Unit 25: Maintaining Computer Systems

Unit code: J/601/7329

QCF Level 3: BTEC National

Credit value: 10

Guided learning hours: 60

Aim and purpose

The aim of this unit is to ensure learners understand the organisational issues related to computer systems maintenance. Learners will develop the skills and knowledge required to plan and undertake routine maintenance activities and monitor and improve systems performance.

Unit introduction

Rapid changes in information technology and its importance in running a successful business have led to a high demand for skilled practitioners who can maintain computer systems of different size and complexity. In larger organisations this may be the role of an IT services department but in smaller and medium-sized enterprises (SMEs) this role may be carried out by an employee within a wider set of responsibilities.

Learners will discover that the most important area of computer systems maintenance is the creation and regular use of scheduled activities (this is often called 'housekeeping'). Housekeeping lists how often a range of maintenance activities occurs. These activities may vary from simple cleaning to more difficult and important procedures such as making back ups of important data files.

In a computer system it should be possible to monitor the work rate and efficiency of any given hardware device. This information should then be used to decide whether a full upgrade or a minor change to system settings is needed. This is important because the user's ability to process, arrange and manage complex data is often limited by the performance of both the system's hardware and software.

Periodic hardware upgrades can usually be predicted as they often reflect the changing needs and scale of a business. In comparison, the upgrading of software is an ongoing process using code fixes or 'patches' to reduce errors and address new hardware issues. However, computer systems maintenance often rewards the careful and cautious approach. It has been found that some fixes will also break other parts of a working system accidentally. It is for this reason that learners must be able to make sound judgements based on the benefits and drawbacks of any planned changes before any action is actually taken.

Learning outcomes

On completion of this unit a learner should:

1 Understand the organisational issues related to computer system maintenance

2 Know how to plan computer system maintenance

3 Be able to perform routine housekeeping on computer systems

4 Be able to monitor and improve systems performance.

Unit content

1 Understand the organisational issues related to computer system maintenance

Issues: organisational policy and procedures eg procurement, sustainability and environmental issues, reporting, documentation and problem escalation procedures, employee and employer responsibilities; legislation eg health and safety, portable appliance testing

Health and safety: minimising risk to users and equipment eg electrocution, fire, electrostatic discharge (ESD), ergonomic factors

Precautions: safety equipment eg ESD wrist-strap, ESD mat, fires and fire fighting equipment and training, first-aid training

2 Know how to plan computer system maintenance

Planning techniques: types of planning documents eg route maps, upgrade paths, schedules, Gantt charts; operational planning; precautions

Operational planning: scope of maintenance; frequency eg routine, non-routine; problems that may occur if maintenance is not performed; other eg use of maintenance specialists

3 Be able to perform routine housekeeping on computer systems

Routine housekeeping: managing file systems; cleaning and ventilation; maintaining systems

Managing file systems: organisation and naming of files; back-up procedures eg online, offline; back-up media; automatic scheduling and deletion of unwanted data; archiving; defragmentation; deleting temporary files

Cleaning and ventilation: hardware eg keyboard, mouse, display screen equipment (DSE), ventilation grills; cleaning methods; materials and tools

Maintaining systems: replacing consumables eg printer paper, ink or toner cartridges; replacing damaged components; approved disposal methods

4 Be able to monitor and improve systems performance

Monitoring: diagnostic tools and utilities; server management eg Simple Network Management Protocol (SNMP); remote administration

Improving system performance: techniques eg Basic Input/Output System (BIOS) settings, firmware updates ('flashing'), operating systems (OS) settings, memory management, disk optimisation, anti-virus, anti-spyware, hardware and software upgrades

Upgrading: hardware eg processor, memory, video card, motherboard; software eg installing patches, installation and un-installation procedures, system rollback; drawbacks and benefits; documentation and review; testing functionality; anti-virus scans, firewall configuration, access control, configurating security policies, managing security patches and updates

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P1 explain the issues organisations must consider when planning computer systems maintenance	**M1** explain the need for policies and procedures to control the maintenance of computer systems	
P2 assess the health and safety risks facing the practitioner when maintaining computer systems [EP1]		
P3 describe a planning technique that can be used to schedule maintenance activities		
P4 perform routine housekeeping on a computer system [SM3]		**D1** evaluate improvements to computer systems achieved through routine housekeeping procedures [IE4]
P5 use monitoring tools to assess system performance	**M2** recommend suitable hardware and software upgrades [EP3]	
P6 improve a system by upgrading hardware and software.	**M3** test functionality of an upgraded system. [IE4]	**D2** evaluate performance changes to computer systems after hardware and software upgrades. [IE4]

PLTS: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills applicable in the pass criteria. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

This unit is designed to introduce learners to the role and responsibilities of an IT practitioner focusing on the field of computer systems maintenance. The content should be adjustable to relate to either a large organisational view of systems maintenance or the smaller scale as of that for an SME or for a range of individual customers.

The learning outcomes are in chronological order and should cover theory and practice from initial planning through to carrying out physical maintenance and conducting reviews.

Initially, learners should be made aware of the need to plan maintenance procedures, whether these are to reflect the routine tasks (for example regular back-up procedures) or those, which are non-routine (for example unexpected hardware failure or incompatibilities). It is suggested that learners become familiar with both operational and strategic planning and the difference between the two. Use of a formal planning document template is suggested although, where possible, learners should be shown a variety of different formats before a model is selected for practical use.

For many learners this unit will be their first opportunity to work routinely with sensitive hardware components and it is important that they are aware of health and safety guidelines when working with potentially hazardous equipment. Learners should be aware of relevant legislation and procedural safeguards to ensure they are respectful of the IT equipment and familiar with the use of available safety equipment.

Although centres will need to deliver some health and safety content before any practical activity takes place, it is recommended that much of the learning takes place naturally whilst learners are engaged in the activity. For example, before any practical tasks learners could be required to identify and record potential health and safety risks and precautions and get this 'signed off' prior to starting a task.

Housekeeping procedures are introduced in learning outcome 3. These are best delivered as a series of practical activities and can generally be performed on generic PC workstations. Back-up procedures may be a little more difficult to demonstrate or perform on a locked-down network environment so it may be advisable to create a smaller cluster of insecure PC workstations on which to perform such tasks or use a virtualisation environment.

Monitoring and upgrading of system hardware and software might also be difficult on a locked-down network workstation. Alternative resources are suggested and early discussions with IT functions in the centre are recommended. The worldwide web is a particularly useful source for upgrade information, support forums, mailing lists, patches, price lists, independent reviews, and formal specification sheets. Systems such as Virtual Box, QEMU and VM Ware all offer realistic alternatives.

Opportunities may exist for learners to visit external technical support departments. Work placements would also be a valuable tool for learners to see some of the more theoretical concepts put into practical effect. With limited hardware resources, a number of different practical activities could be provided with associated task and recording sheets, and learners could cycle through the activities individually or in small groups, possibly with some extra facilitation, if required.

Visits from or to companies would add significant value, particularly if the visits focused on providing insights and knowledge of operational issues such as procurement, disposal, environmental issues and planning. Shadowing IT technicians within the centre would also be of value if practicable.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
Introduction to the unit
Organisational issues: • whole-class exercise – tutor presentation on planning computer system maintenance • whole-class exercise – tutor presentation on organisational policy and procedures • group exercise – discussion of tutor-provided examples of policies and procedures, why are they needed? • whole-class exercise – tutor presentation on health and safety, risks and precautions associated with maintaining computer systems • individual exercise – directed research into safety equipment and tools • individual exercise – directed research into current legislation • a mixture of directed learning, learner exercises, case studies and detailed investigation.
Planning maintenance: • whole-class exercise – tutor presentation on planning techniques, followed by individual exercise based on tutor-set examples • a mixture of directed learning, practical exploration of safety tools and equipment, learner exercises, case studies and research.
Assignment 1 – 'Trouble-free Systems Please'
Routine housekeeping of computer systems: • whole-class exercise – tutor presentation on managing file systems, followed by practical exercise • whole-class exercise – tutor presentation on cleaning and ventilation, followed by practical exercise • whole-class exercise – tutor presentation on maintaining systems, followed by practical exercise • a mixture of directed learning and practical exercises. Access to practical resources and suitable technology, or use of simulators or multimedia tools to gain experience before handling 'live resources'.
Assignment 2 – Maintaining the System
Monitor systems: • whole-class exercise – tutor presentation on monitoring tools and their suitability, followed by practical exercise • whole-class exercise – tutor presentation on methods of improving system performance, followed by practical exercise • whole-class exercise – tutor presentation on upgrading (hardware, software, testing, evaluating), followed by practical exercise • a mixture of directed learning and practical exercises. Access to practical resources and suitable technology, or use of simulators or multimedia tools to gain experience before handling 'live resources'.

Topic and suggested assignments/activities and/assessment
Assignment 3 – Upgrading the System

Assessment

It is suggested that this unit is assessed using the three assignments summarised in the *Programme of suggested assignments* table.

Suggested Assignment 1 – Trouble-free Systems Please

A suggested scenario is that learners have been asked to help a new business sort out the procedures and policies it needs to maintain its new computer system. This is a suggestion only and tutors may have ideas that are more relevant to their own particular learners.

For P1, learners should explain the issues to be considered when planning computer systems maintenance. The unit content indicates the expected coverage, which is linked to P2.

P2 requires learners to assess health and safety risks to user and practitioner whilst working with computer systems. Learners do not need to learn legislation by rote and the simple duplication of legislation is not acceptable for this criterion. Learners could be asked to explain potential risks and precautions for the real activities undertaken for P4 and P5, searching through available regulations as needed. (Note that similar activities on case study material could be used for formative assessment.)

For P3, learners must describe a planning technique that can be used for scheduling maintenance activities. This should be backed up with examples. Ideally they will be able to describe a technique they have used and provide examples demonstrating its use. This could be evidenced through a presentation addressed to the business managers. Extending this work for M1, learners must explain the need for policies and procedures to control maintenance activities. The emphasis here is on why they are needed, not a simple list of what they may be. Examples of failures in systems caused by lack of policies and procedures could support the explanation. Again, this could be evidenced using a presentation with back-up notes.

Suggested Assignment 2 – Maintaining the System

Using the same organisation scenario, learners could now act as IT technicians for the business.

For P4, performing routine maintenance, learners could provide a log with witness statements or observational records of actual housekeeping undertaken. Ideally, the evidence should be naturally occurring and collected over time, but this may not be feasible and 'set piece' workshop practicals may be necessary. A housekeeping activity from each category should be undertaken, ie managing files, cleaning, and maintaining systems.

D1 requires learners to evaluate improvements achieved through routine housekeeping. This is likely to be a theoretical evaluation and learners should be able to identify the routine procedures and the improvements they will achieve, considering whether these improvements are significant and what might happen if the routine procedures were not undertaken.

Suggested Assignment 3 – Upgrading the System

Continuing as IT technicians ...

For P5, learners need the opportunity to use monitoring tools to assess system performance. A witness statement plus records from the activities undertaken will provide evidence.

M2 requires learners to recommend possible upgrades. This could be based on the work they did for P5 and before they start P6 if this is feasible. The recommendations should link to the drawbacks and advantages, however it may be necessary for learners to state assumptions made to make this as realistic as possible.

For P6, upgrading hardware and software, observational records or witness statements would be most appropriate; however, a video record of the completion of a task supported by an observation record or a recorded discussion could also provide very natural and effective evidence.

For M3, learners will test the functionality of the upgrades they have carried out for P6. Test plans and records will provide evidence.

Finally, for D2, learners must evaluate performance changes following upgrades. This should a follow on from their upgrades and consider both advantages and potential disadvantages along with ideas for further improvements.

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Pearson assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1–P3, M1	'Trouble-free Systems Please'	A new business requires information on developing policies and procedures for maintenance of its computer systems, including how best to plan and what the health and safety risks are.	Presentation Leaflet/report
P4, D1	Maintaining the System	The new business has employed you as an IT technician to manage and evaluate the new maintenance procedures.	Witness statements Observation records Activity log Report
P5, P6, M2, M3, D2	Upgrading the System	After using monitoring tools to assess the system's performance, you will recommend, implement, test and evaluate hardware and software upgrades.	Witness statements Observation records Activity log Testing records Report/presentation

Links to other BTEC units

This unit forms part of the BTEC in IT sector suite. This unit has particular links with the following unit titles in the IT suite:

Level 1	Level 2	Level 3
		Unit 12: IT Technical Support
		Unit 13: IT Systems Troubleshooting and Repair

Essential resources

Learners will need access to practical resources and suitable technology. They can also use simulators or multimedia tools to gain prior experience before handling live resources.

Employer engagement and vocational contexts

Using a local computer retailer and the centre's IT supplier as well as support from the in-centre IT support and practical, vocational job-related tasks will provide a vocational context.

Delivery of personal, learning and thinking skills

The table below identifies the opportunities for personal, learning and thinking skills (PLTS) that have been included within the pass assessment criteria of this unit.

Skill	When learners are ...
Independent enquirers	analysing and evaluating the functionality of an upgraded system, judging its relevance and value
Self-managers	organising time and resources, prioritising actions for routine housekeeping on a computer system
Effective participators	discussing issues of concern regarding health and safety risks facing the user and practitioner when working with computer systems.

Although PLTS are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Independent enquirers	analysing and evaluating improvements to computer systems achieved by routine housekeeping procedures, judging their relevance and value analysing and evaluating information performance changes to computer systems after hardware and software upgrades, judging their relevance and value
Effective participators	proposing practical hardware and software upgrades, breaking their installation down into manageable steps.

Functional Skills – Level 2

Skill	When learners are …
ICT – Using ICT	
Plan solutions to complex tasks by analysing the necessary stages	performing routine maintenance on a computer system
Select, interact with and use ICT systems safely and securely for a complex task in non-routine and unfamiliar contexts	using monitoring tools to assess system performance.