer or PC offering processing power unimaginable to the early pioneers. The invention of the *microprocessor* chip has thus given us the *microcomputer*.

By now, all students will have had ample opportunity to use a microcomputer to perform a wide variety of tasks. This unit delves into the inner workings of the machine and allows students to learn more about the hardware, and the software that translates their key-strokes or mouse-clicks into instructions the hardware can understand.

The early computers only ran one program at a time. At any one time all the systems resources were available on demand. This was inefficient and expensive because the computer had the potential to do much more. Software programs were developed in the 1960's to improve the computer's efficiency, releasing the full potential of a system. An *Operating System* is the name given to the software that enables the computer to manage its resources effectively, and provides an interface between the user and the hardware.

The unit is divided into three areas of study: internal workings of the microprocessor chip, the internal architecture of a PC and the Operating System software.

SUMMARY OF LEARNING OUTCOMES

The student will:

- understand the internal structure of a microprocessor.
- be able to program a microprocessor in low-level assembly language.
- understand how the component parts of a microcomputer are linked together.
- know about the relative advantages and weaknesses of two different types of microcomputer Operating System.
- know how to install and configure Operating System software.

LINKS WITH OTHER UNITS

Unit 1: Presenting Information (Advanced) provides foundation skills necessary for presenting a review.

Unit 4: System Installation & Configuration (Advanced) provides an introduction to all the system hardware and software terminology used in this unit.

Unit 16: The Human-Computer Interface (Advanced) covers the interaction between the human operator and the machine in greater depth.

Unit 18: User Support (Advanced) covers the work of the Administrator who configures the computer system to suit the user and sorts out problems encountered by the user.

Unit 21: Data Logging, Computer Control and Robotics (Advanced) extends the students' knowledge and understanding of microprocessor operation and low-level programming.

SECTION 2 OVERVIEW OF LEARNING AND ASSESSMENT STRATEGIES

TEACHING AND LEARNING STRATEGIES

The internal workings of a microprocessor are best understood by study of a particular chip in detail. There are a number of resources available to provide 'hands-on' experience. A manufacturer's evaluation kit for a particular chip is cheap and easy to obtain and usually comes with all components and software enabling it to be 'driven' from a basic PC. Simple assembly-language programs can be written, assembled, downloaded to the board and run under the control of the PC. There are also several simulation packages available, some aimed at the education market which allow a simple microprocessor-based system to be designed on a PC, and then tested without any extra hardware. See **Additional Resources**. It is recommended that only simple 8-bit microcontroller type devices be studied in detail. Modern 32-bit devices such as the Pentium series are far too complex to use as an introduction. In any case, these powerful devices work using the same basic principles as their smaller relatives.

Reference material should be provided for students to be able to research system design. A useful starting point is to access material presented in the BBC broadcast Open University course on computing and systems design. By using these and other resources, students will better understand the theory, development and performance of state-of-the-art components and processors. The students should also be able to research computer systems through the Internet and have access to a PC which they can dismantle and explore.

Students should be allowed to install and configure at least two different sorts of Operating System. One should have a built-in Graphical User Interface (GUI) such as Windows 95, 98, Me or 2000 and another should be command-line based (keyboard only, no mouse) such as Linux.

Another useful activity is for students to consider the many ways computer systems are used. Computers are widely used in the community so it may be possible to develop a good relationship with local companies, retailers and developers. FE and HE institutions may be willing to provide access to students seeking to progress to college or university courses in computing. Lecturers may be willing to make presentations which will help to provide a point of reference for students research and provide insight into the part computers play in education, and the commercial and industrial world.

ASSESSMENT STRATEGIES

The grade for this unit is derived from an **External Assessment** examination. This consists of two parts: examination of written work submitted in response to **Pre-Release Material** provided by Edexcel, and a 1½ hour **Written Test**. The students may take their Pre-Release work into the test.

Opportunities should be made available for peer and self-assessment in order to develop students' skills in being responsible for their own learning and development.

Students must be encouraged to document all their learning activity work in a clear and concise manner. Each student should maintain a log book of all their practical work. It should be emphasised to the student that such log books are kept by the professionals and are a valuable resource when a particular sequence of steps needs to be repeated, sometimes months later.

KEY SKILLS DEVELOPMENT

There may be opportunities to create evidence for their **Communications** portfolio: when they are working as part of a team producing the presentations, discussing ideas and producing design notes.

There may be opportunities to create evidence for their **Information Technology** portfolio: when they are accessing information via the internet or from CD based information systems. They will be keeping log books which will involve the use a word-processor, and perhaps using a drawing package to produce technical drawings and schematics.

There may be opportunities to create evidence for their **Working with Others** portfolio: when they are planning and reviewing their work as part of a team.

SECTION 3 SUGGESTED DELIVERY & ACTIVITY SCHEDULE

TOPIC	TEACHING SCHEDULE	ACTIVITIES	RESOURCES
1	The microcomputer Historical background The Personal Computer (PC) Industrial control systems Automation and Robotics	Activity 1. Individual research Class discussion Tutor input	Internet connection Books External speaker
2	The microprocessor Features common to most devices Variants: the GP micro, the Digital Signal Processor, the microcontroller. CISC and RISC architectures.	Activity 2. Individual research Class discussion Tutor input	Internet connection Books
3	Basic microprocessor internals Program Counter, registers Arithmetic logic unit (ALU) Busses.	Activity 3. Individual research Group rôle play Class discussion Tutor input	Internet connection Books Simulation software
4	Programming a microprocessor Low-level versus High-level language Assembly language Machine Code Monitor program	Activity 4. Write and run an assembly language program.	Microprocessor evaluation kit or development board, PC, assembler software or simulator software
5	Inside the PC Motherboards Expansion cards Bulk data storage devices. Peripheral input/output devices External bus systems: USB, Firewire, COM port, Parallel port	Activity 5. Dismantle a PC, locating and identifying all main components. Individual research	PC with selection of storage and I/O devices. Hardware manuals Device specifications Internet connection Books
6	PC processor systems Microprocessor devices commonly used Clock speeds, internal cache memory, pipelined systems.	Activity 6. Individual research Tutor input	Internet connection Books
7	PC Memory Systems Semiconductor: SRAM, DRAM, SDRAM, FPM RAM, EDO DRAM, ROM, EPROM Disk Drives: Hard, Floppy, CD, DVD Virtual Memory. Unified Memory Architecture (UMA).	Activity 7. Individual research Tutor input	Internet connection Books

8	PC Internal Bus Systems Data links between devices inside the PC Standards: IDE, EIDE, ISA, EISA, MCA, PCI, SCSI	Activity 8. Individual research Tutor input	Internet connection Books
9	PC performance measurement Benchmark software for comparative assessment. Processor speed, memory access times, motherboard bus speed	Activity 9. Individual research Tutor input Run benchmark software on different machines and analyse results	Internet connection Books Benchmark software
10	Operating Systems General principles, why they were developed, principle of multitasking	Activity 10. Individual research Tutor input	Internet connection Books
11	Operating System comparison WIMP or command-line operator interface. Disk space/RAM requirements. Compatibility with applications software Good and bad features. Reliability	Activity 11. Group research Tutor input	Internet connection Books Software manuals Magazine reviews
12	Operating System Installation Preparation and procedures. Use of Wizards. Options presented.	Activity 12. Install two different types of OS, making careful notes of all steps.	PC with blank hard disk. Installation disks for two OS, e.g. Windows 98 and Linux. Manuals
13	Configuring the Operating System User requirements Features for Disabled Access Administrative features	Activity 13. Configure the installed OS to suit a variety of different users.	PC with freshly installed OS. Manuals
14	Inside the Operating System Basic Input/Output System (BIOS) File Management Device Drivers	Activity 14. Individual research Tutor input	Internet connection Books
15	Standard Ways of Working Maintaining files on computer Logging ICT problems Backing-up data	Activity 15 This activity will be spread over the entire time needed to complete the unit.	PC possibly networked, with office application software and disk space for user files.

SECTION 4 SUGGESTED LEARNING ACTIVITIES

ACTIVITY 1: The Microcomputer

Key Skills: C3.1a, C3.2, C3.3, IT3.1, IT3.2

Until large-scale integrated circuits (LSI) were developed in the 1970's computers were either very large occupying whole rooms (mainframes), or about the size of an office desk (minis). The first processor-on-a-chip or microprocessor was the Intel 4004, a very simple 4-bit device intended for a pocket calculator. The concept of the 'home computer' followed rapidly leading to the desktop, laptop and 'palmtop' machines we know today.

Tasks

1. Do some research into the background of the modern microcomputer. It is important that you understand the difference between a 'mainframe' computer, a minicomputer and a microcomputer.
2. Find out about the different kinds of microcomputer used today in the home and office environment. What is meant by the term: 'IBM-compatible'? What is a 'WIMP' interface, who invented it and why is it so important today?
3. The microcomputer has other uses besides that of a Desktop office machine. Find out about other application areas in industry. If you have some local manufacturing firms, try and find out if microcomputers are used in automated processes. Arrange to visit the factory to see for yourself how the machines are used. If you live in the country, you may find that local farmers make extensive use of computers...

ACTIVITY 2: The Microprocessor

Key Skills: C3.1a, C3.2, IT3.1, IT3.2

A microprocessor chip contains all the functions of the old Central Processor Unit (CPU) of previous generations of computers. All the processing power is contained here: the circuitry that keeps track of the instructions being executed, the circuits that actually perform mathematical and logical operations on data, and special registers which hold data temporarily during the execution of an instruction. All these features are common to all types of microprocessor. And there are many types, divided broadly into general purpose microprocessors, microcontrollers and Digital Signal Processors (DSPs). It is the presence of certain special features that determines into which category a particular device falls.

Tasks

1. Research the history of the microprocessor chip. It isn't a long story, but it will show how the various functions of the chip have their origins in far older machines. In other words the concepts are not new, only the technology.
2. Investigate as many manufacturer's web sites as you can and compile a table of devices. Use datasheets (usually downloadable from the web) to locate the performance parameters that distinguish one device from another. Add these parameters to your table.
3. Establish definitions for three broad classes of microprocessor: General Purpose, Microcontroller and Digital Signal Processor. Group your table under these headings.
4. A recent development is to divide micros into two other classes: Complex Instruction Set type and Reduced Instruction Set type. Find out what these terms mean and regroup your table under these headings. Investigate the significance of a microprocessor being of the RISC type.

ACTIVITY 3: Basic microprocessor internals

Key Skills: C3.1a, C3.2, IT3.1, IT3.2, WO3.1, WO3.2

Students should gain an understanding of the sequence of events that takes place when a machine-level instruction is fetched and executed by the microprocessor. As an aid to this, simulation software to run on a PC (see **Additional Resources**) or a manufacturer's evaluation kit would be useful.

Tasks

1. Study the basic instruction fetch-execute cycle that lies at the heart of any computer. In order to understand what is happening you will need to identify standard internal features such as: the Program Counter (sometimes more accurately called the Sequence Control Register), Arithmetic Logic Unit, Accumulator register and Program Store. You will also need to understand the function of the communication links that join these features: Data Bus and Address Bus.
2. Split up into groups. Give each member of the group a rôle as one of the features investigated in Task 1 above. The person playing the program store will have two pieces of paper: one will have a machine-level instruction on it, say, ADD IMMEDIATE which means add the number immediately following this instruction (on the other piece of paper) to the contents of the Accumulator register, leaving the answer in the Accumulator. Who is 'in charge' here? In other words, who tells the program store which piece of paper to pass on and when? Who 'decodes' the instruction and decides what to do? Who does the addition?
3. If available, run a simulation program on a PC to see how the fetch-execute cycle works in a practical device.

ACTIVITY 4: Programming a microprocessor

Key Skills: C3.1a, C3.1b, C3.2, C3.3, IT3.1, IT3.2, IT3.3, WO3.1, WO3.2

All students by now should have had some experience of programming a computer using a High-Level language, probably Visual BASIC or similar. From the previous activities above they should now realise that the microprocessor only understands very simple instructions. They should understand that every High-Level instruction has to be translated into many 'machine code' instructions before execution. This translation is either done in one go by a Compiler program or 'on the fly' by an Interpreter. Each student should at least understand the difficulties and limitations of programming directly in machine language or 'Assembler' by having a go themselves. It is suggested that students work in groups of no more than two for this exercise.

Tasks

1. Obtain (from the Internet) the datasheet for the microprocessor device you are going to program in Low-Level or 'Assembler' Language. You should have been provided with either a physical development/evaluation board for a particular microprocessor device, or have access to a 'Simulator' program that runs on a PC. You should also have a copy of the micro's instruction 'set' and a description and diagram of the circuit board (real or simulated!). Relate the instructions to the various internal registers. Where will your program be stored?
2. If you're used to programming in a High-Level language such as Visual BASIC, then you're in for a shock! You can't have lines like: $A = 3.142 * B$ for example. For a start, there may be no multiply instruction, variables A and B would have to be specified as memory or register addresses and finally, there is unlikely to be any 'Floating-Point' provision. Your processor will probably be 8-bit 'Fixed-Point' only, limiting you to small integer numbers only. If you haven't come across these terms before do some research into number systems before going any further.
3. Familiarise yourself with whatever hardware and software you are going to use. How are you going to generate the 'Source code' program? How is this converted to the 1's and 0's the microprocessor understands? How do you get this machine-code program into the program memory and run it? How do you know if it is running properly, or even doing anything?
4. Write simple programs in assembler language to add numbers together or switch a LED on and off (if the development board has provision for this). Keep accurate records of your programs. Make sure you can demonstrate that they work.

ACTIVITY 5: Inside the PC

Key Skills: C3.1a, C3.2, IT3.1, IT3.2, WO3.1, WO3.2

The microprocessor is just one component of many inside the average PC. It sits on a large printed circuit board (PCB) surrounded by many other semiconductor devices including: the main memory or RAM, graphical display driver chips, disk drive interfaces and so on. The students should now have the opportunity to take a PC apart and identify its internal components.

Tasks

1. Working in groups, begin a study of the internal workings of a desktop PC. Before you start work with a screwdriver, take time to locate information on PC internals from the Internet, computer magazines and books.
2. With no mains power connected, and taking suitable precautions against damage to chips by static electricity, open up the PC case and dismantle everything. But **DON'T** take the power supply unit or disk drives apart and **DON'T** remove chips from boards. Use your research material to identify all the parts. Try and identify the chips on the motherboard handling the video display, sound, disk drives and of course the processor itself.
3. Make notes of device code numbers and see if you can locate the motherboard type number. These will come in useful for research in the next three activities.

ACTIVITY 6: PC processor systems

Key Skills: C3.1a, C3.2, C3.3, IT3.1, IT3.2

The microprocessor in the development system used earlier is extremely simple compared to the powerful devices found in the average PC. From the point of view of learning the basics of microprocessor operation, it would be a nightmare to start off with a Pentium device however. Although the smaller devices have practical uses, the massive demands made by complex office and gaming software, not to mention the Windows Operating system, require the PC designer to use the more powerful chips. The students should investigate the various types of 'super-microprocessor' used in PCs and establish what extra features they have compared to a 'basic' microprocessor.

Tasks

1. Conduct research into the various types of processor device used in recent designs of desktop microcomputers. Find out as much as you can about the device used in the machine you have just dismantled.
2. Prepare a report on the progress of PC microprocessor development in recent years, starting with the original Intel 8088 used in the first IBM PC right through to the present Pentium series and AMD devices. Identify in each case the new processor features added and how existing features were improved. Explain how these changes brought about performance improvements.

ACTIVITY 7: PC memory systems

Key Skills: C3.1a, C3.2, IT3.1, IT3.2

Next to the processor the single most important part of any computer is its memory, used for data and program storage. In a PC there are two main classes of memory: volatile (loses data when you switch the power off) but fast, and non-volatile (usually magnetic or optical disk) and relatively slow. PC specifications usually refer to the 'RAM' and by this they mean the volatile Main Store from which the machine code program instructions are fetched and executed having been loaded there from the Backing Store or hard disk drive.

RAM (Random Access Memory) is nowadays always of semiconductor technology and exists in various forms. Backing Store still uses mechanical moving disks with precision manufacturing techniques yielding larger and larger capacity drives.

Tasks

1. Conduct research into the various memory requirements of a modern desktop microcomputer. You will find that various types of semiconductor memory (RAM) are used on a motherboard, each with specific characteristics in terms of speed and capacity. How is the speed of memory defined? Find out as much as you can about the devices used in the machine you have just dismantled.
2. Study the basic principles of magnetic data storage (floppy and hard disks). Identify the characteristics of both RAM memory and magnetic storage media that make them suitable for their respective roles of Main Store and Backing Store in a computer.
3. Study the basic principles of optical storage (CD and DVD drives). How do they compare to magnetic media for storage and speed? Could they be used instead of a magnetic hard disk drive?
4. Find out what 'Virtual Memory' is, and why it is used in a PC.

ACTIVITY 8: PC internal bus systems

Key Skills: C3.1a, C3.2, C3.3, IT3.1, IT3.2

While dismantling their PC the students should have noticed that many of the devices on the motherboard are connected together by many parallel printed circuit tracks. They will also have removed many ribbon cables linking disk drives to the motherboard. These are all examples of busses: communication highways along which digital data flows in the form of electrical pulses. From Activity 3 they will understand the purpose of basic address and data busses. Indeed, many of the PCB tracks are just such busses, but there are other types designed for interfacing disk drives and 'expansion' cards. These have names like IDE and ISA and conform to a tight specification so that parts from many different manufacturers can be physically connected to any PC motherboard and (usually) work.

Tasks

1. While dismantling your PC, you will have disconnected a number of 'ribbon' cables from multi-pin 'headers' on the motherboard, and perhaps removed expansion boards from the edge-connector sockets along one side. These headers and sockets are the connections for different sorts of bus linking peripheral devices to the processor system. These busses conform to industry standards and have names. Identify the standard busses used on your PC.
2. Conduct some research into microcomputer bus standards. Produce a table of all that you can find with columns for comparative features.
3. The motherboard has a bus system of its own – linking the RAM and other chips to the microprocessor via copper tracks instead of wires. This includes the address and data busses you came across in Activity 3. This too has certain characteristics given in the motherboard specification. What are these characteristic parameters and what effect do they have on overall system performance?

ACTIVITY 9: PC performance measurement

Key Skills: C3.1a, C3.2, IT3.1, WO3.1, WO3.2

The issue of measuring the relative performance of microcomputers is covered by this activity. There are many 'benchmarking' programs downloadable from the Internet designed to test all parts of a computer system. Early benchmarks gave only a measure of number-crunching power in Whetstones (Floating-Point arithmetic) and Dhrystones (Integer arithmetic). This was fine for early designs where the microprocessor handled all the display graphics and data transfers between disk and memory. These sort of tasks are now handled by specialist chips so benchmark tests are now written to test video and disk performance separately. Students should investigate the concept of benchmarking and run some tests themselves.

Tasks

1. Investigate methods of assessing how 'fast' a particular PC is relative to others. Establish performance criteria and search for programs (mostly free) on the Internet which will enable you to obtain performance values.
2. Conduct comparative tests on as many different PCs as you can. Re-assemble the PC you have dismantled and run the test software on that. Compare with other groups' machines.
3. Establish why some machines perform better than others. Some of the benchmarking programs available have diagnostic capabilities to help you. See if you can make changes to your now re-assembled test PC and improve its performance in one or more areas such as processing speed, video display

speed and data retrieval time from hard disk. Obtain permission from your tutor before trying any 'over-clocking' techniques, as permanent damage can result.

ACTIVITY 10: Operating Systems

Key Skills: C3.1a, C3.2, IT3.1

On early computers, the human operator had total charge of the machine and one application program was run at a time using all the available resources. Single user, no multitasking. The concept of an Operating System appeared as soon as memory technology had improved to the point where there was sufficient capacity to hold the OS software and an application program at the same time. The early OS was a 'scheduler' that automatically loaded an application from backing store, allowed it to run with output results returned to the backing store or sent to a printer, and then replaced it with the next program. This was fine for one-off number crunching jobs but no good if you wanted programs to run simultaneously. The later OS could 'time-slice', assigning a length of processor time to a task before switching to another. To the user, it looks as if more than one program is running at the same time. This is multitasking, and it forms the basis of all modern operating systems.

Tasks

1. Investigate the background history of the modern computer Operating System. Establish the purpose of a basic OS and why it is so important to have one. Is it possible to run an OS on your simple microprocessor development system used in an earlier activity? If not, why not?
2. Think about the OS you are currently running on a PC at the moment. Start one or more applications programs, for example a word processor and a spreadsheet program. Make a list of the computer functions that you think are being performed by the OS and another list of those belonging to the application programs. Discuss your ideas with the rest of the class.

ACTIVITY 11: Operating Systems comparison

Key Skills: C3.1a, C3.2, C3.3, IT3.1, WO3.1, WO3.2

By now the students should have a good understanding of the reasons for having an operating system on a computer. They should now be given the opportunity to examine in detail two modern examples and see how they compare in performance, cost, ease of use and configurable features. One should be from the Microsoft Windows series (95, 98, Me, 2000) and the other a version of Linux. MS DOS should not be used as this is considered by most practitioners to be obsolete now. Windows 3.x should also be considered obsolete as it is a '16-bit' system as opposed to the 32-bit types from Windows 95 onwards.

Tasks

1. Carry out a comparative evaluation of two modern PC Operating Systems: a version of Windows and a version of Linux. You should have access to machines running freshly installed copies of these two. They might even be on the same machine as it is possible to arrange for a PC to 'boot-up' from a choice of OS on the hard disk. Your comparison should be based on literature research and from using the actual software. Produce a report summarising your findings under the following headings: Disk space/RAM space required, ability to run the applications programs you need, useful features and utilities, speed of loading applications, reliability, ease of use and cost. Assuming you are working in groups of two, each should work on one OS and then swap over.
2. Investigate other types of PC operating system. Try and find out why Windows is very much an 'Industry Standard'.

ACTIVITY 12: Operating System installation

Key Skills: C3.1a, C3.2, WO3.1, WO3.2

The installation of OS software is still a long and sometimes frustrating process in spite of the attempts by manufacturers to simplify the process with 'Wizards' and the like. Students should experience this process at first hand by carrying out a full OS installation, preferably of both Windows and Linux. They will need a machine with a blank hard disk each time.

Tasks

1. You will perform a complete installation of Operating System software on a PC. Before you do this, spend some time gathering together all the information and resources you will need. Items like manuals are obvious, but what about blank floppy disks for preparing emergency boot/repair facilities in case of later hard disk failure? Have you checked that the PC has sufficient disk space and is the RAM big enough? Have you enough time? – installations can take ages.
2. Perform the installation and make careful notes of every step you take.
3. Repeat this installation process with your other chosen OS. If working in groups of two, each can do one and then compare notes.

ACTIVITY 13: Configuring the Operating System

Key Skills: C3.1a, C3.2, IT3.1, WO3.1, WO3.2

Basic installation is only part of the job: the subsequent configuration and installation of software drivers for all the hardware peripherals can take hours. Provide the

students with lists of 'user' requirements; different ones for each group. Make these requirements realistic, and include things like disabled access.

Tasks

1. Configure the OS to suit the supplied 'User' requirements. Depending on which version you have, you will find a very large number of things you can 'customise'.
2. Now compare notes with your partner on how the configuration task went.

ACTIVITY 14: Inside the Operating System

Key Skills: C3.1a, C3.2, IT3.1, WO3.1, WO3.2

Operating Systems are now very large and complex programs and it is very difficult to understand all the details of their internal operation. Good students should be persuaded to research these inner workings, perhaps grasping the fundamental differences between Windows and Linux which have led to the wide variation in reliability. Other internal aspects such as the BIOS and peripheral device drivers should be considered by all.

Tasks

1. Investigate the Basic Input/Output System (BIOS) of a PC. What is it? Where is it located? It has its own set of configurable parameters. What are these and which ones might a user want to change and how?
2. Investigate how the OS arranges program and data files on the hard disk. Files are not stored as complete units on the disk: they are split up into small blocks and spread around seemingly at random. When a complete program needs to be loaded into RAM, how does the OS know where to find all the scattered pieces? Why does this scattering process happen in the first place, when one of the Systems 'Tools' is a 'Defragmenter' designed to speed up file loading?
3. Install software drivers for devices such as the printer. Sometimes these are supplied on the OS installation disk, but if not, how can you get hold of them? Does the OS automatically detect the presence of peripheral devices?

ACTIVITY 15: Standard Ways Of Working

Key Skills: C3.1a, C3.2, C3.3, IT3.1, IT3.2

This is a kind of distributed activity, performed by each individual student alongside and part of other work. Without these basics, the student will probably end up losing their precious work at some stage.

Tasks

1. Learn how to save and maintain computer files in appropriate directories. Make sure that data filenames reflect the contents clearly, ideally containing version numbers. With software such as Microsoft *Word* and *PowerPoint*, fill in the Properties box for each data file you create. If Tool Tips are enabled (Windows option) then all a file's properties will be displayed when the cursor rests on the filename entry in Windows Explorer. This is a small detail, but can save a lot of time when hunting for a particular file.
2. Maintain back-up copies of data files on floppy disks (or ZIP disks if available).
3. Remember to keep a log of all apparent ICT faults, software glitches or system crashes. A network manager can use this information to establish fault patterns and stop further problems.

SECTION 5 ADDITIONAL RESOURCES

Textbooks

Microprocessor Systems
W.Bolton
Longman
ISBN 058241881X

Linux: The Complete Reference
R.Petersen
Osborne McGraw-Hill
ISBN 0072129409

Setting Up and Troubleshooting Windows PCs
M.Hordeski
Butterworth-Heinemann
ISBN 0750697725

Handbook of Microcontrollers
M.Predko
McGraw-Hill
ISBN 0079137164

BTEC Nationals in Computing
G.Knott, N.Waites
Brancepath
ISBN 0953884813

Microprocessor development software and hardware

Microprocessor and microcomputer interactive courses on CD-ROM:
Computer Science & Mathematics Principles Vsn.7 eptsoft ltd
Electronics & Computer Principles Vsn.7 eptsoft ltd

PIC microcontroller simulator and tutorial with development hardware:
PICtutor on CD-ROM and hardware Wimborne publishing

PIC & 8051 microcontroller simulator and design tools:
Proteus VSM Labcenter Electronics

Internet Web Sites

The electronics site at <http://www.epanorama.net/pc/> is an index to a very large array of technical information about all aspects of PC hardware.

Another useful PC hardware links site is at: <http://www.hardwarehell.com>.

Essential data on the Intel range of microprocessors can be found at:
<http://www.intel.com>

Essential data on the AMD range of microprocessors can be found at:
<http://www.amd.com>

Data on Windows® OS can be found at: <http://www.microsoft.com>