

Cambridge **TECHNICALS LEVEL 3**

IT

Unit 4

Computer networks

H/507/5003

Guided learning hours: 60

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LEVEL 3

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Essential resources required for this unit: Learners should have access to a private network that they will be able to work on without restrictions. They must be able to modify the infrastructure, install, update and remove software and configure the components. The composition of the network, as well as available resources and tools, should be sufficient to ensure that learners are able to achieve the highest grades for this unit.

This unit is internally assessed and externally moderated by OCR.

UNIT AIM

Computer networks form a key part of the information economy. They are the foundation of the World Wide Web on which eBay, Amazon, Facebook and a multitude of other companies depend for their success. The demand for networking capability is enormous and increasing daily. The business world demands network administrators, engineers and technicians who can set up, manage and maintain its networks.

The emphasis of this unit is to give you the practical ability to plan, implement and maintain computer networks. The approach adopted by this unit is 'bottom up' where you begin with a solid set of components, cables and connectors of a network and then progressively build a networking capability. The range of protocols has been deliberately limited to those which are used in the vast majority of computer networks, TCP/IP and Ethernet.

The teaching content is designed to support networking qualifications for certifications such as Microsoft, Cisco and CompTIA Network+.

This unit is mandatory in the IT Infrastructure Technician specialist pathway in the Level 3 Diploma suite of qualifications due to its relevance in an IT technical environment. The unit supports the development of skills, knowledge and understanding relevant to a technical support or network technician job role.

TEACHING CONTENT

The teaching content in every unit states what has to be taught to ensure that learners are able to access the highest grades.

Anything which follows an i.e. details what must be taught as part of that area of content. Anything which follows an e.g. is illustrative, it should be noted that where e.g. is used, learners must know and be able to apply relevant examples in their work, although these do not need to be the same ones specified in the unit content.

For internally assessed units you need to ensure that any assignments you create, or any modifications you make to an assignment, do not expect the learner to do more than they have been taught, but must enable them to access the full range of grades as described in the grading criteria.

| Learning outcomes | Teaching content |
|---------------------------------------|--|
| The Learner will: | Learners must be taught: |
| 1. Understand the concept of networks | 1.1 Network interfaces 1.2 Network types, i.e.: <ul style="list-style-type: none"> • local area network (LAN) • wireless local area network (WLAN) • wide area network (WAN) 1.3 Network components, i.e.: <ul style="list-style-type: none"> • servers • workstations • other hosts (e.g. printer, scanner) • wireless access point • hubs • routers 1.4 Network topologies (layout) (e.g. bus, wireless, segments, backbones) 1.5 Network protocols, i.e.: <ul style="list-style-type: none"> • Ethernet • IP • TCP • UDP • FTP • SMTP 1.6 Networking models, i.e.: <ul style="list-style-type: none"> • OSI 7 layer model • TCP/IP model 1.7 IP versions (e.g. IPv4, IPv6) |

| Learning outcomes | Teaching content |
|---|---|
| The Learner will: | Learners must be taught: |
| | <p>1.8 Network addressing, i.e.:</p> <ul style="list-style-type: none"> • MAC Addressing • APIPA • Class addressing • Classless addressing • Private addressing • Loopback addressing • TCP ports • Default gateway <p>1.9 Network data units, i.e.:</p> <ul style="list-style-type: none"> • Ethernet frames • IP packets • TCP packets <p>1.10 Network security, i.e.:</p> <ul style="list-style-type: none"> • threats (e.g. hacking, virus, spyware, theft) • security systems (e.g. firewall, routers, WEP) • risk assessment <p>1.11 Network virtualisation, i.e.:</p> <ul style="list-style-type: none"> • concept overview • use for system testing • examples e.g. VMware, VirtualBox |
| <p>2. Be able to plan computer networks to meet client requirements</p> | <p>2.1 Network configuration, i.e.:</p> <ul style="list-style-type: none"> • network components (e.g. servers, workstations, routers) • network operating systems (e.g. Windows, Linux) <p>2.2 Network services, i.e.:</p> <ul style="list-style-type: none"> • DHCP • routing • internet connection sharing • Wi-Fi access • other services (e.g. printing, email, web, DNS) <p>2.3 IP configuration, i.e.:</p> <ul style="list-style-type: none"> • manual • automatic • routing • masking <p>2.4 Testing tools, i.e.:</p> <ul style="list-style-type: none"> • ping • ipconfig • pathping • tracert • route |

| Learning outcomes | Teaching content |
|---|---|
| The Learner will: | Learners must be taught: |
| | <p>2.5 Network specification, i.e.:</p> <ul style="list-style-type: none"> • stakeholder requirements i.e.: client, network user • applications • services • constraints (e.g. cost, environment, time) • security <ul style="list-style-type: none"> ○ risk assessment ○ Wi-Fi security ○ network security (e.g. firewall, MAC filtering) • purpose (e.g. file sharing, internet access, network printing) <p>2.6 Network plan, i.e.:</p> <ul style="list-style-type: none"> • user requirements • components (e.g. servers, workstations, routers) • services (e.g. DHCP, printing, email) • software (e.g. operating system, firewall) • configuration requirements • security plan • test plans: <ul style="list-style-type: none"> ○ configuration test plan ○ user acceptance testing plan: <ul style="list-style-type: none"> ▪ purpose ▪ plan a test ▪ design a test ▪ execute a test ▪ defect log ▪ plan update |
| <p>3. Be able to present network solutions to clients</p> | <p>3.1 Solution proposal, i.e.:</p> <ul style="list-style-type: none"> • client requirements • physical design <ul style="list-style-type: none"> ○ devices and technologies • logical design: <ul style="list-style-type: none"> ○ topology ○ protocols ○ addressing (e.g. public, private) ○ security ○ configuration • network design test plan • network map (e.g. servers, workstations, routers) • installation schedule • component configurations • configuration test plan • user acceptance test plan <p>3.2 Performance benchmarking tools (e.g. LANBench, NetIO-GUI, NetStress)</p> |

| Learning outcomes | Teaching content |
|---|---|
| The Learner will: | Learners must be taught: |
| 4. Be able to plan maintenance activities for computer networks | <p>4.1 Maintenance plan (e.g. network map, procedures, policies, security permissions)</p> <p>4.2 Maintenance issues, i.e.:</p> <ul style="list-style-type: none"> • virus: <ul style="list-style-type: none"> ○ sources (e.g. email, hacking, software install) ○ treatment (e.g. virus protection, firewall, security update) • hardware: <ul style="list-style-type: none"> ○ faulty hardware ○ adding new hardware (e.g. workstation) ○ replacing hardware (e.g. network server, switch) • software: <ul style="list-style-type: none"> ○ update software ○ add software • slow speed • security: <ul style="list-style-type: none"> ○ security update ○ security breach ○ security settings (e.g. router, firewall) <p>4.3 Troubleshooting, i.e.:</p> <ul style="list-style-type: none"> • diagnostic tools: <ul style="list-style-type: none"> ○ hardware (e.g. cable tester, protocol analyser) ○ software (e.g. event logs, microsoft message analyzer) ○ ip utilities (e.g. ping, ipconfig, tracert, loopback) • diagnose the problem (e.g. gather symptoms) <ul style="list-style-type: none"> ○ hardware (e.g. slow, intermittent) ○ software (e.g. unexpected quit, load fail) ○ data transmission (e.g. congestion, fail connection) • determine cause • document the process <p>4.4 Disaster recovery (e.g. backup, restore)</p> <p>4.5 Software/hardware updates, i.e.:</p> <ul style="list-style-type: none"> • security updates • performance updates • risks (e.g. application failure) • minimise downtime • configuration changes <p>4.6 Performance management (benchmarking), i.e.:</p> <ul style="list-style-type: none"> • establish a baseline • performance measurements (e.g. response time, workload) |

GRADING CRITERIA

| LO | Pass | Merit | Distinction |
|--|--|---|---|
| | The assessment criteria are the Pass requirements for this unit. | To achieve a Merit the evidence must show that, in addition to the pass criteria, the candidate is able to: | To achieve a Distinction the evidence must show that, in addition to the pass and merit criteria, the candidate is able to: |
| 1. Understand the concept of networks | P1: Explain how network addressing is used | M1: Compare and contrast the OSI and TCP/IP networking models | D1: Discuss the role of TCP/IP in networks |
| | P2*: Explain security considerations for computer networks <i>(*Synoptic assessment from Unit 1 Fundamentals of IT, Unit 2 Global information and Unit 3 Cyber security)</i> | | |
| 2. Be able to plan computer networks to meet client requirements | P3: Create a network specification to meet an identified client requirement | M2: Justify security measures for inclusion in an identified network solution | |
| | P4: Produce planning documentation for the implementation of an identified network solution | | |
| 3. Be able to present network solutions to clients | P5: Communicate the network solution to the identified client | M3: Recommend performance tools to benchmark network solution | |
| 4. Be able to plan maintenance activities for computer networks | P6: Create a maintenance plan for the network solution | | D2: Evaluate the selection of maintenance activities for the network solution |

SYNOPTIC ASSESSMENT

When learners are taking an assessment task, or series of tasks, for this unit they will have opportunities to draw on relevant, appropriate knowledge, understanding and skills that they will have developed through other units. We've identified those opportunities in the grading criteria (shown with an asterisk). Learners should be encouraged to consider for themselves which skills/knowledge/understanding are most relevant to apply where we have placed an asterisk.

ASSESSMENT GUIDANCE

LO1 Understand the concept of networks

P1: Learners are required to explain the network addressing and how it is used. The explanations must include how the IP address identifies a specific network, how to determine different hosts and networks that can be addressed and the function of the MAC address in transporting data between two IP hosts. The evidence could be presented as a report or a technical guide and include examples of network types.

M1: Learners are required to compare and contrast the OSI and TCP/IP networking models. The comparisons must include the purpose as well as the similarities and differences between the two models. The comparison should identify each of the listed network protocols with each model and explain the role each protocol plays. The evidence could be in the form a technical guide or detailed report.

D1: Learners are required to discuss the role of TCP/IP in networks for different topologies as listed in the teaching content. Learners should discuss how TCP/IP routes data between the listed network components and across different types of network. The discussions will also include the purpose of TCP ports and the use of subnet masking. They should also consider the role played by virtual networks when working with TCP/IP. The evidence could be in the form of a report or a technical guide supported by illustrated examples showing connectivity.

P2: Learners are required to explain security mechanisms in computer networks. They must explain different threats to the security of a network and then explain security systems that can be used to minimise the threat. A risk assessment could be included in a report and the solution presented as a technical guide.

LO2 Be able to plan computer networks to meet client requirements

P3: Learners are required to create a network specification to meet an identified client's requirement. They should be given a detailed scenario set of requirements that gives them the opportunity to use different components and topologies. Learners will use the scenario to create a network specification. The specification may have to be modified iteratively until it meets the client's requirements. The evidence could be in the form of a report that will indicate client agreement.

M2: Learners are required to justify security measures for inclusion in an identified network solution. This criterion extends the specification of P3. They will carry out a security risk assessment for the given scenario. The evidence could be a clearly marked addendum to the network specification of P3.

P4: Learners are required to produce planning documentation for the implementation of an identified network solution. They will use the network specification to create a complete network plan. The evidence will be the planning documentation which will include any modifications required by the client.

LO3 Be able to present network solutions to clients

P5: Learners will be able to propose the computer network solution to the client. They will use the network plan to prepare a visualisation of the network. The evidence will be the network plans and visualisation and may be supported by a videoed presentation of learners presenting the solution.

M3: Learners are required to recommend performance tools to benchmark their network solution. The recommendation should give an explanation of what these tools do. The evidence could be in the form of a report or a technical guide.

LO4 Be able to plan maintenance activities for computer networks

P6: Learners are required to create a maintenance plan for an identified computer solution. The maintenance plan should relate to the proposed solution from P5. The evidence will be the actual maintenance plan, which should consider issues as listed in the teaching content.

D2: Learners are required to evaluate the selection of maintenance activities identified for the chosen computer solution in P6. They should review the maintenance plan created in P6 and evaluate how the activities will support the ongoing functionality of the network.

Some providers for the industry qualifications offer quizzes, tests and assessments. Reference to these websites may support knowledge and learning.

www.comptia.org

www.cisco.com/UK

<https://www.microsoft.com/learning/en-gb/default.aspx>

Feedback to learners: you can discuss work-in-progress towards summative assessment with learners to make sure it's being done in a planned and timely manner. It also provides an opportunity for you to check the authenticity of the work. You must intervene if you feel there's a health and safety risk.

Learners should use their own words when producing evidence of their knowledge and understanding. When learners use their own words it reduces the possibility of learners' work being identified as plagiarised. If a learner does use someone else's words and ideas in their work, they must acknowledge it, and this is done through referencing. Just quoting and referencing someone else's work will not show that the learner knows or understands it. It has to be clear in the work how the learner is using the material they have referenced **to inform their** thoughts, ideas or conclusions.

For more information about internal assessment, including feedback, authentication and plagiarism, see the centre handbook. Information about how to reference is in the OCR *Guide to Referencing* available on our website: <http://www.ocr.org.uk/i-want-to/skills-guides/>.

EMPLOYABILITY SKILLS

| Employability skills | Learning outcome |
|----------------------|-------------------------------------|
| Communication | P1, P2, P3, P4, P5, P6, M1, M3, D1, |
| Problem solving | P3, P4, P6, M2, M3, D2 |
| Time management | P3, P4, P5, P6, M2, M3 |
| Critical thinking | D1, M2, D2 |
| Negotiation | P5, M3 |
| Decision making | P3, M2, M3, P6, D2 |

MEANINGFUL EMPLOYER INVOLVEMENT - a requirement for the Diploma (Tech Level) qualifications

The 'Diploma' qualifications have been designed to be recognised as Tech Levels in performance tables in England. It is a requirement of these qualifications for centres to secure for every learner employer involvement through delivery and/or assessment of these qualifications.

The minimum amount of employer involvement must relate to at least one or more of the elements of the mandatory units. This unit is a mandatory unit in the IT Infrastructure Technician pathway and in the Digital Technician pathway.

Eligible activities and suggestions/ideas that may help you in securing meaningful employer involvement for this unit are given in the table below.

Please refer to the *Qualification Handbook* for further information including a list of activities that are not considered to meet this requirement.

| Meaningful employer involvement | Suggestion/ideas for centres when delivering this unit |
|---|---|
| 1. Learners undertake structured work-experience or work-placements that develop skills and knowledge relevant to the qualification. | Work placements in IT departments supporting the network manager to see how some or all of the learning outcomes in this unit in a work-based context. |
| 2. Learners undertake project(s), exercises(s) and/or assessments/examination(s) set with input from industry practitioner(s). | Learners could be provided with a scenario based on an employer requirements where they are required to interview the client and develop a network solution for them. |
| 3. Learners take one or more units delivered or co-delivered by an industry practitioner(s). This could take the form of master classes or guest lectures. | A network manager could be asked to fulfil certain activities that lead to the securing of criteria e.g. how to establish client requirements for a network solution. |
| 4. Industry practitioners operating as 'expert witnesses' that contribute to the assessment of a learner's work or practice, operating within a specified assessment framework. This may be a specific project(s), exercise(s) or examination(s), or all assessments for a qualification. | This could be linked to the work-placement opportunity highlighted above. |

To find out more

ocr.org.uk/it

or call our Customer Contact Centre on **02476 851509**

Alternatively, you can email us on **vocational.qualifications@ocr.org.uk**



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