T Level Technical Qualification in Digital Support Services

Occupational specialism assessment (OSA)

Digital Infrastructure

Assignment 1

Mark scheme

v1.2: Specimen assessment materials
17 November 2023
603/6901/2

Internal reference: DSS-0004-02

T Level Technical Qualification in Digital Support Services
Occupational specialism assessment (OSA)

Digital Infrastructure

Mark scheme

Assignment 1

Contents

Marking guidelines

General guidelines

You must apply the following marking guidelines to all marking undertaken throughout the marking period. This is to ensure fairness to all students, who must receive the same treatment. You must mark the first student in exactly the same way as you mark the last.

- the mark scheme must be referred to throughout the marking period and applied consistently. Do not change your approach to marking once you have been standardised
- reward students positively giving credit for what they have shown, rather than what they might have omitted
- utilise the whole mark range and always award full marks when the response merits them
- be prepared to award 0 marks if the student's response has no creditworthy material
- do not credit irrelevant material that does not answer the question, no matter how impressive the response might be
- the marks awarded for each response should be clearly and legibly recorded
- if you are in any doubt about the application of the mark scheme, you must consult with your team leader or the chief examiner

Guidelines for using extended response marking grids

Extended response marking grids have been designed to award a student's response holistically for the relevant task or question and should follow a best-fit approach. The grids are broken down into levels, with each level having an associated descriptor indicating the performance at that level. You should determine the level before determining the mark.

Depending on the amount of evidence that the task produces, the grids will either be a single, holistic grid that covers the range of relevant performance outcomes (POs), and will require you to make a judgement across all the evidence, or they will consist of multiple grids, that will be targeted at specific POs, and will require you to make a judgement across all the evidence in relation to that particular grid in each case, therefore making multiple judgements for a single task to arrive at a final set of marks. Where there are multiple grids for a particular task, it is important that you consider all the evidence against each of the grids, as although the grids will focus on particular POs, awardable evidence for each grid may come from across the range of evidence the student has produced for the task.

When determining a level, you should look at the overall quality of the response and reward students positively, rather than focussing on small omissions. If the response covers aspects at different levels, you should use a best-fit approach at this stage and use the available marks within the level to credit the response appropriately.

When determining a mark, your decision should be based on the quality of the response in relation to the descriptors. Standardisation materials, marked by the chief examiner, will help you with determining a mark. You will be able to use exemplar student responses to compare to live responses, to decide if it is the same, better, or worse.

To support your judgement, the indicative content is structured in such a way that mirrors the order of the different points within the band descriptors. This will allow you to use the 2 in conjunction with each other by providing examples of the types of things to look for in the response for each descriptor. In other words, the indicative content provides you with a starting point of possible examples and the bands express the range of options available to you in terms of the quality of the response. You should apply the standards that have been set at a relevant standardisation event in a consistent manner.

You are reminded that the indicative content provided under the marking grid is there as a guide, and therefore you must credit any other suitable responses a student may produce. It is not a requirement either that students must cover all of the indicative content to be awarded full marks.

Performance outcomes

This assessment requires students to:

PO1: Apply procedures and controls to maintain the digital security of an organisation and its data

PO2: Explain, install, configure, test and manage both physical and virtual infrastructure

PO3: Discover, evaluate and apply reliable sources of knowledge

Task 1: planning

(20 marks)

PO1

Band	Mark	Descriptor
4	10–12	The vulnerabilities and countermeasures have been explored to a very high level with one or more countermeasures provided for each vulnerability. The exploration has been completed to an exceptional level and the mitigation provided would address the vulnerability. Both physical and digital aspects have been covered. The physical countermeasures have been clearly marked on the floor plan with excellent annotation and outstanding thought regarding placement and impact.
3	7–9	The vulnerabilities and countermeasures have been explored to a good level with one or more countermeasures provided for each vulnerability. The exploration has been completed to a good level and the mitigation provided would address the vulnerability. Both physical and digital aspects have been covered. The physical countermeasures have been clearly marked on the floor plan with effective annotation and good thought regarding placement and impact.
2	4–6	Enough vulnerabilities have been identified and countermeasures have been matched to be considered as suitable. The exploration has been completed to a satisfactory level and the mitigation provided could address the vulnerability, but more viable solutions exist. The physical countermeasures have been marked on the floor plan with reasonable annotation and adequate thought regarding placement and impact.
1	1–3	Some basic threats have been identified and some unlinked countermeasures have been provided covering either physical or digital aspects. Limited evidence of annotation on the floor plan and overall, the response feels disconnected from the brief.
	0	No creditworthy material.

Indicative content

For bands 3 and 4, students will consider multiple mitigations, for example, the risk of theft could be managed with CCTV on the server room, key code server room entry, locked server cages and encrypted data on the servers.

For bands 3 and 4, the threat must be aligned with the countermeasures.

Examples may include, but are not limited to:

- physical:

- fire - gas suppression for example CO2, sprinkler system
- flood - fail-over servers/cloud backup
- electrical - UPS, backup generators
- theft - CCTV

- digital:
  - malware - end point security, firewall, anti-virus, patching/updates
  - hacking - disk encryption, wireless encryption, desktop and network security policies
  - denial of service attack - firewall, end point security, redundant servers, cloud backup

The annotations on the floor plan should demonstrate suitable placement of physical countermeasures for example, CCTV camera covering the server room, keypad entry on the server door.

Note: the above is not an exhaustive list; credit should be given to other suggestions as appropriate to the scenario in the brief.

PO2

Band	Mark	Descriptor
4	7–8	The project plan and Gantt chart have been completed to a high standard with suitable activities and durations shown against the requirements of the brief. All information provided in the task has been included and the project completion is within the timeframe required by the brief. The student has covered all phases of planning, design, testing, pre-production, deployment, monitoring and evaluation with activities that match the nature of the project showing an excellent grasp of the task. The account is highly detailed and accurate covering data security, health and safety and the use of antistatic equipment. The laws selected are appropriate to the brief and have been related back with real confidence and understanding of the task.
3	5–6	The project plan and Gantt chart have been completed to a good standard with mostly relevant activities and durations shown against the requirements of the brief. Only limited errors in the timing requirements but the project runs for the timeframe required by the brief. The student has covered most of the phases of planning, design, testing, pre-production, deployment, monitoring and evaluation with activities that mostly match the nature of the project showing a good grasp of the task. The account is detailed and mostly accurate covering data security, health and safety and the use of antistatic equipment. The laws selected are relevant to the brief and have been related back with a good understanding of the task.

Band	Mark	Descriptor
2	3–4	The project plan and Gantt chart have been completed to a satisfactory standard with some activities shown against the requirements of the brief, but they are mostly generic activities and unrelated to the brief. Some timings are accurate, however overall, the project does not adhere to the timeframe indicated in the brief. The student has covered some areas of planning, design, testing, pre-production, deployment, monitoring and evaluation with reasonable relation to the brief. The account is sufficient and reasonably accurate covering some aspects of data security, health and safety and the use of anti-static equipment. The laws selected are important but not always appropriate to the brief and have only partially been related back to the task.
1	1–2	The project plan and Gantt chart have been completed to a basic standard with a limited range of activities that are relevant to the brief. The timings for the task are inaccurate and the project does not adhere to the timeframe indicated in the brief. The student has covered only a few areas of planning, design, testing, pre-production, deployment, monitoring and evaluation and these have little relation to the brief. The account is superficial covering limited aspects of data security, health and safety and the use of antistatic equipment. The laws selected are inaccurate and have very limited relevance to the task.
	0	No creditworthy material.

Indicative content

Project plan and Gantt chart should be clear and logical.

Clear phases of the lifecycle model should be provided and show suitable activities that align to the requirements of the task. Typical activities include but are not limited to:

- planning - customer requirements, develop project specification, technical specification, project plan
- design - traffic forecasting, storage analysis
- pre-production - VM development, compatibility test
- deployment - server installation, operating system configuration
- testing - shared folders, network access, security policies
- monitoring - response time monitoring, server logs, storage monitoring
- evaluation - user acceptance, functional requirements

In bands 1 and 2, the legal, data and static sections may be generic with limited relevance to the brief.

Working with equipment:

- health & safety - manual handling, COSHH, training, electrical safety

- data security - Data Protection (2018)/GDPR, Computer Misuse Act, backing-up
- antistatic - use of wrist straps, mats, bags

Note: the above is not an exhaustive list; credit should be given to other suggestions as appropriate to the scenario in the brief.

Task 2: design - servers and storage

(28 marks)

PO2

Band	Mark	Descriptor
4	16–20	The student has demonstrated exceptional knowledge and experience of server roles and applications required for the network to fully support the demands of the business. From the server OS, through to the wider roles and applications, the detail provided shows excellent subject knowledge. The judgements regarding the architecting of the servers show a high level of subject knowledge in the generation of the solution with strong evaluative comments that address the demands of network. The judgements demonstrate a high level of subject knowledge in the generation of the solution with detailed and considered evaluative comments. The specification of the servers and storage exceeds the technical requirements, both functional and non-functional, and covers the demand for the network to grow. An extremely proficient diagram that clearly considers the requirements of the brief and builds a potential solution that solves the problem to a very high standard.
3	11–15	The student has demonstrated good knowledge and experience of server roles and applications required for the network to function although not all the required roles and applications have been identified. The essential software and roles have been identified. The approach to the server architecture is appropriate, showing refined technical knowledge and justification with some consideration of alternatives provided. The judgements demonstrate a good level of subject knowledge in the generation of the solution with proficient evaluative comments. The specification of the server and storage addresses the minimum requirements and shows scope for forward planning and expandability. A proficient diagram that delivers on the requirements of the brief and builds a potential solution that solves the problem to a good standard.
2	6–10	The student has demonstrated satisfactory knowledge and experience of server roles and applications required for a network to function. A range of roles and applications the server and network will require have been identified to a satisfactory level of detail but are not aligned to the demands of the business. The approach to the server architecture is reasonable with some technical knowledge and adequate justification or consideration of alternatives provided, but it does not consider the business or network demands. The servers selected would be viewed as achieving the minimum functional requirements of the task with only storage and operating systems included, but choices are not explored or justified. Some reference to the brief has been included. A satisfactory diagram that mostly addresses the requirements of the brief and builds a potential solution that solves the problem to a reasonable standard.

Band	Mark	Descriptor
1	1–5	The student has demonstrated basic knowledge and experience of server roles and applications required for a network to function with gaps evident. Only a few roles have been mentioned in limited detail with little to no consideration for the applications. The approach to the server arrangement is rudimentary with only a basic approach outlined and there is little to no justification related to the brief and alternatives. The servers selected only partially deliver on the functional requirements of the task with only basic storage and operating systems details provided. A functional diagram that addresses the requirements of the brief and builds a solution that could solve the problem with some modification.
	0	No creditworthy material

Indicative content

The details below will vary based on the approach the student has taken and should be assessed based on the viability to deliver on the requirements of the task.

Server roles and applications

- the student should show a range of applications and roles required to deliver on the requirements of the task
- brand names for example, Windows Server or Active Directory should not be penalised
- some example software and applications:
    - Hypervisor
    - Server Operating System
    - Directory Service (Active Directory)
    - DNS
    - DHCP
    - IIS
    - SQL Database Server

Server architecture:

- students could recommend one approach or a hybrid approach with some roles virtualised. Assess the work based on the technical recommendation and justification
- a case for physical servers with a hypervisor to virtualise the machines. Hyper-V or vSphere are appropriate if the justification is accurate and relevant
- benefits include better hardware utilisation
- fail-over of virtual machine to another server
- environmental benefits, reduction in heat and power utilisation
- ability to scale out the infrastructure

Servers and storage:

Note: No marks should be lost if the selection of servers does not align with server architecture marked previously

- when specifying the servers, a suitable server could be PowerEdge R940xa Rack Server, 2x Intel Xeon Gold 2.3Ghz, 16 Cores, 64GB Memory and 10TB storage. This will depend on the approach taken to the server
- the form factor of the servers should be considered based on the requirements of the brief, for example a medium-sized business would look at something other than tower servers for the business
- solutions should use tested technology or technology that is not reaching end of life. The technologies should provide headroom to grow as the demands on the business increase
- server storage could be a SAN-based solution reducing the amount of physical server storage, or it could be another suitable form for example local file store or virtualised storage
- typically, a PowerVault ME4 series could be used to form the storage solution in the region of 60TB. Again, the selection should be both justified and provide opportunities to grow out with the business
- the expansion could take the form of additional disks being added to an array or additional arrays being added. The justification is crucial and should be in line with the requirements of the task

Diagram

- the diagram should be clearly annotated showing the server names, roles and architecture, for example virtualised - the annotations should be detailed and address the following areas:
    - the diagram should represent and align with the approach taken for the task, for example virtualised or physical single servers
    - the OS, roles and applications installed on the servers should be identified, for example VSphere Hypervisor, Windows Server 2019, Active Directory, DNS, DHCP, SQL Server
    - brand/product specific names are permitted for this task and should be encouraged over more generic terms, for example directory service
- the diagram should clearly and effectively convey the design approach

Note: the above is not an exhaustive list; credit should be given to other suggestions as appropriate to the scenario in the brief.

PO3

Band	Marks	Description
4	7–8	The sources of information used and the knowledge gained show excellent research skills, utilising sources that are both very reliable and valid, with fully developed comments and consideration of any possible bias in the sources used and how it has impacted on the information gathered. The judgements provided demonstrate an excellent level of critical thinking in the generation of the solution with highly effective evaluative statements.
3	5–6	The sources of information used and the knowledge gained show good research skills, utilising one or more sources that are reliable and valid, with detailed comments including recognition of any bias in the sources of information. The judgements provided demonstrate a good level of critical thinking in the generation of the solution with mostly effective evaluative statements.

Band	Marks	Description
2	3–4	The sources of information used and the knowledge gained show moderate research skills, utilising sources that are acceptable in terms of reliability and validity, with a basic comment about the suitability and use. The judgements provided demonstrate a reasonable level of critical thinking in the generation of the solution with some evaluative statements that are partially effective.
1	1–2	The sources of information used and the knowledge gained show only basic research skills, utilising sources that are derived from sites which raise concerns regarding the reliability and validity of the information they contain. Any judgements provided demonstrate a minimal level of critical thinking in the generation of the solution with only limited evaluative statements.
	0	No creditworthy material

Indicative content

Students can evaluate each source, or all sources combined aiming to justify the sources and validate the quality of the information. For a student to achieve mark band 3 or 4, they should utilise several sources to verify technical data, performance, quality and usability of the devices. The evaluation should be focused on the source and not the information.

The following points should be considered when marking:

- the sources selected are appropriate and provide valid technical information
- in bands 3 and 4, websites have a higher degree of reliability
- manufacturer forums can be included but the comments must be scrutinised
- reseller customer comments should only be considered for bands 1 and 2, for example Amazon

Suitable brand websites may include:

- Dell
- HP
- IBM/Lenovo
- Fujitsu
- Supermicro
- Synology
- Microsoft
- Linux (Derivatives)
- QNAP
- Buffalo
- Western Digital

Review websites for corroborating brand information may include:

- CNET
- Techradar
- ITPro
- PCMag
- Trustpilot

Note: the above is not an exhaustive list; credit should be given to other suggestions as appropriate to the scenario in the brief.

Task 3: design - communication equipment

(28 marks)

PO1

Band	Mark	Descriptor
4	4	The security aspect of the relevant equipment required by the brief is excellent with a range of modern approaches and techniques that would ensure threats are minimised. The approach is in line with current best practice and shows a high degree of subject competence.
3	3	The security aspect of the relevant equipment required by the brief is good and covers a range of approaches and techniques focused on security. The points raised have been related back to the brief and combined with a technically adept justification.
2	2	The security aspect of the relevant equipment required by the brief is satisfactory and covers a few approaches and techniques focused on security. Some attempt has been made to relate the method back to the brief, but this is technically weak and lacks justification.
1	1	The security aspect of the relevant equipment required by the brief is minimal with only one element of security covered and little or no relevance to the brief.
	0	No creditworthy material

Indicative content

This task should be marked focusing on security of the network rather than each device. A range of security technologies should be considered but are not required to cover each area equally.

WiFi security would cover encryption, authentication of users for example domain username and password, separate VLAN network isolating from main network traffic.

Managed switches for example Cisco, Dell, HPE products that support segmentation, VLAN, and advanced security management should be expected.

A good case could be made for running WiFi or CCTV on a separate physical network so long as the justification was detailed enough.

The selection of security measures should be contemporary and aim to use current best practice, for example WPA2-Enterprise, MAC address filtering and directory service authentication. Legacy approaches for example, WEP or WPA would not be appropriate for mark bands 3 and 4 as they are less effective or robust in a commercial setting.

Note: the above is not an exhaustive list; credit should be given to other suggestions as appropriate to the scenario in the brief.

PO2

Band	Mark	Description
4	13–16	Excellent understanding of the problem with a selection of fully compatible components that will deliver an advanced solution. The plan shows meticulous annotations to enable full visualisation of the approach taken. Advanced subject knowledge has been shown with strong use of technical terminology and reasoning in the selection of the components. The justification is very strong showing multiple benefits to the business using effective evaluative statements.
3	9–12	A good understanding of the problem with a selection of compatible components that will deliver an advanced solution. The plan shows effective annotations to enable visualisation of the approach taken. Effective subject knowledge has been shown with good use of technical terminology and reasoning in the selection of the components. The justification is sound showing a number of benefits to the business using some effective evaluative statements.
2	5–8	An adequate understanding of the problem with a selection of mostly compatible components that will deliver a functional solution. The plan shows a suitable level of annotation to enable some degree of visualisation of the approach taken. Acceptable subject knowledge has been shown with satisfactory use of technical terminology and reasoning in the selection of the components. The justification is functional at best with few benefits shown and few evaluative statements.
1	1–4	A basic understanding of the problem with a selection of components that are relevant to the task but would not result in a viable solution. The plan shows a functional level of annotation which enables only limited visualisation of the approach taken. Little subject knowledge has been shown with rudimentary use of technical terminology and very basic reasoning in the selection of the components. There is a lack of any form of justification other than selection and equipment.
	0	No creditworthy material

Indicative content

Any devices selected should mirror current practices avoiding technology that would be considered end of life or untested in a commercial environment.

When marking, the approach and selection of equipment would naturally vary, so long as the solution delivers on the requirements of the brief.

Some sample devices and further information have been provided as a guide for the selection of equipment, serving as a guide for a medium level solution.

Switches

- possible features to explore are VLAN support, switch management, security for example port monitoring
- 18 network ports on the first floor and 60 ports on the ground floor

- various approaches to the selection and positioning of the switches exists, one single large switch or separate switches for both floors and the CCTV. The approach should be considered on its viability and suitability
- switches should be placed in the main server room and on the first floor
- the switches are managed and arranged logically to enable both growth and management for example Cisco Catalyst 9300 Series, PowerConnect 7048R
- there is no requirement to address how the switches will connect back to each other, but bands 1 and 2 should be considered if this has been addressed

WiFi

- possible features to explore are encryption, power over ethernet (POE), wireless specification for example AC
- the WiFi equipment is at least AC speeds and running on a separate network or VLAN for example Cisco Catalyst 9100 Access Points, Dell EMC Networking Ruckus R720

IP Cameras

- possible features to explore are connectivity, management, lens, POE
- the IP cameras have been suitably placed with good coverage, ideally with a 360 degree lens but this is not essential for example Cisco video surveillance 3520 IP camera, AXIS M3024-LVE network camera
- a suitable network attached storage (NAS) drive has been purchased with enough storage to hold all the video footage for example Synology disk station NVR DVA3219

NAS

- possible features to explore are storage capacity, upgradeability, connectivity, operating system features
- the selection of older specifications for example an access point that only supports 802.11N would not be viewed as favourably as a WiFi AC device
- the approach should be structured, for example, POE for the security cameras, a separate VLAN for WiFi. CCTV cameras and core network traffic
- separate NAS drive should be placed in the server room. Storage for the CCTV cameras should be on OnPrem otherwise no credit can be given

Note: the above is not an exhaustive list; credit should be given to other suggestions as appropriate to the scenario in the brief.

PO3

Band	Marks	Description
4	7–8	The sources of information used and the knowledge gained show excellent research skills, utilising sources that are both very reliable and valid, with fully developed comments and consideration of any possible bias in the sources used and how it has impacted on the information gathered. The judgements provided demonstrate an excellent level of critical thinking in the generation of the solution with highly effective evaluative statements.
3	5–6	The sources of information used and the knowledge gained show good research skills, utilising one or more sources that are reliable and valid, with detailed comments including recognition of any bias in the sources of information. The judgements provided demonstrate a good level of critical thinking in the generation of the solution with mostly effective evaluative statements.
2	3–4	The sources of information used and the knowledge gained show moderate research skills, utilising sources that are acceptable in terms of reliability and validity, with a basic comment about the suitability and use. The judgements provided demonstrate a reasonable level of critical thinking in the generation of the solution with some evaluative statements that are partially effective.
1	1–2	The sources of information used and the knowledge gained show only basic research skills, utilising sources that are derived from sites which raise concerns regarding the reliability and validity of the information they contain. Any judgements provided demonstrate a minimal level of critical thinking in the generation of the solution with only limited evaluative statements.
	0	No creditworthy material

Indicative content

Students can evaluate each source, or all sources combined aiming to justify the sources and validate the quality of the information. For a student to achieve mark band 3 or 4, they should utilise several sources to verify technical data, performance, quality and usability of the devices. The evaluation should be focused on the source and not the information.

The following points should be considered when marking:

- the sources selected are appropriate and provide valid technical information
- in bands 3 and 4, websites have a higher degree of reliability
- manufacturer forums can be included but the comments must be scrutinised
- reseller customer comments should only be considered for bands 1 and 2, for example Amazon

Suitable brand websites may include:

- Dell
- Netgear
- Cisco

- Synology
- Foscam
- Smonet

Review websites for corroborating brand information may include:

- CNET
- Techradar
- ITPro
- PCMag
- Trustpilot

Note: the above is not an exhaustive list; credit should be given to other suggestions as appropriate to the scenario in the brief.

Performance outcome grid

Task	PO1	PO2	PO3	Total
1	12	8		20
2		20	8	28
3	4	16	8	28
Total marks	16	44	16	76
% Weighting	21%	58%	21%	100%

Document information

The T Level Technical Qualification is a qualification approved and managed by the Institute for Apprenticeships and Technical Education.

Owner: Head of Assessment Design

Change History Record

Version	Description of change	Approval	Date of Issue
v1.0	Post approval, updated for publication.		December 2020
v1.1	Branding and formatting final updates. NCFE rebrand.		September 2021
v1.2	Sample added as a watermark	November 2023	17 November 2023