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INTRODUCTION

This is a guide for teachers so that you can see how we mark work for Cambridge Technicals.

The guide contains exemplar candidate work for this unit and covers selected learning outcomes (LOs), and grading criteria.

The accompanying commentary explains why each piece of work was awarded that grade. Additional guidance has been added to suggest improvements that could be made in order to achieve a higher grade.

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Model Assignments

Model assignments are available for the following units from the link below.

<table>
<thead>
<tr>
<th>Unit 4 Computer networks</th>
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Plagiarism

Work must be free from plagiarism. Plagiarism is the submission of someone else's work as your own and/or failure to acknowledge a source correctly. Plagiarism makes up a large percentage of cases of suspected malpractice reported to us by moderators. You must make sure you don't accept plagiarised work as evidence.

In line with the policy and procedures of JCQ on suspected malpractice, the penalties applied for plagiarism would usually result in the claim not being allowed.

Plagiarism often occurs innocently when learners don't know that they must reference or acknowledge their sources, or aren't sure how to do so. It’s important to make sure your learners understand:

- the meaning of plagiarism and what penalties may be applied
- that they can refer to research, quotations or evidence produced by somebody else but they must list and reference their sources
- quoting someone else's work, even when it's properly sourced and referenced, isn't an indication of understanding. The learner has to 'do' something with that information to show they understand. For example, if a learner has to analyse data from an experiment, quoting data doesn't show that they understand what it means. The learner has to interpret the data and, by relating it to their assignment, say what they think it means.
### Learning Outcome 1: Understand the concept of networks

**P1:** Explain how network addressing is used

**P2:** Explain security considerations for computer networks

### Learning Outcome 2: Be able to plan computer networks to meet client requirements

**P3:** Create a network specification to meet an identified client requirement

<table>
<thead>
<tr>
<th>Learning Outcome 1</th>
<th>Learning Outcome 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1:</td>
<td>P3:</td>
</tr>
</tbody>
</table>

- **Grading Criteria - The Learner can:**
  - The grading criteria are the pass requirements for this unit. In order to achieve a pass grade, all pass criteria must be achieved.

- **Grading Criteria achieved (‘’):**
  - Yes

- **Teacher comment:**
  - The student has created a network specification table. Each element of the specification has a range of requirements based on the feedback from a meeting with the client. The student has also included amendments made to the specification following a second meeting with the client and included a statement that the client has agreed the network specification.
**Learning Outcome 1: Understand the concept of networks**

**M1:** Compare and contrast the OSI and TCP/IP networking models

**Learning Outcome 2: Be able to plan computer networks to meet client requirements**

**M2:** Justify security measures for inclusion in an identified network solution

**Learning Outcome 3: Be able to present network solutions to clients**

**M3:** Recommend performance tools to benchmark network solution

---

**P4:** Produce planning documentation for the implementation of an identified network solution  

Yes  

The student has produced a report which includes the required planning documentation. Although some areas are weak all of the required elements have been considered and a range of configurations and settings have been discussed. A network plan and UAT plan have also been developed. The student has linked the network plan to the network specification.

**Learning Outcome 3: Be able to present network solutions to clients**

**P5:** Communicate the network solution to the identified client

---

<table>
<thead>
<tr>
<th>Grading Criteria - The Learner can:</th>
<th>Teacher comment</th>
<th>Page No./Evidence location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pass</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The grading criteria are the pass requirements for this unit. In order to achieve a pass grade, all pass criteria must be achieved.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Learning Outcome 4: Be able to plan maintenance activities for computer networks**

**P6:** Create a maintenance plan for the network solution

---

<table>
<thead>
<tr>
<th>Grading Criteria - The Learner can:</th>
<th>Teacher comment</th>
<th>Page No./Evidence location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Merit Criteria</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The grading criteria are the merit requirements for this unit. In order to achieve a merit grade, all merit criteria must be achieved and all pass criteria must also have been achieved.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---
### Distinction Criteria

The grading criteria are the distinction requirements for this unit. In order to achieve a distinction grade, all distinction criteria must be achieved and all merit and pass criteria must also have been achieved.

### Learning Outcome 1: Understand the concept of networks

**D1:** Discuss the role of TCP/IP in networks

### Learning Outcome 4: Be able to plan maintenance activities for computer networks

**D2:** Evaluate the selection of maintenance activities for the network solution

### OVERALL GRADE (P, M or D)

---

I confirm that:
- the candidate’s work is solely that of the candidate concerned and was conducted under the required conditions as laid down in the qualification handbook;
- internal standardisation has been carried out and that all grades have been correctly recorded and accurately transcribed to the claim being submitted to OCR.

Completed by:  
Date:

Please note: This form may be updated on an annual basis. The current version of this form will be available on the OCR website (www.ocr.org.uk).
**P3: Create a network specification to meet an identified client requirement.**

**Network specification**

A meeting was held with the business manager who is the client for this project. During the meeting a discussion took place to identify the requirements and functions of the network to be designed.

Below is the network specification created after the meeting.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Objectives</th>
</tr>
</thead>
</table>
| **Stakeholder Requirements** | • The client would like to create a network that will connect all of the staff computers and hardware together.  
• The staff will require access to the internet and access to a suitable storage method.  
• Some of the information stored is confidential and so adequate security must be in place.  
• Data stored must be secure and backed up. |
| **Purpose**                 | • The client requires a network to allow the staff to be able to share documents and be able to access documents and folders from any of the workstations in the offices.  
• The staff should have access to shared hardware (printers and scanners) to reduce hardware costs.  
• Use of a network should improve the speed that documents can be transferred and updated.  
• A central storage area will be required for the staff documents and folders reducing storage costs. |
| **Applications**            | • The staff will require access to office applications including word processing and spreadsheets.  
• The network must allow the use of email software and an intranet  
• Internet browsers will be required to access online websites and the intranet.  
• A dedicated, secure area on the network should be used for financial records and data systems.  
• Staff will require appropriate software to allow the use of video conferencing and webinars. |
## Services

- Staff should have access to printers and scanners.
- Staff will require access to external emails.
- A network administrator should be appointed to be responsible for upgrades, licenses and security.
- Appropriate and routine backup systems will be required.
- Staff will be set up with usernames and passwords (with appropriate access rights and permissions).
- Regular network usage reports should be made available for the network administrator.

## Constraints

- The client would like the network to be complete and tested within 4 weeks of the start date.
- The latest version of office software should be installed.
- The client has a budget of £5,000.

## Security

### Wi-Fi security

- WPA security protocols should be set up.
- Usernames and passwords will be required.
- Anti-phishing and anti-virus software should be installed and routinely updated.
- A computer misuse policy should be created.

### Network security

- Anti-virus software should be installed and routinely updated.
- Firewalls should be set up at each workstation including the server.
- Password protection for the network will be required.
- Network access permissions for staff will be allocated as appropriate.
- Network and usage policies should be created and maintained.
- Physical security systems should be installed.

## Modifications

Following an additional meeting with the client the below modifications were agreed:

- The software version of office applications should be no later than Office 2013.
- The budget should be increased to £9,000
- Security protocols should be increased to WPA2.
- The deadline for the completion of work should be amended to 12 weeks from the start date.
Following the meeting a final review of the requirements was completed and the network specification was agreed by the client.
P4: Produce planning documentation for the implementation of an identified network solution.

Network Plan

User requirements

- The client would like to develop a network that will connect all of the office computers and hardware together (a total of 15 workstations are required including one printer and one scanner – it is expected that staff will ‘hotdesk’).
- The staff will require access to office applications including word processing and spreadsheets (approx. 20 staff to increase to 23 over the next 3 years).
- The network should allow staff the ability to share documents and be able to access documents and folders from any of the workstations in the offices.
- The staff should have access to shared hardware (printers and scanners)
- The staff will require access to the internet and access to a suitable storage method (cloud storage preferred).
- Authorised mobile devices will be allowed access to the network using wireless connectivity. Authorisation will be granted by the network manager.
- Some of the information stored is confidential and so adequate security must be in place.
- Data stored must be secure and backed up.
- A central storage area will be required for staff documents and folders.
- The network must have an automated backup system installed.

Components

The below diagram shows the layout of the network (LAN).

<table>
<thead>
<tr>
<th>Component</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wireless Router</td>
<td>Hardware device used to connect computers together in a network and send data to the devices including mobile devices e.g. authorised tablets and pda’s.</td>
</tr>
<tr>
<td>Client</td>
<td>Are the computers or devices that receive information and data from the server.</td>
</tr>
<tr>
<td>Server</td>
<td>Is the central computer used to store programs and operating systems and controls the network</td>
</tr>
<tr>
<td>Hub</td>
<td>Is a connection point for the computers on the network but cannot transmit data.</td>
</tr>
<tr>
<td>Switch</td>
<td>Uses packet switching to send data to the correct workstation.</td>
</tr>
<tr>
<td>Gateway</td>
<td>Is used to connect the office LAN’s together and to connect the network to the internet.</td>
</tr>
<tr>
<td>Ethernet cable</td>
<td>Special cable designed to transmit digital data with minimal loss.</td>
</tr>
<tr>
<td>WAP</td>
<td>Allows the connection of the network to the internet without the need for cables</td>
</tr>
</tbody>
</table>
The workstations in each office (five workstations) will be connected using a ring topology and Ethernet cabling and each of the offices (three offices) will be connected to the network using a star topology. A wireless router will be used to allow the connection of authorised mobile devices e.g. tablets and pda’s. Authorisation will be granted by the network manager.

The components required have been labelled on the diagram.

**LAN Network Diagram**

**Services**

The network will have internet access using Wi-Fi connectivity providing a shared internet connection.

The network will be connected to a remote printer and scanner that will be accessed by all of the staff.

Outlook will be installed as the primary external email service provider for all workstations connected to the internet via a proxy server.

Usernames and passwords (including access rights and permissions will be set up by the network administrator).

File sharing will be made available and read/write access permissions will be authorised by the network administrator.

Regular network usage reports should be made available for the network Administrator.

**Software**

The network will be running a Linux operating system.

Anti-phishing and anti-virus software will be installed using Sophos 3.0.

Office 2013 and Google chrome 10 will be installed.

Each workstation will be set up with a standalone firewall and antivirus software.
Network performance monitoring software will be used by the network administrator to ensure the network remains robust during office hours.

**Configuration**

Each workstation will have the same configuration locked by the network administrator.

All network hardware devices will be connected via a host and connected using the TCP/IP network model.

IP addressing will be dynamic for ease of connection to all devices. IPV6 addresses will be assigned by the DHCP server.

Multiple IP addresses and multiple gateways will be configured on the IP/TCP settings to allow the quicker transfer of data (static IP).

The routing protocol to be used will be RIPv2 for quicker communication times.

Static IP addressing will be used which will also be used for the web server.

Domain Name Servers (DNS) will be used to locate workstations from their IP address. The DNS will be configured to allow the DHCP server to locate workstations automatically.

Ethernet will be configured to use dynamic IP addressing.

**Security plan**

1) **Risk assessment plan**
   The network administrator will perform a risk analyses of the potential threats to the network.

2) **Security controls**
   1. All of the data stored by the staff will be encrypted. This will include all external storage devices.
   2. Communication between the web server and the internet will use SSL encryption (Secure Sockets Layer) to protect the network from unauthorised access.
   3. One-time passwords will be implemented for use within the digital storage area to ensure the security of the data. The password can be used with an emailed token only ‘one time’ per session.
   4. Access Control Lists can be implemented and monitored to only allow authorised users on the list to access the network.
   5. Intrusion detection software can be installed to minimise the impact of unauthorised access and provide an immediate warning/
   6. Firewalls will be set up on each workstation and the web server.

3) **Training requirements for staff**
   1. Staff will be trained in the requirements of the Computer Misuse Act.
   2. Staff will be trained in the requirements of the Data Protection Act.
   3. Staff will be trained to recognise the symptoms of unauthorised access or virus attack.

4) **Contingency planning**
   1. Each night the data stored will be back up onto the cloud
   2. Each week all data will be backed up onto magnetic tape storage.
3. An uninterruptable power supply (UPS) will be installed to minimise the loss of data if the electricity supply is lost.

**Test plan**

**Configuration test plan**

<table>
<thead>
<tr>
<th>Test</th>
<th>Reason for test</th>
<th>Expected outcome</th>
<th>Actual outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet connection</td>
<td>Testing the configuration of the router and browser settings to ensure that connection to the internet can be made.</td>
<td>Successful connection to the internet</td>
<td></td>
</tr>
<tr>
<td>Ping test</td>
<td>Test to show that all workstations are connected to the network and have an appropriate response time.</td>
<td>All workstations are connected to the network</td>
<td></td>
</tr>
<tr>
<td>Password protection</td>
<td>All workstations to be tested to show that password protection is active.</td>
<td>Access to the workstations and networks is only successful by using the correct password.</td>
<td></td>
</tr>
<tr>
<td>File sharing</td>
<td>Using two workstations to test if files or folders can be accessed and shared over the network</td>
<td>Documents and folders can be accessed and shared.</td>
<td></td>
</tr>
<tr>
<td>Anti-virus</td>
<td>Testing the configuration of the antivirus software.</td>
<td>The antivirus software will be running and monitoring the network and will be up to date.</td>
<td></td>
</tr>
<tr>
<td>IP configuration</td>
<td>Using ipconfig the settings on each workstation will be checked to ensure that connection to the network is secure (static IP addressing is to be used).</td>
<td>IP configuration settings will match the gateway and DNS settings.</td>
<td></td>
</tr>
<tr>
<td>Data routing</td>
<td>The pathway used to transfer data packets will be timed to ensure that there is no lag or collision. The Tracert utility will be used for this procedure. Pathping will be used to verify that all data packets have been sent and received.</td>
<td>Data transfer will be successful with no errors or time delay.</td>
<td></td>
</tr>
</tbody>
</table>
User acceptance test plan (UAT)

The client will be asked to complete the below questionnaire. The tests are based on the user requirements from the specification.

<table>
<thead>
<tr>
<th>Test Details</th>
<th>Pass/Not pass</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Password protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All workstations require a secure password to access the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>network, using the wrong password prevents access to the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>network.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 File sharing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Files can be accessed and updated from all workstations.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Backup systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The client will be shown the backup system and the</td>
<td></td>
<td></td>
</tr>
<tr>
<td>configuration for the routine automated backing up of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>files and documents each day.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Access to printer and scanner from all workstations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All workstations can print documents and scan documents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>through the network using the central printer and scanner.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Access to the internet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All workstations have access to the internet using a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>secure password. Using the incorrect password will</td>
<td></td>
<td></td>
</tr>
<tr>
<td>prevent access to the internet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Office applications version</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The client will be shown the license for office</td>
<td></td>
<td></td>
</tr>
<tr>
<td>applications to confirm the version is no later than</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office 2013.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Access to cloud storage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The client will be shown the configuration settings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>used to create a cloud based back up of all data on a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>weekly basis. Back up is achieved automatically.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Wi-Fi access using portable devices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to the network can be achieved using portable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>devices using a wireless connection. The wireless</td>
<td></td>
<td></td>
</tr>
<tr>
<td>connection is password protected.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I the client have tested the network and confirm that all requirements of the specification have been included and are fully working

Signature & date

..........................................................
Commentary

LO2 P3 requires learners to create a network specification for a specific purpose.

The learner has created a table itemising each category within the specification and has identified a range of requirements within each of the categories. The purpose for the development of the network has been explained and constraints to the project clearly identified.

The learner has also included modifications to the specification based on feedback from a second meeting with the client.

LO2 P4 requires the learner to produce the planning documentation required for the implementation of a network solution.

The learner has produced a network plan which includes all of the planning elements relating to their proposed network. Within each section a range of specifications, configurations or requirements have been considered including security and testing.

Although some areas of the network plan are weak (particularly relating to configuration), and the technical depth is minimal, all of the required criteria for the successful achievement of P4 has been included.

LO2 P4 could be improved by the learner developing the depth of their technical understanding of networks and present a more detailed network plan. This can particularly be seen within the configuration section and the configuration test plan when learners have the opportunity to demonstrate their technical knowledge and understanding of network configuration and configuration testing. The learner could also have further developed this section to include the configuration of peripheral devices e.g. the printer or scanner.

Within LO2 P4 a more detailed explanation of the reasons supporting the planning decisions made relating to security would be beneficial towards the achievement of M2 when learners are asked to provide justifications for the security measures they have selected.

Unit 4 can be technically challenging and so a more practical approach to the delivery of the teaching content may be beneficial to learners. Allowing learners to practise and develop a network in the classroom environment would develop the learners practical knowledge required for the technical aspects of the unit. This would also be an opportunity for meaningful employer involvement by utilising an external expert, or the network manager, to facilitate the learning experience of developing networks. This could be recorded on the MEI document.

Learners could include a video of the meetings with the client to evidence the development or modifications of the client requirements for LO2 P3. This could also be recorded on the MEI document.
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