TLM - User Skills in Cloud Systems and Services

High Quality Qualifications for 16-19 Performance Points and UCAS (UCAS Points)

The specification for

TLM Level 3 Certificate in IT User Skills in Cloud Systems and Services

For 2016 delivery onwards

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This is version 1.0 of the TLM Level 3 IT handbook for schools and colleges eligible for UCAS points from 2016 onwards and first published in September 2016. Further printed copies can be obtained from Lulu.com or the pdf freely downloaded from www.theingots.org/community/handbookL3C

The ITQ is the qualification framework based on the UK National Occupational Standards for IT Users developed by eSkills and the Awarding Organisation Forum that is made up of all the Ofqual accredited organisations that offer IT User qualifications. It is referenced to the European Qualifications Framework devised by the European Union.

The assessment model for the qualifications presented in this publication was designed by TLM in consultation with employers and academic institutions in order to offer the most up to date set of skills and experiences available at the time of delivery. The core units are based on cloud technologies and services, which is the most prevalent form of IT in use and has a recognised skills shortage. Learners study some optional units in areas of interest or ones that compliment other academic subjects they are studying. The overall assessment is based on coursework completion and an external examination.

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Supporting quotes from Academic Institutions and Employers in the sector.

Not so long ago cloud computing was an emerging technology but is now becoming increasingly ubiquitous in industry and even everyday life. Qualifications in IT and computing have generally not kept up with this and it is an area of study that is often absent, not only at degree level, but also at level 3. The design of a curriculum such as this is very welcome indeed.

As a University we see computer science students entering the first year with a miscellaneous collection of A-levels and Diploma awards not directly related to computer science with their only computing knowledge gained as PC or tablet users at home. The addition of a level 3 cloud computing qualification such as this to their portfolio would make them much higher quality applicants and more prepared for undergraduate study by having experience and knowledge of such a contemporary IT field.

The units offered hold together very well and I can see this as being quite an exciting area of study for the learners. The learning outcomes are appropriate for the level and are very well articulated. The requirement throughout for learners to demonstrate research skills, analytical skills and critical interpretation in this area, also often absent in the qualifications they present to us on entry, will put them in good stead for further study in this area or study at higher level.

It is pleasing to see security issues given such prominence, as well as legal and ethical issues that naturally arise in this area. These are areas high on our list of priority for courses at level 4 and above and exposure to this at level 3 in this context is excellent.

The real world project is an exciting unit offering learners the opportunity to bring all they have learnt together in a piece of independent research and development. A vitally important skill and one that we see lacking in our applicants to University. Having an opportunity like this for guided

independent work at level 3, in a computing related discipline, is tremendous.

My own feeling is that a learner gaining this qualification alone or in combination with others is well placed for working in industry, perhaps taking up an apprenticeship, or going on to further study. I can see this working very well as an extra qualification to go alongside more traditional A-levels as well as forming part of a larger vocational type qualification. In particular, it would work very well alongside the more theoretical and non-computing type A-levels that students typically present on entry to computer science degrees at Westminster. It would be wonderful if some of my students had this knowledge and skill before starting their undergraduate course.

Mark Baldwin
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and Faculty Director of Quality Assurance
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Contents

1. For those in a hurry

Please read the rest of the book later as the details are important!

1.1 TLM's assessment model is common to most of its qualifications. It is based on competence based assessment of coursework using a portfolio of evidence supported by a free optional cloud based evidence management system and an externally set and marked synoptic grading examination. The rationale for this design can be found at http://thelearningmachine.co.uk/qualification-design/

1.2 Pupils have to demonstrate competence against the assessment criteria from their day to day work and the teacher assessor has to verify that they are competent in relation to the general level descriptor using indicative assessment criteria. TLM's external moderator will check the judgements and the quality of the evidence and provide feedback. This process is not graded, the intention is that it is a flexible way of checking basic practical competence in the subject at the qualifications framework level. Once this is secure the pupil becomes eligible to take a grading exam. If the coursework is secure the candidate should at least get sufficient marks on the grading exam to get a pass grade but it is not inevitable. If many pupils pass the coursework but fail to achieve a pass grade overall it implies that the coursework assessment is not sufficiently rigorous and should be adjusted accordingly.

1.3 The grading test has questions of varying difficulty. This will differentiate the grades from the most to least able based on knowledge and understanding underpinning practical competence. For example, at Level 3 grade A*/A indicates the student is potentially suitable for further study at university in this field. C grade candidates are possibly more likely to use the qualification as an example of

their competence in this field for other studies or apprenticeship programmes.

Procedures

1.4 The first thing to do is to arrange assessor training with TLM. TLM trains at least one assessor as Principal Assessor for IT who must accept responsibility for standards within the Centre. The Principal Assessor can train and appoint assessors within the Centre as long as they are competent to take on the work and are willing to sign an agreement on the web site to uphold standards.

1.5 TLM will provide initial training in the pedagogical model and using the supporting technologies to provide the evidence needed. The purpose is to get you started and then we provide ongoing support to ensure you are confident and we can work as a professional partnership. We advise new Centres to do some coursework assessment early so that they can receive feedback and quickly become confident in doing routine coursework assessment. Our aim is to make this no more onerous than normal routine assessment that anyone would do as a normal part of the teaching job. This gives more time to focus on teaching and therefore to support raising attainment.

1.6 The grading exam can be done in three modes. The first mode is a "mock". This enables the school or college to put all, a sample, or individual pupils into an exam that is identical to the real thing to gauge readiness to take the "real exam". We mark the exam externally for you so that it is identical to taking a real exam. It's identical in all respects but it won't actually provide the qualification. For this reason a mock exam costs the same as the real thing but you might use it strategically with a representative sample to support grade predictions and judge readiness for cohort entry. Mocks are entirely optional: you can put none of the cohort in or all of the cohort multiple times, but the intention is for you to use sampling to provide strategic management information from relatively few tests.

1.7 The second mode is the "real exam". This is the main grading exam and provides the grades for the qualification as a whole. Once a school or college has designated the examination as the real examination they are committed to accepting the grades as such. The third mode is "re-sit". Candidates are allowed one resit and this should be arranged BEFORE the qualification is claimed. We discourage "blanket resits". The purpose of the re-sit should be to give a candidate that has clearly and unexpectedly under-performed a second chance, it should not be used routinely to try and improve the grades of an entire cohort.

1.8 Once the qualification is finalised the candidate can not retake it for at least 6 months. This is to give time for further study to make a significant difference in the outcome. (This retake might well not be eligible for league table points, it will depend on DfE policy at the time.)

Differences with respect to GCE

1.9 Tech Awards and Applied Generals are not GCEs. They provide points equivalent to GCEs but they have different rules. With TLM qualifications, there are multiple versions of the exam designed to be the same difficulty. This enables us to have much more flexibility about when candidates can take the exam and the time can be different for different children or groups in the same school or college. Coursework moderation is on demand to suit you not us but we advise doing it as you go along so there are no pressure points or surprises at the end of the course when there is no time to do anything about it.

1.10 Level 3 exams can be done online or on paper. Ring us for current prices or look at the fees section on the web site http://thelearningmachine.co.uk/registrationfees/. You must give at least 6 weeks notice to take any exam. This gives us time to plan the marking so we can get results to you promptly. We also need any fees to have been paid in full before the pupils take the exam. If you

can give more than 6 weeks notice we will give you a higher priority when it comes to marking.

1.11 Unlike GCE you can schedule progression from Level 2 to Level 3 over time making a more coherent progression from KS4 to KS5. If the candidate fails to achieve a Level 3 grade after they have achieved Level 2 they still have the Level 2 grade to fall back on. Level 3 qualifications provide the points of the E-A* grades of GCE. If a pupil achieves the Level 2 qualification it has no effect on the Level 3 other than its points will be replaced by the Level 3 if the candidate upgrades to it.

2. Introduction

2.1 The purpose of these qualifications is to recognise the development of IT User Skills directly related to the National Occupational Standards. They support progression to higher level qualifications in digital technologies and they are complementary to existing qualifications in the TLM provision using the TLM assessment model. For example, they enable extending the range of IT User contexts when compared to the Open System Computing qualifications and they are complementary to Tech Awards in Product Manufacture or Design, Engineer and Construct. Anyone wanting to develop their knowledge and understanding of IT applications in order to hone practical skills relevant to learning and the world of work will benefit from these qualifications.

2.2 We believe these innovative qualifications provide the most inclusive and cost-effective points scoring ICT qualifications available while preserving the necessary rigour for the highest attaining candidates. In addition, there is a clear intention to reduce the bureaucratic overhead on teachers while preserving the benefits of coursework for motivating learners. We have demonstrated that we can provide Level 3 qualifications that are accessible to average and below average attaining learners, and at the same time differentiate and reward the A*/A students. Our qualifications help candidates in deciding whether they are more suited to an academic or technical approach.

2.3 the TLM IT User Skills in Open Systems and Enterprise qualifications are specifically designed to enable coverage of up-to-date ICT skills and knowledge with a choice of contexts and emphasis to suit local interests and needs. These qualifications provide certification of competence across the curriculum without over-burdening teachers with administration.

2.4 This specification is for Level 3 qualification which can be offered as a clear progression from Level 1 and 2 Certificate specifications that are already accredited, or as a stand-alone qualification. The beauty

of this progression model is that students always have a lower level qualification to fall back on. The qualifications target secondary schools and further education colleges but are also suitable to be used in apprenticeships. They have the following key benefits.

- devised in consultation with leading industry consultants, professional bodies and universities.
- clear and flexible unit based structure referenced to the European Qualifications Framework (EQF).
- straightforward assessment of competence in real rather than contrived contexts.
- grading through controlled exams introduced progressively from KS4.
- provides a focus for continuing professional development for teachers through moderation/verification feedback.
- moderation/verification of coursework on demand.
- examination opportunities for Certificate and Diploma are on demand with one resit opportunity allowed. Candidates keep the higher of the two scores if they elect to re-sit.
- use of open source cloud based technologies to reduce costs and add value for schools.
- reduced bureaucracy for teachers and flexibility for them to target specific interests.

2.5 These qualifications lend themselves to formative assessment practices allied to competence based and summative differentiation by outcome that can optimise and motivate attainment for individuals rather than assume all will reach a certain level or grade at a particular time. We do this by providing a coursework component that is competence based, reflecting the best and most up to date research in assessment in the workplace, complemented by an academic multi-part examination for the Certificate and Diploma.

2.6 All candidates must complete the coursework before being eligible to take an exam. This provides an incentive to complete the

coursework and makes it less likely that those sitting an exam fail through inadequate preparation. It provides flexibility to encourage innovation and the use of up to date contexts but limits the influence coursework can have on achievement of the highest grades.

2.7 The Level 3 exams grade candidates across a range from Pass to A* with grades A*, A, B, C, D, E, available as pass grades. If coursework is completed to the Level 3 standard, in keeping with the Level 3 general descriptor, the candidate can go on to take the Level 3 exam which will then differentiate grades A*-E.

2.8 In this way we can provide valid competence based assessment and rigorous testing of underpinning knowledge and understanding at a lower cost than both traditional vocational and academic methods applied separately. There is research evidence that this approach should enhance motivation that will result in higher attainment by supporting both performance-approach goals that focus on displaying competence and performance-avoidance goals that focus on avoiding a display of incompetence. (Conclusions from Effects of Classroom Assessment Practices on Students' Achievement Goals, Hussain Alkharusi Sultan Qaboos University, Oman.)

3. Summary of the qualification specification

3.1 The Level 3 Certificate is graded across 6 levels from A*- E with A* the highest grade equating to 80%+ of the available marks and grade E equating to a minimum of 50%.
Candidates that complete the coursework to the appropriate standard at Level 3 will carry forward 30 marks. Those that achieve 20 more marks from the exam will be awarded a grade E (50%). 55% for a grade D, 60% for grade C, 70% for grade B, 75% for grade A and 80% or more for A*.

Content

3.2 The qualification content has been designed for use in schools and colleges by building it on L1 and 2 foundations that are referenced to the new National programmes and testing it against similar assessments carried out in current Level 3 qualifications. It is also designed to enable learners to meet the needs of employers, through consultation with innovative small business employers, progressive universities and professional bodies representing a wide section of the industry. Guidance for coursework is aligned with the CBI employment criteria and the qualifications are therefore specifically targeted on employability.

3.2 The use of real equipment and technology rather than simulations or generalisations provide the real world contexts needed for motivation. There is an emphasis on increasing understanding of the importance of collaborative working using open systems in keeping with recent Cabinet Office policy and the Government Industrial Strategy 2025 and policies to shift government systems to Open Systems.

" The cost of the government's IT is currently too high and needs to be reduced. There is a lack of market diversity in existing government contracts. A more diverse market and level-playing field

for access to government IT contracts is needed to improve competition, reduce cost and improve public service outcomes."

(Open Standards: Open Opportunities - flexibility and efficiency in government IT: https://www.gov.uk/government/consultations/open-standards-open-opportunities-flexibility-and-efficiency-in-government-it)

Assessment

3.4 The qualifications at Level 3 have two assessment components.

1. Coursework assessed in terms of competence in practical areas where knowledge and understanding can be applied in real and motivating contexts.
2. An externally set and externally marked examination to assess the knowledge and understanding that underpins user competence.

3.5 The Certificate qualification is unit based and consists of mandatory and optional units, as well as a mandatory project to be undertaken in a work based environment to gain some hands on skills. A minimum of 24 credits is needed equating to a minimum 200 Guided Learning Hours. An additional 30 hours is required to make up the mandatory 230 hours TQT (Total Qualification Time). As part of TQT, it is expected that candidates will carry out work and assessment activities outside of their guided hours, including research and analytical activities as part of their real-world project.

3.6 The synoptic examinations of knowledge and understanding that are used for grading are based on a syllabus related to all the mandatory units ,including the Undertaking a Real World Project. Questions on the exam paper may be asked in which candidates will gain credit by giving examples from their options and/or coursework. The design does not allow candidates to compensate for weak coursework by doing well in the exam only or vice versa. The exam is providing an additional level of quality assurance for the evidence

of competence provided for the units and it enables grading in order to inform academic and vocational routes in higher education. Candidates must complete the coursework to a satisfactory standard at Level 3 to be eligible to take the examination.

3.7 A weak examination performance will limit the attainment level graded informing the candidate of their likely success in further related academic study. It is likely that candidates that display competence in coursework will at least pass the exam but that is not inevitable and they must take the exam to pass overall as it is a mandatory aspect of the qualification as a whole. The exam then also provides an additional very low cost dimension to external moderation/verification feedback for the coursework. Centres with a high proportion of candidates judged to be satisfactory on coursework yet failing to gain sufficient marks in the examination flag up a need for further investigation and will help prioritise CPD.

Rationale

3.8 The assessment is specifically designed to motivate learning that will support the highest grade(s) attainable by each candidate but also broader aspects of learning that can not be assessed in a traditional exam. Learners must demonstrate competence across the units before being eligible for the examination which is used in part as a confirmation of that competence.

3.9 There is considerable flexibility to enable contexts of individual interest to be explored in depth. Those that have completed the coursework in areas of personal interest and to a high standard are far less likely to fail to achieve at least the minimum standards set in the examination. This ensures basic practical competence in realistic and motivating scenarios as well as at least some retained general knowledge and understanding in the more academic sense to enable skills transfer as technology changes. This is essential in a 21st Century workforce as there is never going to be sufficient resource to keep retraining everyone every time something changes.

Aggregation of marks

3.10 Coursework across mandatory and optional units contributes 30 marks.

Grade	Coursework 30 %	Examination 70 %	Percentage of Total available marks needed.
Pass E	30	20	50
D	30	25	55
C	30	30	60
B	30	40	70
A	30	45	75
A*	30	50	80

Candidates will be provided with their marks as well as their grades. Candidates can take the examination when their assessors judge that they are ready and when they have completed the coursework to a Level 3 standard across the required units.

3.11 The examination questions get progressively more difficult starting with 10 multiple choice questions, then in part 2, 8 short open response questions and then 4 long open response questions. Those achieving the highest marks will be those most likely to cope with further academic higher level study e.g. at university. Those that produce sound coursework but low exam scores are more likely to be suited to further technical training, direct employment or apprenticeships.

3.12 A candidate that completes the coursework to a satisfactory standard at Level 3 but fails to gain sufficient marks in the examination can retake the exam the next time it is available

3.13 In the interests of inclusion, there will only be additional fees for additional examinations taken since the coursework cost will already have been paid. An optional subscription model that covers the family of Open Systems and Enterprise qualifications means that schools and colleges can enter as many candidates as they believe can meet the criteria and there are no hidden costs such as late entry fees, double entries or replacement certificate fees. This maximises the opportunities for learners to get their achievements recognised without the school worrying about financial penalties and providing the savings associated with economies of scale.

4. Qualification Content

4.1 The qualification is made up from units that are referenced to the European Qualifications Framework (EQF), the largest system for referencing nationally accredited qualifications in the world. Unit credit is compatible with the European international credit transfer system ECVET. The units were designed by the Sector Skills Council for IT and Business in order to provide learners with the skills needed by employers. This specification is an interpretation of the learning outcomes and assessment criteria in those units to support learning in schools and colleges. There is an emphasis on developing the transferable knowledge, skills and competences that will support raised attainment in the subjects of the curriculum as well as supporting employability.

4.2 Extensive consultation with business leaders and universities has taken place. This specification is a distillation of this extensive market research specifically geared to supporting learning in schools and colleges. There is an emphasis on developing the transferable knowledge, skills and competences in open systems and enterprise that will support lifelong learning, providing the grounding needed for future hi-tech professionals. There are references to science and mathematics especially in terms of formulae, measurement and hardware and software requirements. Specialist vocabulary with words such as compression, structured query language, and Sourceforge, will help support technical English at a level beyond that of most adults.

Key subject aims

4.2 The overarching aim is to enable learners to broaden their understanding of technical and professional procedures associated with a range of IT careers and disciplines and the contextual background needed to work efficiently and effectively in these occupations. Those seeking careers in a digital environment will have an appropriate grounding in collaboration and applications to enable them to make rational decisions about their progression

routes into employment in this sector as well as going onto further study:

- developing the skills needed for employment.
- gaining practical experience and competence with contemporary technologies and applications.
- increasing the capacity to transfer knowledge and skills between contexts.
- developing practical skills in creativity and problem solving.
- developing an understanding of the social and commercial impact of IT.
- developing an understanding of the legal, social, economic, ethical and environmental issues raised by IT.
- developing safe, secure and responsible practice when using IT, including reducing risk.
- developing the skills to work collaboratively with IT.
- developing skills in critical evaluation and feedback.

Knowledge and understanding

4.3 A strong candidate will be able to demonstrate knowledge and understanding associated with a wide range of IT terms.

- The list below is not exhaustive but provides an indication of the breadth expected. Some terms will be analysed to a much greater level of detail than others but candidates should have some idea of basic definitions and contexts for as wide a range of these terms as possible. Flexibility in the assessment model will allow more in-depth study in areas of particular interest.

Access point, Analogue-to-Digital Converter (ADC), Asymmetric Digital Subscriber Line (ADSL), Algorithm, Alpha Software, ANSI American, National Standards Institute, API Application Program Interface, Archive, ARP Address resolution protocol, Adware, Array, ASCII, Backup, Bandwidth, Base Station, Batch Process, Bcc, Beta Software, Binary, Binary Coded Decimal, BIOS, Bit, Bitmap, Bitrate, BitTorrent,

Blog, Bluetooth, Bookmark, Boolean, Boot, Bot, Broadband, Browser, Buffer, Bug, Bus, Byte, C/C++, Cache, Captcha, CCD, Checksum, CISC, Clock Cycle, Clock Speed, Cloud Computing, CMOS, CMYK, Codec, Commercial Software, Compiler, Computer Ethics, Contextual Menu, Cookie, Copyright, CPU, Cron, Crop, Cross-Browser, Cross- platform, CSS, Cyberbullying, Cybercrime, Cyberspace, DAC, Daemon, Data, Data Transfer Rate, Data, Type, Database, DBMS, Debug, Debugger, Deprecated, Default, DHCP, Dialog Box, Digital Signature, Dithering, DNS, Domain Name, Domain Suffix, Driver, DRM, DTD, Error Correction Code (ECC), Electronic Data Interchange (EDI), Emulation, Encryption, EPS, Ethernet, Extranet, FAQ, FAT32, Fibre-Optic Cable, FIFO, File, File Extension, File Format, File System, Filename, Firewall, Firmware, Flash Memory, Flat File, Floating Point, FLOPS, Flowchart, Folder, Format, FPU, Freeware, FSB, FTP, Gateway Gigabyte, Gigaflops, Gigahertz, GNU, GPS, GPU, GUI, GUID, Hacker, HDMI, HDTV, Heat Sink, Hertz, Heuristic, Hexadecimal, Host, HTML, HTTP, HTTPS, Hyper-Threading, Hyperlink, Hypermedia, Hypertext, I/O, ICANN, Icon, ICT, IEEE, Illegal Operation, IMAP, Integrated Circuit, Intellectual Property, Interface, Internet, Intranet, IP, IP Address, IPv4, IPv6, IRQ, ISO, ISP, Iteration, Keylogger, Keywords, Kilobyte, LAN, Latency, LCD, LDAP, LED, LIFO, Linux, Load Balancing, Localhost, Log, File, Logic Gate, Login, Lossless, Lossy, MACAddress, Macro, Mainframe, Malware, Markup Language, Mbps, MBps, Megabyte, Megahertz, Megapixel, Memory, Memory Leak, Meta Search Engine, Meta Tag, Metadata, Metafile, MIPS, Mirror, Mnemonic, Modem, Motherboard, Mount, Mouse, MP3, MPEG, MTU, Multimedia, Multiplatform, Multiprocessing, Multitasking, Multithreading, Name Server, NAS, Native File, NetBIOS, Netiquette, Netmask, Network, Network, Topology, Node, Null, Null Character, Nybble, OASIS, OCR, ODBC, OEM, OOP, OpenClipart, Open Firmware, Open Source, OpenGL, Operating System, Overclocking, P2P, Packet, Parallel Port, Parse, Partition, Password, Path, PDF, Peripheral, Perl, Permalink, Petabyte, Petaflops, Pharming, Phishing, PHP, Ping, Pipeline, Piracy, Pixel, Plain Text, PNG, POP3, Port, PostScript, Power Supply, PPGA, PPP, Primary Key, Primary Memory, Process, Processor, Program, PROM, Protocol, Proxy, Server, Pseudocode, Python, RAID, RAM, Raster Graphic, Raw Data, Readme,

Real Number, Real-Time, Recursion, Recursive Function, Repeater, Resolution, RFID, RGB, Rich Text, RISC, ROM, Root, Router, RSS, RTE, RTF, Ruby, Samba, SAN, SATA, Schema, Script, SCSI, SD, SDK, SDRAM, SDSL, Search Engine, SEO, Serial Port, Shareware, Shell, Site Map, Skin, Smartphone, SMB, SMS, SNMP, SOAP, Socket, Solid State, Source Code, Spam, Spider, Spoofing, Spyware, SQL, SRAM, SSH, SSL, Stack, String, Subdirectory, Subnet Mask, Superscalar, Surge Protector, Switch, Sync, Syntax, System Analyst, Tag, TCP/IP, Telnet, Terabyte,
Teraflops, Terminal, Text Editor, TFT, Thin Client, TIFF, Torrent, Traceroute, Trojan Horse, Troll, TTL, U, UDP User, Datagram Protocol, Unix, UPS, URI, URL, USB, User Interface, Username, Vector, Vector Graphic, Virtual Memory, Virtualization, Virus, Visual Basic, VoIP, VPN, VRML, W3C, WAIS, WAN, Waveform, Web 2.0, Web Host, Web Page, Webcam, Webmail, Webmaster, Website, WEP, WHOIS, Wi-Fi, Wiki, Wildcard, WiMAX, Windows, Worm, WPA, WWW, XHTML, X86, XML, XSLT, Zip.

Other general skills will include:

- Demonstrate analytical and experiential knowledge in evaluating, using and recommending IT applications and procedures.
- Demonstrate technical and practical knowledge sufficient to be able to set-up and maintain a basic IT system for a specific purpose..
- Demonstrate the application of understanding digital systems including analogue to digital conversion and digital to analogue conversion, how digital information is stored, transmitted and received, made secure and validated.
- Use fundamental knowledge and understanding to analyse and evaluate systems that might or might not be familiar.
- Use judgement and awareness in supporting effective project management tasks in IT.
- Use knowledge of open systems to make better decisions in relation to risk and achieving value for money.

Skills

4.4 Opportunities are provided to support real skills, the great majority of which will be assessed directly in coursework in valid contexts. Candidates will carry out a major IT project based on a real and significant need. A range of appropriate tasks follow the journey building and supporting their system including;

1. Understanding contemporary project development techniques.
2. Working collaboratively and promoting community cohesion.
3. Building information modelling skills.
4. Researching and finding out how to do specific tasks as needs arise.
5. Consideration of efficiency and effectiveness.
6. Developing in-depth knowledge of a range of IT applications.
7. Receiving and acting on evaluation feedback.

Although not mandatory, it is recommended that an able candidate make contributions to an open source project to evidence their competence. Demonstrating competence in a real world context with serious peer review and for a genuine need is the best way of proving their knowledge and skill level. Help and support can be provide from TLM or partners on this.

Unit contents

4.5 The content of units is in Annexe C below with some examples of interpreting the criteria. These are available in more detail on the TLM community learning site and will be linked to progressively more free and open supporting resources and guidance as these become available.

4.6 All centres have an assigned Account Manager who will be very pleased to help at any time. Our aim is to give professional assessors, most of whom are qualified teachers, the confidence to make judgements with a minimum of bureaucracy so that they can focus their time on maintaining their professional knowledge and skills and support learning through effective teaching rather than “chasing paper”.

4.7 There is often a confusion between bureaucracy and rigour, since unnecessarily complex bureaucracy can actually detract from rigour by obscuring the importance of the outcomes in unnecessary process. As with all our Level 3 qualifications, we use an Agile development approach. All assessors must sign an agreement to uphold standards and feedback from moderation/verification will support consistency.

4.8 **Websites** - TLM provides support through a cloud based system for evidence management linked to grading and certification. Providing assessment grades and the management of certification through the Awards Site is mandatory and all assessors are provided with training in its use. It is simply a matter of recording learner competence against the unit criteria as the evidence is collected and claiming a certificate on behalf of the learner when a unit has been fully assessed. All assessors must sign an agreement to uphold standards before they can use this site.

4.9 The community learning site provides online exams and free optional facilities for learners to submit their evidence online, linking it to the assessment criteria across single or multiple units. The assessor can accept or reject this evidence and comment on it providing a full audit trail for evidence. Moderator/verifiers can get immediate access to this evidence and so it is potentially a lot more efficient than alternative methods. No paper, no e-mails with file attachments necessary. There are facilities for progress tracking that can be based on criteria and/or units. The system can be linked as an extension to any standards compliant VLE/e-portfolio system for centres that are already committed to a specific VLE product. Training can be provided and free support is available from your Account Manager. The aim is to eliminate all paper based bureaucracy, all screen-shots and referencing that draws time away from teaching.

4.10 **Telephone** and e-mail support is available to all Centres. There is a general convention of firstname.secondname@tlm.org.uk for e-mail

addresses. It is usually best to e-mail your account manager in the first instance. Google hangouts can be arranged for video conferencing support.

5. Assessment

Assessment summary

Coursework

5.1 Evidence has to be provided against the unit assessment criteria from practical tasks related to the learners' everyday work. This is likely to be from specialist lessons supported by a subject specialist but links with A levels and other equivalent subjects, for example from maths, science, computing, art and design and other relevant subjects is to be encouraged. The way evidence is gathered is up to the assessor, the only requirement is that it clearly supports the judgements against the assessment criteria and the relevant learning outcomes and reflects the learner's personal competence in line with the guidance in this handbook and the general description of Level 3 qualifications provided in the EQF. If on moderation the account manager finds gaps in evidence related to a particular candidate they will request more evidence before agreeing that the coursework criteria have been met. Assessors must then adjust their work to ensure all their learners are providing the appropriate level and breadth of evidence.

5.2 We encourage early submission of at least some evidence so that assessors are confident from the feedback that what they are providing is sufficient (and indeed not over-kill). In this way we can maintain standards while supporting improved efficiency.

5.3 Synoptic assessment has become a popular term. In essence all the coursework assessment is synoptic in that the evidence provided is against collectively synoptic assessment criteria underpinning the learning outcomes for the unit. Synoptic evidence of competence across all the units is mandatory for the particular qualification. This equates to a minimum of 150 for the Certificate.

5.4 For the Certificate, there are 3 mandatory units, and learners take 2 optional units for a further 9 credits minimum. Dividing into a unit structure is for convenience and compatibility with international

conventions for referencing national qualifications frameworks and to enable credit transfer e.g. as in the European system ECVET. It is NOT intended to determine the method of delivery. Teachers are free to cover units concurrently deciding where the elements are logically related or sequentially as some content comes naturally before others e.g. research before evaluation. We encourage the use of the flexibility provided to target particular interests of learners, to motivate them in persevering in difficult areas and to raise the level of expectation in cognitive development.

5.5 The central project within this Level 3 curriculum is to develop an IT project that is useful to other people, preferably as part of an open source community. This could be improving or building upon an existing application or it could be an original piece of work starting from scratch. As long as there is evidence against the criteria in keeping with Level 3 the candidate will be successful.

5.6 There is an obvious progression from Level 2 to Level 3 where learners will be expected to tackle academically more challenging questions requiring analysis and quantitative skills. The Award and Certificate can be used as stepping stones to the Diploma or treated as qualifications in their own right. The outcomes for individuals in terms of the broad level descriptors allied to the assessment criteria, verified by the teacher/assessor and externally moderated by TLM will determine the final outcome.

Progression and inclusion

5.7 There are some fundamental misunderstandings of unit based assessment with regards to progression and inclusion. The paragraphs below will explain how criticisms related to these issues can be rejected. It is mainly an issue of having higher levels of professional expectation and better CPD strategies rather than simply “dumbing down” to less professional approaches.

5.8 This qualification provides a unique project based learning opportunity in the context of open source applications. There is support for numeracy skills through applied mathematics and literacy through practical communication, providing a general education as well as the specifically vocational elements. This ensures that those that take these qualifications but decide against a career as a specific digital technologies specialist, are well-placed to go on to specialise in other fields with the value of the knowledge, understanding and skills they take from their study broad enough to support a wide range of employment.

5.9 Open Enterprise links to career progression into the digital technologies sector, from support to systems management or any profession where a high degree of technological literacy is required.

5.10 It is very unlikely that any learner embarking on a TLM qualification based on these methods will not achieve at least some kind of recognition for their work at a level appropriate to their current attainment level with a progression route from where they end up to higher levels. Clearly some will take longer than others. This inclusion is achieved without sacrificing rigour for the highest attainers since the questions in the examination targeting the A/A* grades can be as difficult as necessary without risking weaker candidates dropping out of a grade altogether. Indeed able students can start Level 3 work in KS4 differentiated by outcome where appropriate. Currently there is a good argument that candidates achieving A* and A grades across all their subjects are not being

adequately stretched and the natural progression from Level 2 to Level 3 can be used to tackle this directly.

5.11 For the highest attainers that gain some Level 3 credit early, it provides additional time to tackle more ambitious real world projects, with opportunities for making early links with universities who are only too pleased to help support the most able candidates. This is the rationale for the Award and Certificate. These can provide supporting credit for the project unit and can be used as milestones to enable candidates the research background necessary to participate in open source projects alongside professional level practitioners.

5.12 Coursework at Level 3 should reflect useful and meaningful activities with practical activities that add to the digital resources available to the wider community. Work might include creating and documenting a specific CRM system for a small local business or charity. We want to encourage work that reflects contemporary society using standard tools and technologies freely available from the internet. We want to enable Level 3 learners to contribute to their potential alongside established professionals. Projects lend themselves to cross-curricula work supporting raising attainment in other subjects, numeracy, literacy, science and information skills but also aesthetic subjects such as art and design. It is far better to learn through creating original and useful work than to do simulations or theoretical exercises. This is a fundamental part of TLM's coursework philosophy and founded in research evidence.

Criticisms of coursework answered

Criticism 1: Coursework is too susceptible to plagiarism and other forms of dishonesty.

A Google search will have a high chance of finding any extended text that has been copied from an online source. If we are genuinely concerned about "copying from the internet" simply inform teachers of how to combat the issue using freely available tools. Require teachers to accept professional responsibility for the authenticity of their learners' evidence. If teachers really want to cheat why would they not simply tell students the answers to an exam? If learners want to cheat why not simply forge a convincing looking certificate? There is no tradition of easy certificate authentication so there is a high probability that forgery will be successful. A complementary examination means that we can check back to see if individual teachers are "passing" student coursework for a disproportionately high number that then fail the examination. That provides an evidence source to cross-reference the quality assurance in order to better target staff development.

Criticism 2: Unit based assessment means that knowledge is in compartments.

Unit structures are for administrative convenience **NOT** teaching plans. There is nothing to stop elements of several units being supported through one or more projects concurrently. The unit IPU is explicitly designed to work in parallel with other units. Most academic syllabuses are divided up into sections. That is no different in practice to labelling the sections units. If teachers do not teach unit based courses effectively, train the teachers, don't blame the tools.

Criticism 3: Unit based assessment does not support progression.

On the contrary, unit based qualifications organised in a levelled framework provides a better support for progression when the unit content is designed for that purpose. Where qualifications are opportunistically designed to simply target one level there is a good argument that progression is badly supported but that is true of any qualification whether unit based or not.

Criticism 4: Competence based assessment has to be lowered to the level of the least difficult assessment criterion.

In well designed assessment units the assessment criteria are contextualised to the general level specified in the overall level descriptors. This means all assessment criteria should be interpreted in terms of that overall level. It is impossible to measure anything with absolute precision and it is scientifically bogus to claim we can, even if it is politically sensitive to admit that there will be some uncertainty in assessment outcomes when applied to individuals. This is true of both coursework based and exam based methods. The important thing is to get a reasonably consistent set of outcomes within the expected degrees of uncertainty.

Criticism 5: Exams have always been the tried and trusted way of assessing attainment. There is no need for anything else.

Examinations have been widely used for academic assessments in schools and universities. However, that is largely due to their academic heritage where theory is often more important than practice. Even so coursework is well-established where there are practical elements e.g. in science and medicine. Few jobs assess prospective candidates exclusively using written exams. In most practical areas from brain surgery to teaching, no-one would trust a written examination on its own to prove competence. That is not to say examinations are not of value. The key is to use coursework

and examinations intelligently together in order to provide something that is better than either treated in isolation.

The Examination

5.13 Examinations at Level 3 are primarily for grading. The details of the way grades relate to marks are provided above in section 2. The examinations also provide a cross reference in order to increase confidence in the validity of the coursework component.

Weightings

5.14 There are three classes of objectives. AO1, AO2, AO3 are generic assessment objectives:

AO1 - Recall, select and communicate knowledge and understanding.

AO2 - Apply knowledge and understanding through analysis, reasoned judgements and drawing conclusions.

AO3 - Practical and technical skills related to applying skills knowledge and understanding in context.

5.15 Additionally, the qualification units each specify subject specific learning outcomes. The qualification design draws on both classes of objective to ensure balanced representation and that the assessment is a valid representation of what has been learnt.

5.16 The assessment objectives provided by the unit learning outcomes are evenly weighted in the coursework element since all must be achieved in order to pass.

5.17 The synoptic examinations are directly related to the unit learning outcomes and assessment criteria using the content definitions in section 3. This is designed to be broadly representative of the aspects of the learning outcomes testable in a synoptic terminal controlled examination related to the learning outcomes. The examination provides a means of testing associated knowledge and

understanding, powers of analysis and reasoning and of grading the qualification whereas the course work ensures that there is basic competence in their practical implementation in real and relevant contexts.

5.18 At Level 3 the examination weighting of AO1 is 20%, AO2 50% and AO3 30% .

5.19 The overall weighting of the objectives varies depending on the grade because for higher grades AO2 will contribute a greater proportion of the marks. This is a deliberate strategy because AO2 is the most important learning when it comes to academic learning in HE. The assessment will therefore better inform progression pathways while still having the characteristic of inclusion.

Grade E approximately weighted AO1 - 40%, AO2 - 40%, AO3 20%.
Grade A* approximately weighted AO1 - 20%, AO2 - 50%, AO3 30%.

5.20 This then provides evidence that the Grade A* candidate is likely to be more suited to future academic study whereas the Grade E candidate is likely to find it difficult to cope with courses highly dependent on academic testing.

Learner entry and costs

5.21 TLM's subscription model enables schools and colleges to enter learners at times convenient to them. There are no late entry fees and no additional fees should a learner fail to produce evidence at a particular level but can meet the criteria at a lower level. This can reduce costs to the school by more than 50%. Examination entry will depend on whether or not learners meet the coursework criteria. This again saves money because the school is not paying for examination administration for learners that are unlikely to be successful or for whom there is little or no benefit in taking an exam. There are no fees for replacement certificates or verification of certificates because all certificates can be directly authenticated against a secure database. For details of current subscription costs

please contact us or refer to the web site. All of these design features are intended to reduce direct costs but just as importantly the indirect administrative overhead that diverts teachers from teaching.

Online examination

5.22 The examinations can be delivered in a traditional paper based format or online. There is a surcharge for paper based examining reflecting the extra cost involved. The online versions have a secure web user interface and require no software installation. They can run through any standards compliant web browser on any type of computer. The user is restricted to an area in the centre of the screen during the examination and has no access to the internet, or any other storage device without moving the mouse pointer out of the secure area and this will set off a warning. Persistence will result in disqualification from the examination. Since the Level 3 online exams contain open-ended questions they have to be physically marked and so the results will not be immediately available but we will aim to have these ready within 2 weeks of taking the exam. For those taking the examinations in the traditional paper based format it is likely to take 4 weeks to finalise results.

5.23 No candidate should have prior access to the questions in an examination paper either directly or indirectly, before they sit the paper. TLM will have several versions of the examination available and if there is any suspicion of compromise of security, the Principal Assessor should contact TLM to work out a solution. Assuming there is no malpractice, it might simply be a matter of scheduling an alternative paper. Papers will be planned to be of similar difficulty. Candidates can retake an examination once before claiming the award. After the award is finalised candidates must wait 6 months before retaking the entire qualification. Centres can use the exact same procedure for mock exams. These are charged at the same rate and might help inform the centre of the likely results outcome when candidates take the fully regulated examination.

Internal standardisation of coursework

5.24 The Principal Assessor has the ultimate responsibility for consistency in assessment standards within a centre. All assessors have signed a contract agreeing to uphold standards and should therefore co-operate with the Principal Assessor and Account Manager at TLM to ensure that standards across the centre are consistent. It is advisable to send work samples to TLM early to check that evidence is at the right standard so that there is time to make any adjustments necessary to the course and learner expectations. TLM will generally check a higher quantity of work from new assessors and feedback to ensure that they are confident to make appropriate judgements over time. This reduces risk and improves efficiency in the longer term.

Authentication

5.25 All assessors must take reasonable steps to ensure that any coursework evidence submitted by candidates is a true reflection of the candidate's competence. This is in keeping with the assessor undertaking to uphold and maintain standards in the contract with TLM.

5.26 Certificates can be authenticated directly on-line using the certificate number or by scanning the QR code on the certificate. There is no charge and it makes it more likely that certificates will be checked and that in turn improves security. Certificate forgeries are a significant problem when authentication is not simple and straightforward because convincing forgeries are easy to achieve with recent technologies and will get easier as time goes on.

6. Other considerations

Access arrangements and special requirements

6.1 All TLM's qualifications are intended to be accessible, as widely as possible. There is an extensive policy documented on the web site at https://theingots.org/community/QCF2.13
Centres should contact TLM if they have any questions related to accessibility issues.

Language

6.2 The language for provision of this qualification is English only. This will only change if we have a significant demand in another language that is sufficient to cover the additional costs involved.

Malpractice

6.3 TLM has comprehensive policies and procedures for dealing with malpractice. These are documented with links on the web site at https://theingots.org/community/QCF5.29-5.32 Assessors should be familiar with these policies and make them clear to candidates. Assessors should inform their account manager if they suspect any instance of malpractice that could have a material effect on the outcome of any assessments, either for themselves or colleagues. This is part of the upholding of standards that is part of the contract with TLM.

Equality of opportunity

6.4 TLM promotes equality of opportunity through policies and procedures. These are again documented in detail on the web site at https://theingots.org/community/QCF2.11-2.14

Resources, support and training

6.5 A clear goal of these qualifications is to enable learners to support their own learning and to reduce dependency in order to become "lifelong learners". The IT revolution makes this progressively easier

especially with the growth of supportive online communities. As far as possible we encourage the use of technology and up to date methods especially those based on empirical evidence.

6.6 TLM encourages the use of free and open source applications to reduce costs and to further inclusion. However, students are at liberty to use any software they wish to support their coursework. Learning more about free and open source resources provides more choice and better informed decisions.

6.7 It is anticipated that the open source community paradigm will help teachers grow in confidence, develop their own networks of industry based support and be able to develop new projects of their own – ones that may be unique to their local context or that offer specific targeted challenges.

6.8 The curriculum introduces new areas of learning that include close engagement with the world of work and academia. Teachers and learners alike will find it rewarding, challenging and exciting – a combination that guarantees successful outcomes and a learning environment that is happy, productive and fun.

6.9 The qualification is designed to support learning that enables access to Further Education, Higher Education and employment for a wider range of young people.

7. Grade Descriptions

A **grade A** candidate will exhibit most the following characteristics.

7.1 Candidates demonstrate a high level of independence in using their knowledge and understanding to support activities beneficial to themselves and others in everyday contexts. They recall, select and communicate a thorough knowledge and understanding of the general competences needed to support lifelong learning and personal well-being in keeping with the Level 3 general level descriptor in the EQF.

7.2 They apply knowledge, understanding and skills to a variety of situations including those that are unfamiliar and require some analysis and synthesis of new ideas, selecting and using knowledge and information efficiently to solve problems and produce effective support for their own learning as well as the needs of others. They relate these to comparable activities in the world of work. They manipulate and process data efficiently and effectively based on objective criteria. They interpret information and transfer knowledge and understanding from familiar to unfamiliar contexts and produce new insights in practical circumstances. They work creatively exploring and developing new ideas. They adopt systematic approaches to safety, promoting secure and responsible practices and they can make confident decisions to obtain good value for money.

7.3 They use industry standard methods to analyse problems such as effectiveness and efficiency of user interfaces and applications. They set hypotheses in relevant contexts and critically analyse and evaluate the knowledge they gain. They use sound knowledge to review their own work and that of others including that of industry professionals making appropriate, supportive and constructive criticisms and recommendations for improvements. They communicate effectively, demonstrating a clear sense of purpose and audience.

A **grade E** candidate will exhibit most of the following characteristics

7.4 Candidates demonstrate the ability to select and use relevant knowledge, ideas, skills and procedures to complete defined tasks and address realistic but straightforward IT problems. They take responsibility for completing tasks and procedures initiating and completing tasks and procedures as well as exercising autonomy and judgment within limited parameters.

7.5 They use factual, procedural and theoretical understanding to support their work and use appropriate investigation to inform actions. They address problems that, while well defined, may be complex and non-routine. They appreciate different perspectives on subjective issues.

7.6 They work safely and securely, identifying key risks, taking reasonable actions to avoid them. They can work in teams, where relevant taking responsibility for supervising or guiding others, collaborating in reviewing their work evaluating the way they and others use their construction knowledge and skills and taking positive actions to improve. They use standard English and IT to support clear and efficient communication, demonstrating consideration of purpose and audience and use straightforward mathematical techniques in quantitative work.

Annexe A - Example Examination.

Example Level 3 Examination.

(70 marks)

The following principles will apply to the design and structure of each exam.

Questions will vary in the general area of the required learning outcomes specified in the relevant units and cover the assessment criteria in the approximate proportions presented in this document. Questions will reflect a balance of the content listed and explained in the guidance in keeping with Level 3 as defined by the EQF global level descriptors and the grade descriptions above.

Questions

Part 1 - Multiple-choice questions (10 marks)

Each multiple choice question is worth 1 mark each.

Part 2 - Short answer questions (20 marks)

5 questions worth 2 marks each, 2 questions worth 3 marks each, and 1 question worth 4 marks.

Part 3 - Long answer questions (40 marks)

4 10 mark questions which are short essays or planning elements.

Sample Exam

1. The main reason for companies to move to the cloud for services is likely to be:

a) access to more support features as all cloud based services have more support
b) cheaper backup services
c) better service as you are more reliant on experts for answers
d) long term savings to invest elsewhere

(d) 32, 3.5

2. Which of the following is not a cloud based service

a) secure socket layer encryption technology
b) Windows XP based virtual machines
c) remote controlled USB mouse
d) command line access to servers

(c) 32, 1.5

3. A hypervisor is

a) a supercomputer used to emulate cloud based applications
b) a hardware based firewall designed for malware detection
c) a host computer used to run other systems
d) an abstraction layer used to implement data manipulation

(c) 33, 1.1

4. Layer 3 of the OSI model is responsible for all of the following, except

a)TCP/IP in full
b) translating network addresses to machine numbers
c) splitting large messages to smaller chunks
d) assigning networking protocols

(a) 32, 1.1 & 1.2

5. Using an open source license improves the availability of cloud applications because

a) there are more open source developers available
b) it makes it cost effective to develop and deploy open source based services
c) open source systems and software are always better than paid for versions
d) proprietary operating systems do not run on Tier 1 hardware

(b) 33, 3.5

6. Which of the following is not an aspect of cloud based account management

a) setting folder permissions and shares
b) sharing personal account information with other servers
c) creating user accounts and associated permissions
d) removing accounts and archiving data

(b) 32, 2.2

7. Which of the following account management software packages is not open source

a) ISPConfig
b) Webmin
c) ZPanel
d) CPanel

(d) 32, 2.5

8. A data management system will generally use an SQL based software as part of a LAMP stack. Which of the following is not an attribute of SQL.

a) uses algebraic and logical operators in functioning
b) uses expressions to organise data
c) is based on shared standards across companies
d) organises data in truth, false and unknown categories

(c) 33, 2.4

9. Which statement most accurately describes a disaster recovery strategy

a) backing up all of your important systems onto CDs for retrieval in 20 years
b) using mirrored servers at the same server farm
c) using RAID based technology
d) using a local power supply running in the office

(c) 34, 3.3

10. The most noticeable efficiency increase of a cloud based server is likely to come from

a) how easy it is to contact technical support out of hours
b) how many hours it takes to get a system back from a disaster
c) the amount of configuration allowed on the control panel software
d) the voltage regulation used on the main server motherboard

(b) 32, 3.1

11. Write two detailed statements to best describe the purpose of a router in a network structure? (2 marks)

The examiner here will be looking for a basic understanding of the functions of a router. Candidates could reference that it works as part of the OSI at layer 3 (network Layer) and determines how and where to send data packets as they arrive. They can talk about the fact that routers build up a map of the other routers around them and work on the principle that if a package has passed through more than 30 other routers to get to it, it needs to be destroyed or data will be pinging around the Internet forever. They should also be aware that routers read packet information in data to determine how to deal with it and what type of protocol is being used.

33, 1.2

12. What was the aim of your project and what was the nature of the client's needs. (2 marks)

The purpose for this question is for candidates to discuss some of the determining factors of their project work. They can discuss the aim of their client and why they thought they might be able to solve it. Examiners will be looking for an understanding in terms of why IT was chosen. Are the aims of the client best solved by IT, if so, why is that the case and can they give some examples. By explaining what the client's expectation were, this will illustrate their understanding of developing plans and solutions based on these inputs.

34, 1.1-1.2 & 2.1

13. Describe briefly the two most important requirements of a cloud based system in relation to a company that deals with medical records. (2 marks)

The key piece of information here is that this is for a medical practice and therefore the data will be private and sensitive. The candidates need to be aware of this and therefore talk about the laws that impact on this type of data such as the DPA. This will also inform them of the level and detail of required security. They could discuss physical security, or software and hardware based means of protecting the data.

33, 2.3 & 2.3

14. Explain in detail how you would enforce an AUP if you were responsible for a public forum. (2 marks)

Candidates need to show an awareness and appreciation for technologies that would help them meet these needs. They could have some type of sign-up policy which will allow people to use the site only if they sign the agreement with a description of the benefits of this approach in terms of legal backing should anything go wrong. They can also discuss the need for the ability of users to flag up bad behaviour and for them or the users to be able to act on this.

32, 2.8

15. Describe two key limitations of handheld devices, such as smartphones, when connecting to the cloud and explain how these limitations can be minimised. (2 marks)

There are a number of areas here that can be discussed and earn marks. The obvious one is the problems with No-spots with smartphones as they have limited coverage in certain areas. This is quite difficult to overcome, but they could talk about trying to use public wi-fi places as a stop gap. The other problem might be in terms of their management of systems. Most account management software has app based versions of their software, but due to the complexity of the systems and what they manage, these may not always be workable. One way to overcome this might be to search for responsive theme based versions of the software to try and make it usable on small screens.

32, 1.3

16. The three most serious threats to computer based security are: physical, hardware based and software based. For each of these threats, describe in detail a measure which can be used by a company to limit any possible damage that may be caused. (3 marks)

Most schools or companies that have server rooms have some means in which to identify who enters or leaves the rooms. In the case of large ISPs, there is usually people guarding the perimeter and various checkpoints to make sure people do not enter the building unless they are authorised. Some even have passports and fingerprint controls. In terms of hardware, most Internet based devices have tamper proof chains and guards on them and have settings in their bios to notify if they have been opened. Many companies can use servers as “honeypots” to try and trap hackers and will use servers in something like a DMZ (Demilitarised Zone) in order to keep hackers out as far as possible from the physical network. In terms of software, there are various firewalls and root detectors which will keep track of intrusion, as well as software to prevent viruses and other malware.

33, 3.1

17. Apple and Google have both decided to no longer support the Flash file format for video playback developed and maintained by Adobe. Discuss what impact this will have on developers and

suppliers of material for the cloud and explain the alternative method of delivery proposed. (3 marks)

This question is about keeping up to date with developments in the news about IT. The main direction of cloud based services is towards the adoption of HTML5 as it works more effectively on all types of devices. It is also about control and dominance. Adobe was a dominant force in computing, but Apple and Google between them now control a huge piece of the Internet: Apple through its phones and devices and Google through internet search, but also its Android system. Candidates need to give some examples of what developers will need to do, given these directions.

33, 2.6

18. You develop a website for a client that collects information from people that is personal as well as collects money in subscriptions. Describe in detail two hardware or software elements that would need to be used to make sure the system was fully secure and say why they are required. (4 marks)

Any web based system that collects this kind of data must use https with SSL (Secure Socket Layers). Candidates need to explain what this is and roughly how it works. They can discuss some detail about encryption and keys shared between servers which make data exchange safe. The data itself can also be encrypted on the server and they can talk about software and hardware measures used to protect that data at source. There is also some aspect of legal requirements here since firms that collect this data will be obligated to protect it because of DPA or other laws.

33, 2.1

19. Explain the cloud based alternatives to two desktop based applications you have used. Using the applications for reference, describe in detail the benefits identified. (4 marks)

There is no real specification here as it will depend on what the candidates have used and have experience of. In most cases, they will probably compare something like Google Docs to their desktop based variants which will probably be Microsoft Office. Examiners will be looking for clear examples which show that they understand the applications strengths and limitations and can identify how these may impact on work. For example, Google docs does not have a huge range of editing facilities, but how many of the myriad Office facilities are used?

33, 1.6

20. In your project for the real-world element of this course, you were expected to work with a local organisation to assist them in some aspect of their IT. Detail below five examples of skills and knowledge you gained from this experience and describe how this will assist you in a chosen career in IT or extending your educational knowledge in this field. (10 marks)

This is a relatively open question and marks will be awarded for obvious and clear examples of efficiency and effectiveness in their use and development of IT. They will need to use examples from their own work with a client as this will be clearest in their minds, but they can use other examples if it illustrates their point. Examples here will be along the lines of, “I used a CRM software to help a local company be able to track their sales more effectively. It was not the most comprehensive system available, but was the most basic. It was easy to set-up and use and they were quickly proficient in using it. This will help me in my future career as it has shown me the value of testing software thoroughly against client needs and not always going for the most feature rich application, but going for the one that will most help the client.”

34, 5.2

21. You find a job advert from a local company that is looking for a new Internet security person. They have asked you to write a short summary of your knowledge and skills in cloud based security as part of the application. Write below what you would write to this

company to secure the position for yourself, giving examples of your solutions to common problems. (10 marks)

This question is similar to the above question and is to allow candidates to express themselves in terms of a real-world situation. They will need to have a good understanding of security issues and apply this knowledge to a task to "sell" themselves. They can pick a number of common problems, such as rootkits and explain why these are such a problem for Internet based companies, or people working on the Internet and what technologies or applications they would use to counter them. The examples they use will likely come from their real-world project.

33, 3.2 & 3.3

22. Using your experience of account management systems and including examples to illustrate your points, describe in detail the most cost effective and feature rich example you found and recommended for clients. (10 marks)

The question here is to concentrate on one piece of software and list and explain its strengths and weaknesses. The candidates should have explored a number of applications as part of the underlying criterion in Unit 32 and they can use this research to inform their answer. It may be useful to illustrate what feature rich might be. Is this a good thing or a bad thing? It may be that a feature rich system is too complicated to operate and therefore counterproductive, in which case, they need to use this as a counter example. If they concentrate on the LAMP stack, they can talk about the system in terms of how easy or effective it is/was to manage the underlying server, the database application or the web server software. How easy was it to carry out maintenance tasks such as updates or backups. Does cost play any part in this etc.

32, 2.7

23. Identify and describe two laws that affect the use and development of cloud based systems and assess their impact on a national and international level. (10 marks)

This type of question will likely be taken from some topical aspect of IT and try to assess candidates ability to analyse and comment on the developments from their own experiences and understanding. For example, a recent European Law has overturned the US Safe Harbor initiative. This law basically said that US servers were a safe place for European citizen's data. This is no longer the case, though it is being appealed, which means that companies like Facebook and Google who use US based servers for European citizens now have to make sure that data is housed and managed in European data centres. Companies of their scale probably find this something of an inconvenience, but what of SME (Small and Medium Enterprises)? There are issues that may be specific to the UK, such as the DPA, which are not recognised by other countries, though they may have similar laws. How does this impact on services?

The overall idea of this question type will to be how candidates can analyse and synthesise their knowledge and skills and apply them to topical issues.

33, 3.6

Annexe B - Detailed syllabus for the examination

B.1 Note that while this content syllabus covers the range of the qualification in terms of what can be sensibly tested in a controlled exam, it does not cover every single aspect of learning. Elements requiring practical competence in a work context are more validly assessed through practical coursework evidence which is to a minimum standard of competence.

B.2 The majority of questions on the examination will be taken from the mandatory units of study. Therefore, students will be examined on their understanding of cloud based applications, services and associated elements. These are generic IT knowledge and skills and are therefore also part of B.3 below.

B.3 In the examination, questions will be set related to the following broad areas associated with improving productivity through the use of IT. Examples are illustrative rather than exhaustive.

1. Audiences at which work is targeted.
Aspects of the work that makes it particularly suitable for the audience. Global audience and how cloud and communications technologies offer scope to improve productivity. Key characteristics of writing formally as opposed to writing informally in IT environments and why.

Examples: Knowing that people with disabilities need special consideration. Simple cases such as choosing colours that will not cause problems for people with colour blindness, having text alternatives for graphics to enable blind people to know what is being displayed, subtitles for videos for deaf people.

Description of a science investigation or other learning activity taken from the core curriculum, using a web page(s) with links to references so that a future employer can see the quality of work simply by knowing the URL.

Using translation software to communicate with someone in a different country. Public web page (Wiki) to collaborate with friends in producing an information page about the local environment because it enabled collaborative working. Making it easy for other people to contribute and make the results easy to link to other similar sites. Advantages and disadvantages.

Formal writing in a web page to present part of an e-portfolio is important because employers will get a bad impression otherwise. Creating notes on a subject so they are accessible to themselves and peers from any location and can be linked to references and supporting resources. Using on-line publishing services for formally written texts.

Informal writing, SMS conventions, chat and instant messaging of friends using accepted short cuts and slang to communicate meaning. Awareness that many people using English discussion groups and mailing lists are not native English speakers.

Checking e-mail headers to make sure replies are only sent to people that need them. Not using automated replies on mailing list e.g. “I’m out of the office” and why.

“Spam” - knowing not to contribute to it e.g. by making your e-mail address public in a web page or replying to it.

Basic principles of files names and structures associated with applications. File sizes, file types and conversion between files. Issues related to interoperability of applications from different providers. Save as, import and export to and from applications.

Passwords enable security but quality of passwords matters. Identifying unsafe practice. Knowing that people on the internet should not be trusted without good and independent verification of their identity. Knowing that simple internet searches can reveal a lot about you and other people. Knowing that leaving your computer without logging out is a very significant security breach. Knowing about common internet scams.

2. Purpose in common applications and/or applications they have used. Security and safety when working online.

Examples: Word processing makes redrafting more efficient. Collaborative technologies enable sharing documents and concurrent development. Vector design programs produce drawings that can be scaled almost infinitely without loss of quality or increasing the size of the files. Web browsers should all display information provided on the internet consistently irrespective of the device. A spreadsheet enables mathematical models. The internet is increasingly the computer platform, its purpose is to store and provide and enable creation of information all over the world. Text messages enable low cost asynchronous communication.

3. Strengths and weaknesses in the ways information is presented. Make comparisons between methods. Improving the way information is presented. Making information more accessible.

Examples: As a method of presenting information to a general audience, using web pages is better than desktop presentation software if sharing the information and updating it for a wide range of users is important. Desktop presentation software is better if there is a need for visual effects to a static audience. A lot of information gets presented inefficiently because most people associate presentation with desktop presentation software and many have little experience or skills to use other methods. The problem with e-mailing files as attachments or even downloading a file is that there is then a big task managing all those files and no means of updating them centrally. Mostly routine presentations are simple slides and so there is no great advantage compared to using linked web pages or a simple web based presentation system. Giving the audience the URL (web address) of the information means all they have to do is bookmark it. If anchors are set in the information and published the users can integrate precise bits of information into their own information systems with simple links. With the shift from desktop to the web these issues are becoming increasingly important in improving productivity.

There is still reluctance to acknowledge benefits when people have all their personal learning locked into older less efficient methods. This is why education for technological change is important rather than just teaching current established practice.

Handling and interpreting information in IT contexts, trends, rates of change and comparisons. Understanding trends will help in making better choices and improving productivity.

Information in formats that can be viewed and edited by free tools is more accessible to more people. Importance of open standards and the interests of particular commercial entities in proprietary standards.

Significant facts should be referenced to evidence. Many people providing information have a commercial interest. This includes the news media who will often distort facts to get a reaction to sell more news. Companies selling software and services will play up any advantages and keep very quiet about any disadvantages. Candidates need to be aware of the possible conflicts of interest behind the information presented to them enabling them to make better decisions that underpin improved productivity.

4. Copyright licensing and patent issues that affect information associated with common applications. Candidates will be expected to be familiar with commonly used file types and important open standards.

Examples: All candidates should be able to Identify key image file formats svg, jpg and png as open standards associated with web browsers. .psd as a common undocumented proprietary image format associated with desktop applications. HTML5 as an open standard including video playback. Flash video as a proprietary video file format. Describe the relationship between copyright and licensing. Illegality of using copyright material contrary to the license. Problems of long term access to information in “secret” formats and for interoperability of data between applications from different suppliers and the effect on competition. Referencing work and respecting trademarks. Balance between the

power given to copyright/patent holders compared to the power of the end-user. All these have a significant impact on risk and productivity.

In recent years licensing for sharing has become increasingly common. Whereas the traditional approach is to forbid copying without paying a license, removing such barriers can massively increase proliferation. Examples are the IBM PC hardware design, worldwide web, Wikipedia, web browsers, Android Smart-phones. Note, mostly these things are NOT copyright free, they are copyrighted but they are licensed for free use sometimes with conditions.

Association of common files such as .doc, .docx, .xls, .xlsx, .ppt, .pptx, .pdf, .eps, .html, .odt, .odc, .odd, .wav, .mp3, .mpg, .ogg, .mov, .wmf, .flv, .exe, .txt, .zip, .rtf, .mp4, .jpg, .png, .svg, .gif, .avi. with types of application is expected.

5. System of information flow starting with input of information, through processing the information to outputting results.

Examples: Providing information in an e-portfolio system, linking it to assessment criteria and providing self-assessment and passing it to an assessor, assessor returning it with feedback. This could be in any subject of the curriculum.
Listing the information sources needed for a homework assignment, explaining how they will be organised and how the final outcomes will be presented.
Gathering empirical data through data logging, processing it and presenting it in graphical form. Gathering data from the internet about two different software applications and processing and presenting the results to highlight comparative data.
Collecting survey data using web forms, processing it and presenting the results.
Issues in an information flow linked to interoperability of different components in the system. Efficiency in terms of the degree of automation in the process and the tools used (Too many people collect data in word processor documents even at national government level. It is simply bad and inefficient practice probably resulting from low

expectations in digital literacy and lock-in to dated methods and software) Macros, scripts and programs that improve productivity. Issues related to copyright and licensing of information in the system.

6. Costs of different applications, direct and indirect costs.

Examples: Putting information directly into web pages makes them available to anyone with a web browser and there are options to get free web browsers on free operating software. Putting information into e.g. MS Publisher and saving in .pub files makes it impossible to access the information without buying MS Publisher (and MS Windows). There are then license fees to pay for Publisher and the Operating System on which it is running.
Saving a drawing in svg format enables it to be accessed and edited using free software and displayed on the web. A drawing in .cdr format can only be reliably opened using Corel Draw.
Compare different aspects of costs to a company in procuring different applications and decide which is most significant. For example managing e-portfolios on a local server will need maintenance on the local server whereas managing an e-portfolio on an internet based server means no local server management. Training costs can be significant in changing working patterns. If short term costs are critical it will mitigate against the investment in training needed to support more efficient working practices in the future. Direct costs include software licenses, technical support to install the application. Indirect costs include the hardware to run the application, need for other associated applications e.g. anti-virus software, maintenance, mandatory upgrades that cost additional fees, technical support, training on new systems.

7. Target setting for IT projects. SMART targets, the importance of objectives and targets that can be rationally evaluated. Identifying resources needed for projects. Identifying critical success factors.

Examples: When producing a book and publishing it with its own ISBN using on-line publishing set specific targets at key points in the process. In the context of an e-portfolio recognise that providing 3 screen sized pages for 3 subjects by 31st July is a SMART target. Know that “produce

an e-portfolio to show employers" is an aim not a SMART target. "Critical to success of this project is access to the internet, a graphics editor that can produce .png files, an online content management system" these are critical success factors.

8. Specific characteristics of software to make choices of tools.

Examples: Using Inkscape as a design tool because it is free and is available on 3 major desktop platforms.
Use MS Word for documents because it is the only word processor available on the school network.
Use Google Docs spreadsheet because it can be used by several people in different schools at the same time working on the same sheet.
Using Portable Apps because they can be run from a USB key without having to install anything on the computer.
Use a content management system because it is easy to generate and edit web pages making them available to a wide audience.
Support for macro generators/programming to automate common processes.
Analysis of software applications to identify factors and attributes that support productivity and efficiency, including short, medium and long term effects.

9. Purposes and outcomes in ICT projects

Examples: Describing how a science investigation was presented on the internet.
Describe how they supported learning in their Ebacc subjects using IT.
Describing how they published their own book with its own ISBN.
Describing how they built a simple web site for a small business that did not have a presence on the internet.
General understanding of productivity issues coming from practical projects they have completed.

10. Key aspects of local "Acceptable Use Policy" and their purpose. Legal issues related to usage.

Examples: Not sharing passwords, being polite to other people in social/collaborative networks, not attempting to hack into the system or use other people's accounts. No bullying.
Reasons can include privacy, accountability, technical security against malware and general good manners.
How do constraints related to acceptable use affect productivity? Legal issues such as copyright and licenses. National versus International rules and regulations, which takes precedent?

Annexe C - Extract from coursework evidence portfolio

Example portfolio evidence used to support coursework assessment criterion.

Please contact the TLM Offices for exemplar materials

Building, deploying, training and supporting an open source collaborative system

1.1 Research possible needs in the local community to determine the scope of your project and work out the best support tools to use. Create a working plan from this material and use collaborative software to build in timelines and project management. Small teams can work together on each other's projects, provided it is clear that each person contributed to each piece and it is identified as such.

In most communities, there are primary schools, charities, clubs (sports or social) or small businesses that require tools to help them train their staff, educate their students or collaborate on work. Candidates can use free and open source tools such as Moodle or Owncloud to support this need.

1.2 Plan and create a learning site using Moodle or something similar in order to deliver learning materials to a small group of learners. Try to use a number of different learning materials such as text, images, documents, and videos. More advanced elements of the site can be used such as lesson modules for advanced learners. Alternatively, organise and deploy a dropbox and google docs replacement system using Owncloud.

1.3 Implement a working site and modify an existing site template to give your site a "house feel".

1.4 Deliver some material or allow access to self-learning materials and track progress for a number of weeks, interacting with users to assist them in their journey.

1.5 Train users to use or administer the site so that they can take control once the project is over

1.6 Present how to guides to the organization on the system and take any feedback and comments to act on improving the system.

Annexe D - Unit assessment – coursework guidance

The following is a brief summary of the main assessment elements of the Certificate.

The Course consists of 5 Units of work each of which approximate to 10-50 Guided hours. This amounts to 170-200 GLH Minimum—In addition, candidates will need to spend time in research particularly for the Real World Project, making a total of 230 hours TQT (Total Qualification Time)

Coursework when accepted through moderation will generate 30 marks and allow candidates to take the external examination.

The coursework will be met by satisfactorily completing the 2 mandatory units and two optional units to a Level 3 standard, as well as a mandatory real-world project unit.

Assessment	
Coursework Project (30 marks)	**Exam (70 marks)**
Cloud based mandatory units 8 marks	Cloud based mandatory units 56 marks
Working in the Real World 10 marks	Working in the Real World 6 marks
Optional units 12 marks	Optional units 8 marks

Mandatory (60 marks exam)

Cloud based services (50 GLH 5 credits)
Cloud based security (50 GLH 5 credits)
Working in the Real World (10 GLH 5 credits)

Optional units Assessed on the Project (6 marks per option) and (5 marks per option) on the examination

There are a large number of optional units available. For details, see the link here: https://theingots.org/community/ICT_qualification_info_units

The optional units range from 30-45 GLH each.

Project

Choose an area of interest which will allow you to demonstrate some of the skills and knowledge you gained from your optional units and use it in a work based situation.

You will be assessed on:

Making a Proposal and Teamwork
Planning
Research
Development and Testing
Delivery
Interpretation and Evaluation

Coursework Guidance (30 marks)

The candidate must produce a portfolio of evidence to show their knowledge and understanding for all of the units mandatory and optional.

The portfolio should contain the Real World Project.

Where evidence for the assessment objectives is not available through the Real World Project supplementary evidence should be included in the portfolio.

The format of this evidence is left to the assessor.

Assessor's guide to interpreting the criteria

Assessment Method

Assessors can score each of the criteria L, S or H.

N indicates no evidence and is the default starting point.

L indicates some capability but some help still required.

S indicates that the candidate can match the criterion to its required specification.

H indicates performance that goes beyond the expected in at least some aspects.

Candidates are required to achieve at least S on all the criteria to achieve the full award.

General Information

NQF general description for Level 3 qualifications

- Achievement at EQF Level 4 reflects the ability to identify and use relevant understanding, methods and skills to complete tasks and address problems that, while well defined, have a measure of complexity. It includes taking responsibility for initiating and completing tasks and procedures as well as exercising autonomy and judgment within limited parameters. It also reflects awareness of different perspectives or approaches within an area of study or work.
- Use factual, procedural and theoretical understanding to complete tasks and address problems that, while well defined, may be complex and non-routine.
- Address problems that, while well defined, may be complex and non-routine. Identify, select and use appropriate skills, methods and procedures. Use appropriate investigation to inform actions. Review how effective methods and actions have been.
- Take responsibility for initiating and completing tasks and procedures, including, where relevant, responsibility for supervising or guiding others. Exercise autonomy and judgement within limited parameters information and ideas

Requirements

- Standards must be confirmed by a trained Platinum Level Assessor or higher
- Assessors must at a minimum record assessment judgements as entries in the on-line mark book on tlm.org.uk certification site.
- Routine evidence of work used for judging assessment outcomes in the candidates' records of their day to day work will be available from their e-portfolios and on-line work. Assessors should ensure that relevant web pages and files are available to their Account Manager on request by supply of the URL.
- When the candidate provides evidence of matching all the criteria to the specification subject to the guidance below, the assessor can request the award using the link on the certification site. The Account Manager will request a random sample of evidence from candidates' work that verifies the assessor's judgement.
- When the Account Manager is satisfied that the evidence is sufficient to safely make an award, the candidate's success will be confirmed and the unit certificate will be printable from the web site.
- This unit should take an average level 3 learner 50 hours of work to complete.

In all cases assessors are advised not to assess units in isolation when there are logical links between units or indeed work in other subjects.

Unit assessment - coursework guidance

Level 3 Unit 40 - Cloud Based Services and Applications (5 credits)

1. Plan select and analyse the connectivity required for cloud based services and applications	2. Evaluate the account management and costs involved in cloud based services and applications	3. Analyse and evaluate the interoperability requirements and suggests solutions
1.1 I can describe the connectivity needed for cloud based services to work	2.1 I can analyse the requirements for account management	3.1 I can analyse system needs based on effectiveness and efficiency
1.2 I can analyse the connectivity needed to make cloud based services productive and efficient.	2.2 I can assess the needs of account management and recommend procedures and processes for optimal use	3.2 I can document and describe system needs to match outcomes
1.3 I can critically assess the needs of different devices needed to connect and use the cloud, including any limitations they might have	2.3 I can verify account management procedures are fit for purpose	3.3 I can describe and explain different file types relating to expected needs and outcomes
1.4 I can research and recommend applications for cloud based services dependent on needs	2.4 I can evaluate costs associated with cloud based access against requirements	3.4 I can describe and explain file extensions in terms of strengths and weaknesses
1.5 I can describe and evaluate the limitations on connectivity based on speed and expected outcomes	2.5 I can describe and recommend account management packages based on value for money and suitability	3.5 I can present my research and match my findings to the needs of different company needs and expectations
	2.6 I can use /evaluate different tools / control panels / portals to manage cloud based products	
	2.7 I can compare several different offerings and recommend the best one based on cost, services and account flexibility	
	2.8 I can use account management techniques in line with local guidelines and legal restrictions	

Expansion of the assessment criteria

1. Candidates will plan select and analyse the connectivity required for cloud based services and applications.

1.1 I can describe the connectivity needed for cloud based services to work

Candidates should be able to describe the main issues with connectivity when using cloud based services.

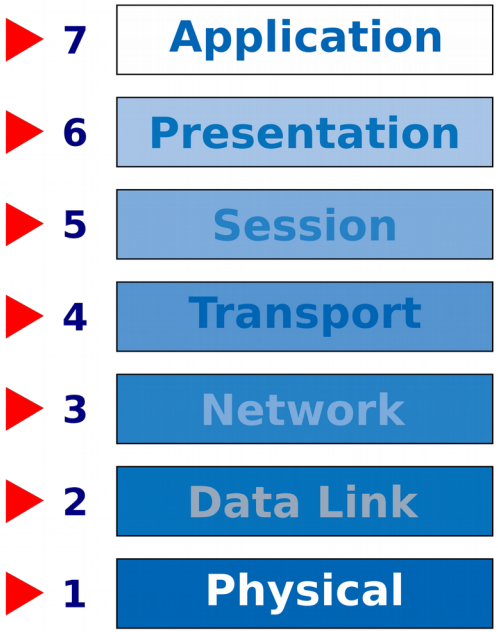
Evidence: will be provided directly from student portfolios and assessor feedback.

Additional information and guidance:
Learners should be able to demonstrate that they can research the possible options and find some detail about how they work in terms of performance. It would be useful if they can illustrate some of the elements that will affect connectivity, such as interference on wi-fi, contention levels or being in areas where there is little or no phone connectivity. Some indication of the required performance for specified tasks would be useful. If they want to get some HD video up onto their cloud based video server, then a poor quality 2G connection will not be suitable, so there is a need to plan around connectivity and how much impact it has on tasks overall. It might be useful for them to use this in conjunction with their project so that they may do a check-list of tasks required and describe the connectivity needs of each of these and discuss how they might be met, or at least mitigated. If they combine this with their real-world project, they can carry out some basic connectivity tests for a client and assess how well they work and what some of the main issues were (if any) that needed to be resolved.

One key issue of Internet connectivity that candidates need to understand is the importance of the OSI model.
https://en.wikipedia.org/wiki/OSI_model

The Open Standards Connection model has been used to make sure that devices working on the Internet, regardless of level and function, will generally be able to talk to each other. In this way, regardless of your initiating (sending) or terminating (receiving) device, it will generally work. Therefore, if you send an email from your Apple phone, it will pass through Linux or Windows servers and be presented to your friend on a Windows device and look pretty much the same as how you sent it.

The following is a standard diagram of the OSI from openclipart.org.



Candidates need to be familiar with the main functions and attributes of each layer, but do not need to know them in great detail. They should also understand what hardware or software usually operates at each layer and there are plenty of websites to explain this detail.

1.2 I can analyse the connectivity needed to make cloud based services productive and efficient

Candidates should be able to analyse the main features of cloud based connectivity and relate these to its effectiveness and efficiency.

Evidence: will be provided directly from student portfolios and assessor feedback.

Additional information and guidance:
Learners should be able to carry out some research into the different aspects of cloud based services and look at the ways that people use these, or might use these. They could carry out a simple survey in order to gather data to support their conclusions and guide their solutions. The key terms here might well be “productivity and efficiency”. Do people working in a local office really need some of the advanced features of a desktop based, full-featured word processor? How can you assess what their needs are and what package might meet them. Most companies are moving to the cloud as a cost saving exercise, but also for more efficiency. There is little or no training required if the word processor being used has only the basic features required. Candidates need to show this level of research and understanding. If systems are less feature rich, this might also translate into less connectivity needs. However, many organisations, such as primary schools, are moving to completely mobile systems. What are the connectivity requirements now?

1.3 I can critically assess the needs of different devices needed to connect and use the cloud, including any limitations they might have

Candidates should be able to assess in detail connectivity issues, including any limitations.

Evidence: will be provided directly from student portfolios and assessor feedback.

Additional information and guidance:
Learners should be able to demonstrate their complete understanding of the range of needs of connectivity for any organisation considering a move to the cloud. One key aspect which is sometimes overlooked is the use of responsive theme designs or sites that use elements such as Flash. As of 2016, Google and Apple will no longer support Flash with their browsers. What impact will this have on connectivity? How many organisations that develop material for devices are designing using HTML5 and what impact will this have on the functionality and usability of various devices. Are some devices more useful than others? What speed and range are required for different environments and how can these be accurately assessed. if limitations are recognised, what general considerations need to be made to address this weakness?

1.4 I can research and recommend applications for cloud based services dependent on needs

Candidates should be able to make realistic and reasoned recommendations to meet real needs based on solid research.

Evidence: will be provided directly from student portfolios and assessor or client feedback.

Additional information and guidance:
Learners should be able to match user needs to their clear understanding of applications. They will need to research in detail the different solutions and be able to accurately match these to perceived needs. In some cases, they may be able to make recommendations which exceed client's needs as they have been so detailed in their research and understanding. At Level 3 they would be expected to be at this level of professionalism. As with 1.3, it would be useful to deploy various techniques to assess needs such as surveys or interviews. In terms of applications, they should show that they do not rely just on manufacturer's claims, but research more widely and use opinions from forums and other social media sites.

1.5 I can describe and evaluate the limitations on connectivity based on speed and expected outcomes

Candidates should be able to describe and evaluate connectivity on a range of issues and relate these to expectations and needs.

Evidence: will be provided directly from student portfolios and assessor feedback.

Additional information and guidance:
Expected outcomes are often closely related to speed of devices and connections, though most people do not appreciate this. If someone is having difficulty viewing a video from a website on their hand-held device they will blame the site more than anything else, though the problem is more likely to be with their device and/or connection. Some people view videos and complain that they have an Internet connection problem when the server they are connecting to is probably an old system that can't deliver a fast enough data rate from it's old disk to satisfy the speed of video streaming. The Internet itself hides the fact that media rich content is passing through many, many disparate devices before it gets to the end user and any one of these could produce a bottleneck or cause issues. Candidates need to be aware of some of these restrictions and the impact they have when evaluating and describing connectivity issues. Any home user will tell you that the 8Mbit connection they are paying monthly for is rarely that fast, especially if they are in a busy area or more than 1km from the exchange. What are the realistic speeds and outcomes from 2G, 3G or 4G compared to wi-fi? What sort of speeds and connectivity quality can you expect from public wi-fi? What sort of considerations should designers of websites make for the variety of devices and speeds connecting to their sites? Should they cater for the LCD (Lowest Common Denominator)? A recent article asked if Windows 10 might have been significantly better if they had designed it for high-end computing equipment (like Apple does with proprietary and non-backwards compatible hardware) than trying to cater for legions of low spec old computers. Even with an 80Mbit fibre Internet connection, a low spec Atom computer still struggles with media rich websites.

2. Candidates will evaluate the account management and costs involved in cloud based services and applications

2.1 I can analyse the requirements for account management

Candidates should be able to demonstrate all of the key aspects of account management and the range of requirements.

Evidence: will be provided directly from student portfolios and assessor feedback.

Additional information and guidance:
There are a vast array of possible needs when it comes to cloud services, and although there are a number of basic types of account, the learners need to demonstrate that they have researched and understood as much as possible of the options. Some people will require very limited access to data and perhaps no real security or storage; others will require a sophisticated array of security elements, unlimited data and backup options and other services. How do we determine what is required and what does this do to the proposed service? Is there any aspects of account management that can not be met, if so, what is it and why? What are the key drivers that determine a user's account and what would they need to be advised when trying to organise a cloud based account for the first time? Much of the cost associated with cloud based services is related to the management of your account. The less you want to know about it and worry, the more you will need to get someone else to do that for you. Some people have multiple accounts for different purposes and many people use free online mail accounts for their "junk" accounts. What criteria do they use for their "premium" accounts?

2.2 I can assess the needs of account management and recommend procedures and processes for optimal use

Candidates should be able to work out what is required of different accounts, in terms of management, and recommend to clients how to optimise these.

Evidence: will be provided directly from student portfolios and client feedback.

Additional information and guidance:
Candidates should effectively, through their research and practice, be cloud based “super users”. They should be in full control of their accounts and know what their status is and have processes and procedures ready to deal with any issues. Many organisations, for example, offer free online storage, but it is restricted in the amount. If you use this up, but don’t want to pay for the next level of service, how do you manage your accumulated digital life? Although storage is relatively cheap, this is no real excuse for digital clutter. How do you assist people in managing their data and keeping it to workable levels, given the above example of needing to move it elsewhere. many service providers don’t charge for storing your content, but might charge a great deal for the traffic to and from your account. What technologies can you use in this instance and what options are available? Some systems organise digital artefacts in terms of content, although the blurring of social media systems these days makes it hard to know if the site you are using is for pictures, words or videos, or all three. It might not matter too much in terms of storage, but is it good to spread your digital material over several platforms? Does it really matter? If your system provider does not offer regular back-ups, how will these be managed? What are the sharing options and issues they will need to deal with.
It would be useful if candidates can get access to a linux based network as this will offer the easiest and widest range of account management experience. The Raspberry Pi is a cheap and easy way to achieve this.

2.3 I can verify account management procedures are fit for purpose

Candidates should be able to show effective account management based on a sound understanding.

Evidence: will be provided directly from student portfolios and assessor feedback.

Additional information and guidance:
Fit for purpose will perhaps be difficult to always understand, though if they have researched enough they should know what people require. Some sites that have different levels of access for users may be easy enough to work out and others can be adjusted to suit. In a popular blogging system like Wordpress, there are pre-set accounts that can be assigned. Are these obvious? They are Administrator, Editor, Author, Contributor and Subscriber. What is the difference between an editor and author? In addition, they have a super administrator as well, how does this differ. Candidates will need to research various systems and fully understand what these roles do and how to properly deploy them. Starting with some software site, like Wordpress, can be helpful here.

http://codex.wordpress.org/Roles_and_Capabilities

Once set up, they will need to be checked to make sure they do not give any extra access to the roles to make sure that security is tight. The above link goes into great detail about the access and responsibilities of these roles. Many systems will be similar, but candidates will need to show that in their own case they understand the wider issue of account management, as well as the more specific ones related to what they are setting up themselves.

2.4 I can evaluate costs associated with cloud based access against requirements

Candidates should be able to analyse the main costs associated with cloud systems and make informed recommendations as a result.

Evidence: will be provided directly from student portfolios and client feedback.

Additional information and guidance:
In their project work, candidates will be able to look in detail at the costs involved in moving to the cloud. They need to take “the long view”. In many cases with technology, there are some steep initial costs, but if you

look at it across 5 or 10 years, there are significant savings to be had. These types of detailed cost analysis decisions need to be explored. It is perfectly legitimate to conclude that it is not worth it for an organisation if there is sufficient evidence to back up the conclusion. Candidates will need to use spreadsheets and other analytical tools to compare and contrast all of the costs factors and look at both direct and indirect costs to make sure they get a complete picture. In a small number of cases, the company they are investigating for might be happy with additional costs as the benefits are significant in terms of productivity or efficiency. In this competitive world, the slightest edge over competitors can have a huge impact.

Some of the costs will be related to the set-up and ongoing costs, as well as other charges. Many cloud solution providers offer web pages where different parameters can be “dialed in” to see the potential costs.

https://www.cloudorado.com/cloud_server_comparison.jsp

2.5 I can describe and recommend account management packages based on value for money and suitability

Candidates should be able to analyse the main account management packages against criteria for value and whether they are suitable for the client.

Evidence: will be provided directly from student portfolios and assessor feedback.

Additional information and guidance:
Most cloud based systems come with a range of account management features. You can sign up for some free trials on some platforms (though Google requires a credit card which could be an issue).

There are multiple services that can be deployed, depending on the type of service needed and the type of user. Once the server or service has been deployed, there are then more detailed control panels for management. More traditional servers, or indeed virtual machines, offer account management via software such as CPanel or Webmin.

TLM partner organisations should be able to provide cloud based servers and control panels if candidates can't secure these themselves.
Most site also have some sort of documentation to help users.

http://aws.amazon.com/resources/

A useful overview of the main proprietary and open source systems is here: http://www.techmint.com/web-control-panels-to-manage-linux-servers

2.6 I can use/evaluate different tools/control panels/portals to manage cloud based products

Candidates should be able to use and appreciate the features of various control software systems.

Evidence: will be provided directly from student portfolios and assessor feedback.

Additional information and guidance:
Using some of the control panels and services listed above, candidates should be able to demonstrate their knowledge and competence with these to carry out a number of basic tasks such as creating new systems, managing data levels and general account management tasks. If they are carrying this out for a potential clients, it would be useful to create a table of strengths and weaknesses to back up any recommendations they might make. If candidates can try out a number of systems, they can get a better sense of what is on offer across the range and therefore make more informed choices based on practical experience.

2.7 I can compare several different offerings and recommend the best one based on cost, services and account flexibility

Candidates should be able to summarise all of their research and trial work and make recommendations.

Evidence: will be provided directly from student portfolios and assessor feedback.

Additional information and guidance:
Having looked at all of the offerings available and tried out the services on behalf of their client, the candidates should now be able to recommend their top choices. This could be in terms of value for money, or the one that is the most feature rich or simplest to use. This can be determined in advance by the client's needs. It may be useful to write it as a report and include some screen grabs and callouts to better show

that they are talking about or by carrying out a presentation with a shared screen.

2.8 I can use account management techniques in line with local guidelines and legal restrictions

Candidates should be able to work with systems in line with any rules about privacy and possible legal restrictions.

Evidence: will be provided directly from student portfolios and assessor feedback.

Additional information and guidance:
One of the key issues relating to cloud computing is that it is global. Most of the main cloud based companies, at least the big ones, are US headquartered. This can cause problems for us in the UK. A recent European law decreed that the European government no longer recognised the Safe Harbour agreement. This was an agreement between Europe and the US where Europe accepted that the US servers were safe to store data on European citizens and companies.

http://www.politico.eu/wp-content/uploads/2015/10/schrems-judgment.pdf

Since they no longer accept this, it means that UK companies can't really use US based servers. The US ones tend to be cheaper and more cost effective so it is something of a barrier. Candidates need to show an appreciation for these types of issues in their work and possible solutions. There are obviously many laws, for instance the Data Protection Act, that come into play when storing and exchanging data on servers which candidates need to investigate. If they set up a server and it is used for illegal activities, it is essentially the server "owner" who is responsible, so how they can they monitor for this and make sure they don't fall foul of the law?

3. Candidates will analyse and evaluate the interoperability requirements and suggest solutions

3.1 I can analyse system needs based on effectiveness and efficiency

Candidates should be able to show clearly what the system can achieve with examples of efficiency and effectiveness.

Evidence: will be provided directly from student portfolios and assessor feedback.

Additional information and guidance:
As students investigate various systems, they should become increasingly proficient at understanding the complex needs of the system and begin to be able to recommend the best ways to improve the system. The improvements will be in terms of how effective it will be or could be. Effectiveness is a qualitative term for the most part. Do the new features make it easy to complete tasks, is it more enjoyable to use and accessible for people with limited prior skills and knowledge. These types of issues will help to make the system work better and therefore be more effective. Issues of efficiency are more quantitative in focus. If the existing system takes a day of technical time to do a back-up, but only takes 5 hours on the cloud based system, this is a clear and visible measure of the efficiency gains. The terms do overlap to some extent and quantitative and qualitative labels should only be used as loose guides in working with this criterion. As long as the candidates written analysis has some examples to back up their claims, then this will be satisfactory.

3.2 I can document and describe system needs to match outcomes

Candidates should be able to write clear and unambiguous documentation to match their outcomes to requirements and needs.

Evidence: will be provided directly from student portfolios and assessor feedback.

Additional information and guidance:
In most projects and investigations, there is a basic need set at the outset. Most candidates will set themselves these types of needs. For example, the basic need to go further in education will require an outcome of 3 good A levels. The candidates can then set about a plan on meeting this end goal. The same applies to system analysis and development. Candidates need to look at existing systems and determine some of the areas of weakness (criterion 3.1 above). This information will give them clear objectives to meet and if these have been discussed with the client, meeting these objectives should satisfy the needs. In some cases, clients will be unaware of what is possible, so will need some clear and understandable guidance. Therefore, the need for clear documentation in this process can not be overstated. The documentation should set out the agreed needs, show analysis and examples of how these should be met, and end with some conclusions about how well these were met.

3.3 I can describe and explain different file types relating to expected needs and outcomes

Candidates should be able to show a good understanding of the range of file types required.

Evidence: will be provided directly from student portfolios and assessor feedback.

Additional information and guidance:
The overall analysis will indicate different tasks within the system and these tasks may well require different data types. For example, most LAMP based data management systems will have a web based front end for the collection of data, this will use HTML, XML or PHP file types. The data collected will be stored and analysed as part of a database which will likely be an SQL type of system. The data will need to be output and

presented in other forms for people to understand and look at so this could be some type of document or portable document type and these may well contain graphic elements such as PNG or SVG files. This level of detail will need to be shown in the documentation and planning process of the candidate's work and will show that they understand the micro and macro elements of system design and analysis.

3.4 I can describe and explain file extensions in terms of strengths and weaknesses

Candidates should be able to detail the different file types deployed in their solutions and list their attributes that make them suitable or not.

Evidence: will be provided directly from student portfolios and assessor feedback.

Additional information and guidance:
The different characteristics of file types and extensions are important for good system reliability and functioning. It is also important to have an awareness in terms of system longevity. the recent announcements by Google and Apple to no longer support Flash based videos is an example of making sure you appreciate what is occurring in technology and as much as possible make your system designs future proof. One advantage of using open file types and standards is there is more chance that they will continue to be developed and supported and will work with other existing open standards. Candidates should show this level of awareness when describing the files they are using in their designs and investigations.

3.5 I can present my research and match my findings to the requirements of different needs and expectations

Candidates should be able to professionally present their overall findings.

Evidence: will be provided directly from student presentations and assessor feedback.

Additional information and guidance:
Once they have completed all of their research and analysis, they should be in a position to present their material to their client. The presentation should be professional and cover all of the main areas of interest to the client and not be overly complicated. The client can investigate their findings in more detail in supplementary documents and links. The presentation should convince the client of their solution and they should be prepared to answer questions and get some critical feedback in order to improve their offering.

The reasons will probably vary as much as the clients themselves, but some common themes are likely to be:

1. **Cost** - does it save the client money? It does not have to be an instantaneous saving and could be something relating to TCO (Total Cost of Ownership) and take several years to be realised.
2. **Usability** - if a small company can use the account management system and not have to rely on external experts to assist them, this is a significant saving in time and money.
3. **Security** - is the backup and storage of their data regular and secure? Is it monitored so that there is always a reliable copy that can be retrieved? The more you pay, the better the future proofing and it is like insurance, it costs a lot, but nowhere near as much as if you don't buy it and have a disaster.
4. **Future-proofing** - is the solution likely to be around and improve over time or will the cloud company be gone in 3 years and leave you with no access to your valuable data. Some cheap hosting packages use old operating systems and do not update them for you. If you use front-end software that requires up-to-date versions of key software like PHP, you might not always get it or have to struggle to install it yourself.
5. **Support** - is there plenty of help on technical issues or is it all DIY. Most cheaper are that way because the help is via you

reading lots of books and web pages or using public forums. This might be enough, but perhaps not for all small businesses.

Level 3 Unit 41 - Cloud Based Systems and Security (5 credits)

1. Analyse and describe the key elements of cloud based systems	2. Describe and assess the data management needs for cloud based systems	3. Critically evaluate the security aspects of cloud based systems
1.1 I can describe and compare the main hypervisors used to deliver cloud computing	2.1 I can evaluate the key hardware and software required for big data solutions and describe how it is used	3.1 I can analyse and research the main threats to cloud based systems
1.2 I can describe the main systems used for cloud based use and list their main features	2.2 I can analyse the data requirements of different situations	3.2 I can describe the threats to cloud based systems and give examples
1.3 I can analyse the features of the main cloud based systems and services	2.3 I can describe how the data needs of different companies and usage will affect the data needs	3.3 I can describe and recommend ways to minimise threats to cloud based systems
1.4 I can assess the strengths of the cloud based services on offer and give clear examples to illustrate my conclusions	2.4 I can describe the different types of data management system available	3.4 I can describe the laws which affect cloud based services
1.5 I can asees the weaknesses of the cloud based services on offer and indicate ways to minimise the impact of these problems	2.5 I can assess the strengths of data management systems and recommend the best in terms of effectiveness and efficiency	3.5 I can describe the licenses and their impact on cloud based services
1.6 I can evaluate cloud based services and systems against desktop based systems	2.6 I can evaluate data management and attempt to predict future trends	3.6 I can evaluate the impact of laws and licenses on the development of cloud based services
	2.7 I can analyse the legal implications of cloud based data storage and retrieval	

Expansion of the assessment criteria

1. Candidates will analyse and describe the key elements of cloud based systems.

1.1 I can describe and compare the main hypervisors used to deliver cloud computing

Candidates should be able to describe the key features of hypervisors.

Evidence: will be provided by portfolios and reports as well as assessor feedback.

Additional information and guidance:
Candidates need to describe the main hypervisors on the market and compare some of their features. They need to define what a hypervisor does and what it needs to do. This will then determine some of its features. Most hypervisors are management systems which take a host machine and create spaces inside the machine to allow it to run other machines. Students can explore how this works by installing the hosted hypervisor software VirtualBox and running a guest system on it. If their main machine is windows, they can get a Linux OS disk and run the entire Linux system inside their windows machine. As far as the guest system is concerned, it has access to all of the host machine's resources.

https://www.virtualbox.org/

There are TLM videos on how to use this here: http://mediadrop.tlm-test-server.co.uk:8081/categories/open-systems-management

Some useful eBooks can be downloaded here: http://ubuntu.cloud/

1.2 I can describe the main systems and hardware used for cloud based use and explain their main features

Candidates should be able to describe the purpose of their work and why using IT adds value to it in some way or ways.

Evidence: will be provided directly from the presentation of work in web pages that has clear purpose and describes the purpose of the work.

Additional information and guidance:
Candidates might describe the audience at which they are targeting their work and any aspects of the work that makes it particularly suitable for the audience e.g. "I presented a science investigation using a web page with links to references so that a future employer can see the quality of my work simply by knowing the URL". "I used a public web page to collaborate with my friends in producing an information page about the local environment because it enabled us to work together effectively. It also made it easy for other people to contribute and made the results easy to link to other similar sites". They should be able to fully explain the key characteristics of writing formally on a web page to present part of an e-portfolio as opposed to the style used for chat and instant messaging of friends. The candidate will show evidence of understanding relevance in relation to purpose. Information that is irrelevant to a task will not support its purpose and inaccurate or biased information could be against the purpose. The main difference between Level 3 and Level is that in Level 3, the quality of explanation needs to be explicit and clarity of understanding, whereas in Level 2 it is enough to describe the purpose e.g. from a list of options or other supporting structures. Their documented web pages, blogs and/or files should contain detailed explanations in keeping with the guidance here.

1.3 I can analyse the features of the main cloud based systems and services

Candidates should be able to show a detailed understanding, through research, of the main features of cloud based systems.
Evidence: will be provided by portfolio work and assessor feedback.

Additional information and guidance:

Candidates need to explore and comment on the services that are available for cloud based systems. It would be useful to have a table or report like format where they identify the main elements and give some detailed descriptions of what they do and why they are included in any package. Features will include things such as the amount of support available, the types of services in terms of range so that they can be compared and contrasted across providers. What sorts of policies and procedures back up their offerings. What is the overall scope of the features and what would a service be like without them. How quickly can the system scale and contract for needs. How much can the user do on their own and how much requires an intervention from the company that runs the service. Candidates can download and analyse a company's SLA (Service Level Agreement) and see what level of quality they can expect.

1.4 I can assess the strengths of the cloud based services on offer and give clear examples to illustrate my conclusions

Candidates should be able to draw clear conclusions from their research and analysis.

Evidence: will be provided by portfolios and feedback from assessors and clients.

Additional information and guidance:
Candidates should be able to use the information they gather to make informed decisions. If they are working with a client to recommend cloud based services to them, for example to replace an office based server with a cloud one for email, they need to be able to give clear justifications backed with evidence. Much of the material provided will be marketing material which is sometimes exaggerated in order to make sales. If they read around the topic enough they should be able to separate some of these myths from reality to make good choices. What is a strength and how might it be measured? What reference points do they need to use to assess these strengths?

1.5 I can assess the weaknesses of the cloud based services on offer and indicate ways to minimise the impact of these problems

Candidates should be able to document and comment on the aspects of cloud computing which are not quite fit for purpose.

Evidence: will be provided by portfolio work and assessor feedback.

Additional information and guidance:
As with all things in life, nothing is entirely a perfect match for your needs. Cloud computing has many strengths, but also has some weaknesses, though this really depends on your perspective. A weakness does not always mean that the service is not right and it could be that a work-around is required. Candidates need to show that they understand the nature of the services on offer to such an extent that they can recommend their use with some caveats. It might mean that they recommend a compromise which has most of the benefits of a cloud based solution, but the user has to accept a few issues that can't be overcome. An example here might be that the client has huge data storage needs, but little in terms of traffic and processing power. It might be that the candidate will recommend that the user has to download and archive data regularly in order to benefit from the other services, without incurring extra charges for their data storage, assuming it can be archived without disruption to what the company offers. It may be that the best service on offer is US based and because of EU restrictions, the client needs to keep personal data on a local server while still using the cloud services for their main needs.

1.6 I can evaluate cloud based services and systems against desktop based systems

Candidates should be able to offer clear and detailed examples of a side by side comparison of some key services of cloud versus local.
Evidence: will be provided directly from portfolio evidence and assessor feedback.

Additional information and guidance:
In most cases, cloud based servers are virtual machines that are hosted in data centres around the world. Companies that offer cloud systems have large physical servers themselves, but the resources of these systems are pooled and combined across multiple data centres to offer flexibility and scalability. Therefore, if you purchase a cloud based server, it should be the same as having one in the office next door. What then are the differences? Is there a way to compare like for like between the two systems? One example might be in terms of storage. If you have your own local server, adding storage and extra memory is relatively easy as you can physically add them. With cloud services you only really pay for what you use, so you would only need to pay for this when required. having said that, the cost of storage and memory might be relatively high in comparison. A basic Cloud Server from most providers would cost (in February 2016) as little as £8 per month for a 1 CPU, 2GB RAM, 25GB storage device. To double all of these resources would be only £16 and £30 for quadruple. To buy a server yourself would be expensive if you bought a proper system and not just a desktop PC with lots of RAM and drive space. However, adding a 1TB of storage to your own server would be less than adding 50GB to the cloud server. The other issue is even with fast broadband, you will not get the access speed of a proper Tier 1 data centre.

A table or report comparing these features and giving some examples will be required for this criterion.

2. Candidates will describe and assess the data management needs for cloud based systems.

2.1 I can evaluate the key hardware and software required for big data solutions and describe how it is used

Candidates will need to list and evaluate in detail the main components of a system with reference to the needs for big data.

Evidence: will be provided by reports and assessor feedback.

Additional information and guidance:
Candidates should at first define what big data is in order to set the scene for how the needs of it can be achieved. As an example of the scope of big data, in 2012 alone 2.5 exabytes of data were created every day. That is 2,5,000,000,000,000,000,000. Every single device around us is Internet aware and capturing and transferring data. The idea with big data is that if this can be analysed, companies and governments can determine trends and act on them. This volume of data, however, requires massive computing power, storage and transfer capabilities and other aspects which are beyond most traditional servers. In most cases, it can only be fully managed by using parallel processing, so pooling the resources of 100s or 1000s of computers together.

Candidates at this level should be able to define the hardware and evaluate how effective it might be, as well as looking at some aspects of the software involved. They do not need to have an in depth understanding of the more detailed aspects of functionality. They should be able to give some detailed examples to illustrate their findings however and there are plenty of examples around such as weather predictions or epidemiological studies of health trends etc.

2.2 I can analyse the data requirements of different situations

Candidates should be able to describe the requirements of a range of situations.

Evidence: will be provided from portfolios and assessor feedback.

Additional information and guidance:
Candidates should be able to work with different organisations and be able to take some details from them about overall usage and from this determine their data needs. The key determinants will be traffic requirements and data storage needs. An email server requires hardly any processing power, though it may require a great deal of data storage capacity if the email needs to be kept for a long time. Schools offer real challenges in terms of cloud based services as they have 100s of logins

at peak times which requires processing power. If a school has a web based system that all staff and students need to use, they will have very high levels of **concurrency**. At certain times of the day, i.e. the first lesson in the morning and afternoon, virtually every computer will be trying to login to the system. The web software and database that manage this system will be dealing with all of these people wanting the same resources at the same time. The server will be in overdrive to cope. In contrast, a system such as a social media site may have millions of users, but they will not all be active at the same time so the server needs will be very different. candidates need to give examples such as these to illustrate data needs in order to process and manage data in different circumstances and for different purposes.

2.3 I can describe how the data needs of different companies and usage will affect the data solutions

Candidates should be able to describe the range of uses of data.

Evidence: will be provided from portfolio work and client feedback.

Additional information and guidance:
Candidates need to expand on 2.1 and add some extra details about specific usage of data. Is the data need for a great deal of analytics, therefore the data has to be processed regularly and reports generated, or is the data just required to be stored and backed up regularly for archival reasons. These different data needs will determine the types of systems and services needed for the job. Candidates should be comfortable enough to make basic recommendations of system solutions based on some data needs as this will drive the required solution given.

2.4 I can describe the different types of data management system available

Candidates should be able to describe a range of data management tools.

Evidence: will be provided by reports of reflective journals.

Additional information and guidance:
Some common examples of data management systems will help to illustrate the range of ways that data is used. For example, many companies that are sales based use a CRM (Customer Relationship Management) system which tracks all of the details and interactions of possible customers (leads) and actual customers. Most candidates will be familiar with school and college based MIS (Management Information System). These are used to store personal information about students and also information about their time-tables and upcoming examinations. There are many other examples and candidates just need to describe some of their main features and give examples of their use, especially focussing on what they are designed to do with data.

2.5 I can assess the strengths of data management systems and recommend the best in terms of effectiveness and efficiency

Candidates should be able to give examples from different systems and rate these in terms of fitness for purpose and expectations.

Evidence: will be provided by reflective journal entries and assessor feedback.

Additional information and guidance:
Candidates can explore different data management systems and look at their main strengths. Do they deliver on what they say? A good resource here is the open source software testing site: http://www.opensourcecms.com/
Candidates can log in and test these systems as an administrator and as a user and see their features.

What makes a system effective and efficient?

Most cloud based systems, for example Facebook, Amazon and eBay, run on Linux servers. Candidates should be familiar with the LAMP stack (Linux, Apache, MySQL, PHP) or similar for these types of services.

https://en.wikipedia.org/wiki/LAMP_%28software_bundle%29

One of the world's biggest companies that not many people know about is Oracle who make large scale databases. Some of these organisations need to be investigated and evaluated.

2.6 I can evaluate data management and attempt to predict future trends

Candidates should be able to make an informed judgement from their studies about data management.

Evidence: will be provided by blogs or reflective journal entries.

Additional information and guidance:
Candidates have explored the current trends in data management and looked at the issues such as big data. In their opinion, backed with some examples, where do they see the industry heading in the next 5 or 10 years. This is the sort of information that is important for when they work with clients. Should their clients use cloud computing now, or should they wait and see. Are some of the problems with security and ownership such that it is never worth the effort?

2.7 I can analyse the legal implications of cloud based data storage and retrieval

Candidates should be able to write in detail some of the legal considerations around cloud services.

Evidence: will be provided by the project, reports and assessor feedback.

Additional information and guidance:
One key strength of cloud computing is also a relative weakness in some ways. One of the main concerns that companies have, particularly companies dealing with very private data, is who actually owns it? Recent issues have being aired in Europe where all of the cloud based companies, at least the larger ones, are US based. The European government accepted that their servers were safe enough to manage European citizen data, but no longer. If a company you use for cloud services goes bankrupt and closes down in a short space of time, how do you get your data back? These are some of the issues of this situation and candidates need to reference some of the laws and frameworks which currently govern data storage and retrieval.

3. Candidates will critically evaluate the security aspects of cloud based systems.

3.1 I can analyse and research the main threats to cloud based systems

Candidates should be able to demonstrate a good level of understanding of security issues.

Evidence: will be provided by a report or portfolio.

Additional information and guidance:
The cloud is an always on and always accessible service and now has some of the biggest, and therefore most valuable, data in the world. It therefore is a natural target for organised crime and disaffected people with computing skills. In a way, the threats are no different to your own home threats, but the sheer scale of the problem is different and the reward for hackers huge. Recent articles in the media highlight the scale of issues where companies such as telephone companies can lose millions overnight due to the lack of confidence in their security. Problems experienced by TalkTalk in late 2015 turned out to be not as bad, scale wise, as first predicted, but the damage financially through lack of confidence in the company as a result of the leak was irreversible.

other potential threats in terms of finance could be in the compromise of systems such as the stock exchange systems. if people managed to hack into the London Stock Exchange system, they could cause billions of pounds in damage. If people hack into cloud based systems used by something like hospitals of airlines, they could cause mass deaths and panic. The high stakes involved in cloud based systems and services means that the threats are constantly monitored. Just recently a security flaw was found in some Linux code. Since Linux systems run 80% of the Internet and most mobile phones this is a large scale problem. The key point about open source is that these problems are found and then fixed, in proprietary systems, you rarely find out.

The threats to systems are generally: physical, hardware or software based.

1. **Physical** - most damage to systems is caused by internal personnel. They may be disgruntled or have other issues with the company and cause damage or disruption from the inside. Most companies, such as ISPs, have high levels of checks on personnel and even clients who use the centres need to go through very thorough checks before they can enter the centre to work on their own servers. If possible, it would be useful for schools or colleges to organise a visit to an ISP or large company to see the security on offer.
2. **Hardware** - hardware protection can be physical, in terms of locking servers in rooms or having padlocks on their side panels to prevent tampering, but also can be machine based such as physical firewalls or putting servers into demilitarized zones which prevent hackers getting past. Servers can also be used as decoys or “honeypots” to trick hackers into hacking the wrong devices.
3. **Software** - Software protection will come from systems such as intrusion detection software or rootkit detectors. It will also be anti-virus and malware software.

3.2 I can describe the threats to cloud based systems and give examples

Candidates should be able to describe in detail the main threats they find in their research.

Evidence: will be provided directly from their portfolios of work and assessor feedback.

Additional information and guidance:
Candidates need to detail and give examples of the main threats. Some of these include: data breaches, data loss, hijacking of accounts or services, poor quality middle man data files (APIs, libraries), Denial of Service attacks, disgruntled employees, abus (using the cloud servers as a large scale attack device), poor customer understanding and shared problems (since many services share the same underlying machine, if that is compromised, a large scale problem will occur).

3.3 I can describe and recommend ways to minimise threats to cloud based systems

Candidates should be able to describe the processes and procedures which will help to reduce the items identified in 3.2.

Evidence: will be provided directly from a report or portfolio.

Additional information and guidance:
Candidates might describe how the items they identified in 3.2 can be minimised or avoided and tie these two criteria together. Useful reports exist on the Internet as guides and most cloud based services will have support materials as guidance.

3.4 I can describe the laws which affect cloud based services

Candidates should be able to describe the main laws and legislation which currently affects services in the cloud.

Evidence: will be provided by portfolio work and assessor feedback.

Additional information and guidance:
Candidates need to give a detailed overview of the law as it currently stands and give their view on the usefulness. Many commentators show that the evolution of the Internet and cloud based services is moving too fast for the slow moving legal system to react effectively.

http://www.isaca.org/Groups/Professional-English/cloud-computing/GroupDocuments/DLA_Cloud%20computing%20legal%20issues.pdf

The above document shows that the laws apply to different levels and services in cloud based computing and are not always straight-forward. As long as candidates can show a good appreciation of the legal issues and some reasoned conclusion, this will cover the criterion.

The other key aspect of the cloud is that it crosses borders and what might be acceptable practice in one country is not in another, but who is responsible? What is a company's legal responsibility for data and information?

3.5 I can describe the licenses and their impact on cloud based services

Candidates should be able to describe the different kinds of licenses that help cloud service work. They can give examples of open source and proprietary ones.
Evidence: will be provided directly by their portfolio work and general reports.

Additional information and guidance:
The vast majority of cloud based services run on free and open source hardware and software and the Internet itself has grown exponentially as it adheres to open standard and protocols. Candidates should describe and reflect on some of these licences and give examples of what part

they play in the growth of cloud based services. The Linux operating system allows companies to quickly and cheaply deploy many servers and then offer cloud based hosting, though they still need some of the peripheral software and hardware, some of which may require proprietary licenses. Some of the control panel software in free and open source, but some isn't. What advantages does this offer for the growth and longevity of cloud systems?

3.6 I can evaluate the impact of laws and licenses on the development of cloud based services

Candidates should be able to reflect and comment on the various laws and licensing issues that help or hinder cloud systems.

Evidence: will be provided by reflective journals and assessor feedback.

Additional information and guidance:
Candidates can summarise much of their findings in this section by saying what the current situation of cloud systems is in regard to laws and licenses and what possible future impacts there might be. If some of the main software used were to become proprietary and therefore expensive, would this help or hinder growth? Is the growth so fast now that customers will accept the extra charges associated with paid for software? Will it be dictated by the quality of the offering, regardless of price? The current battle between the European courts and US companies has an impact on the use and uptake of some services and could greatly hinder cloud systems. If laws become much stricter on the responsibility of cloud companies for the data they have, i.e. they become legally liable for any terrorist activities that take place on their servers, will this limit the expansion of so many providers?

Unit 42 - Project Work - General Guidance

For the project work, it is expected to take place with real clients and situations that will enhance the real world aspects of the material. Throughout the process, the candidates will be assessed on their ability to carry out meaningful work; working individually and as part of a team.

Marks for the project elements will be awarded as: 1 makes an attempt, 2 shows competence, 3 demonstrates flair.

Learning objectives	Learning outcomes
1 Research and plan a real-world project to apply my theoretical knowledge in a practical way	1.1 I can state the aims and objectives of the project 1.2 I can show a real need for the project undertaken 1.3 I can define the client base 1.4 I can provide a list of alternative solutions 1.5 I can evaluate the alternatives
2 Analyse the service and security requirements for the project to be a success	2.1 I can identify the service requirements for the project 2.2 I can identify the security requirements of the client 2.3 I can produce an outline plan for the project
3 Describe the applications and data requirements needed in line with client needs and expectations and to cope with scaling and flexibility	3.1 I can identify a range of hardware and software solutions 3.2 I can explain the limitations and cost implications of each solution to the client 3.3 I can describe the backup and disaster recovery processes to ensure system stability
4. Produce a project based on my research and understanding to meet the client's needs	4.1 I can produce a working system to meet the client's needs and objectives set out in the planning process
5 Recommend services and applications to meet client needs.	5.1 I can evaluate the solution with respect to the client budget 5.2 I can test and evaluate the solution to meet the client's needs 5.3 I can evaluate the solution with respect to local conventions and legal requirements

Expansion of the assessment criteria

1. Research and plan a real-world project to apply my theoretical knowledge in a practical way.

1.1 I can state the aims and objectives of the project

Candidates should be able to clearly set out their overall aims and objectives in relation to their project.

Evidence: will be provided by portfolios and reports as well as assessor feedback.

Additional information and guidance:
Candidates need to set themselves some clear and achievable targets for their project. They can use some SMART targets in order to get some clarity. There will be some generic aims, such as making a system user friendly, as well as some more specific quantitative aims such as the system carrying out a certain operation in under 10 seconds etc. The clearer these are in the beginning, the easier to project will be to complete. It will be worth the candidates working closely with clients or other team members to make sure they agree to the set aims and objectives. The can carry out interviews or hand out questionnaires to the main stake-holders to make sure they introduce the features that users actually want and need.

1.2 I can show a real need for the project undertaken

Candidates should be able to show through examples that their project meets an actual need.

Evidence: will be provided by portfolios and reports as well as client feedback.

Additional information and guidance:
Working closely with a client will ensure that the final project plan, including the above aims and objectives is properly “signed off” and the client agrees that this project will help them in some way. If the client is unsure or not sufficiently tehnical to appreciate exactly what they require, then the candidates need to be comprehensive and convincing in their evidence and conclusions. They should show some confidence in their ability and understanding.

1.3 I can define the client base

Candidates should be able to clearly show the range and complexity of who will use their solution.

Evidence: will be provided by project, portfolios and reports as well as client feedback.

Additional information and guidance:
The candidates need to do some extensive research to make sure that everyone who uses the system or might use the system is catered for, at least within the scope of what they are hoping to achieve. If they are making a small sales system for a local business, then they need to be aware that a range of people will use the system in different ways. Some people will just be searching the system for name and contact details, others will be entering data and will need a different set of tools, others will be interrogating the system to get reports.

By writing a definition of the client based and describing what they need and how it might be achieved, it will help the project be more defined and easier to complete.

1.4 I can provide a list of alternative solutions

Candidates should be able to detail some options and recommendations.

Evidence: will be provided by portfolios and reports as well as client feedback.

Additional information and guidance:
In some cases, the candidates might recommend some other system which is beyond their abilities as a solution. As long as they back up their conclusions with quality evidence, they will still be helping the client. An example here might be in recommending a number of CRM systems to a client. The candidates might recommend Drupal as a system since they are most familiar with this. However, they may have explored Sugar CRM as part of their research work and recommend that they did not have time to learn it, but felt it was a better system for the client to give them some future proofing. Similarly, they may have trialled Salesforce and recommend this even though it is an expensive proprietary system. This knowledge is still invaluable to many clients who don't have the time or expertise to make these conclusions.

1.5 I can evaluate the alternatives

Candidates should be able to evaluate and scale alternatives for reference.

Evidence: will be provided by portfolios and reports with tables.

Additional information and guidance:
Linked closely with the above criterion, candidates should show a reasonable depth of research and analysis to back up their recommendations and claims. The candidates will be familiar with certain tools in their day to day IT use, but should try and explore alternatives and test them as thoroughly as possible. They may not want to use them, but they need to be objective and look from the client's perspective. Some graphic applications may be very powerful and the candidates can use them efficiently because they have done so for a number of years, however, clients might not be able to pick them up and have time to learn them to this level, so they need something as a transition package.

Candidates can put together a table of comparative features and give examples of these features against each other with some examples.

2. Analyse the service and security requirements for the project to be a success.

2.1 I can identify the service requirements for the project

Candidates should be able to give some detail of the range of services they are trying to improve as part of this project.

Evidence: will be provided by portfolios and reports as well as assessor feedback.

Additional information and guidance:
The service requirements of the project will vary depending on the overall scope. If it is a minor change to an existing system it may just require an overview presentation of the new features and some basic documentations. If the project is a significant change from the previous system, then candidates might need to carry out some training and short-term support of the client, as well as some nominal help desk features, in order to help them transition. As with some other criteria here, the idea is to show what will be required through an initial investigation in order to better plan for time and other resources. many large scale public projects come undone because the developers and planners have not fully anticipated the services required from the outset and they are then very difficult and expensive to turn around.

2.2 I can identify the security requirements of the client

Candidates should be able to detail the main security issues for investigation and development.

Evidence: will be provided by portfolios and reports as well as client feedback.

Additional information and guidance:
Security is increasingly becoming the central focus for any project. The more connected we become, the more incentive there is for people to control or damage our systems. The nature of the project will determine the style and level of security, albeit very few organisations will not want quite high levels. There may be specific legal issues that dictate what candidates need to deploy. For example, if they are assisting a local primary school, they need to be extra vigilant about personal information being available, whereas if they are producing something like a website for a local charity, then it is more an issue of preventing it from being hacked and stopped. Security concerns can also be physical ones, such as who can have physical access to hardware and software. Once the range has been identified, the requisite solutions can be recommended and later tested and developed.

2.3 I can produce an outline plan for the project

Candidates should be able to fully plan what they intend to do, how and when.

Evidence: will be provided by portfolios and reports as well as assessor feedback.

Additional information and guidance:
Once candidates have gathered all of their research materials and begun to think about all of the solutions in different areas, they can begin to put it together as a more formal plan. They can set out their aims and objectives, and associate some provisional timelines to these. They can use some aspects of SMART targets to give themselves milestones and markers to work towards. The plan should include some idea of resources required and some of these may require time to get or develop. If they need to use a new piece of software or hardware to solve the issues, this will need to be learnt and mastered to some degree.

The plan will be in outline at this stage because it is likely to change as problems are encountered and dealt with and as expectations change

based on what works and what doesn't. having a plan will give a clear focus to the work ahead however.

3. Describe the applications and data requirements needed in line with client needs and expectations and to cope with scaling and flexibility

3.1 I can identify a range of hardware and software solutions

Candidates should be able to list and define the range of hardware and software they are likely to need and use.

Evidence: will be provided by portfolios and reports as well as assessor feedback.

Additional information and guidance:
This is part of extending the planning and development of the project and beginning to look in detail at the resources. In most cases, it will be documenting the hardware and software required and giving some idea of why and how it is to be used. As with other criteria here, the level of detail will depend on the project as some will require a great deal of detail and possibly client training, while others will just require some detail listing how they will be used. If the project is using Internet based services, e.g. setting up an internal web server for a client, then probably a hardware upgrade to a more robust router and firewall will be needed. They may also need to look at making the software more secure and use elements such as SSL certificates. All of this will need to be discussed and determined.

3.2 I can explain the limitations and the cost implications of each solution to the client

Candidates should be able to give details for the client to make informed decisions.

Evidence: will be provided by portfolios and reports as well as client feedback.

Additional information and guidance:
In many cases, the most expensive may well be the best, but it depends on many factors. Many companies continue to use something like Microsoft Office because they are most familiar with the way it works. However, the later versions of Office tended to include additional features that 90% of companies will never use and the interface became more complex to reflect the way people used devices. Is this a necessity? Most free and open source office software includes all of the main features of Office. The main thing they lack is the ability to deal with complex formatting and some macro functions but these are very specialised and few people use them. Therefore, recommending this type of system will be better as a solution and more cost effective. if companies insist on expensive and proprietary systems, they need to be aware of licensing costs and support costs over the lifetime of the product or TCO (Total Cost of Ownership). is the candidate's solution the best on all of these issues?

3.3 I can describe the backup and disaster recovery processes to ensure system stability

Candidates should be able to describe the way the system will be protected in the medium and long term.

Evidence: will be provided by portfolios and reports as well as assessor feedback.

Additional information and guidance:
Building a system is only the beginning of the process of making it work and be accepted. The one thing which is often overlooked is the scaling and longevity of the system. If the system has time sensitive data or data that is required to be kept, such as a school, how will this be managed? What is the best way to guarantee the company can get the data they need when they need it? Recent tests have shown that CDs and DVDs

only last 5-10 years. IDE based hard drives are not supported as well on modern computer motherboards as SATA interfaces have replaced them. If people put important data on these types of media and require them at a later date, they may be disappointed to find they are no longer available. Technology moves along very quickly and the system will need to build in, as far as possible, this future proofing.

What provision will the candidates use for disaster recovery? The incidence of flooding is becoming more prevalent and as data becomes more valuable there will be higher levels of theft. How can a company get back their data? Studies show that companies that lose their data tend to fold very quickly, so disaster recovery is imperative. The cloud is a good option, but the large companies can be quite expensive initially, but small companies can disappear quickly without warning.

Candidates need to address these concerns and offer workable solutions as much as possible.

4. Produce a project based on my research and understanding to meet the client's needs

4.1 I can produce a working system to satisfy the client's needs and objectives set out in the planning process

Candidates should be able to put all of their research and planning together to make it work.

Evidence: will be provided by a working project and assessor and client sign-off.

Additional information and guidance:
Much of this will be produced in other criteria, but the simple outcome for this criterion is a working project.

5. Recommend services and applications to meet client needs

5.1 I can evaluate the solution with respect to the client budget

Candidates should be able to assess how well they kept their solution within the demands of a client budget.

Evidence: will be provided by portfolios and reports as well as client feedback.

Additional information and guidance:
An important skill and consideration is working towards some type of budget. Most solutions will cost something in terms of resources and costs (such as wages). In this case, the cost might be in buying some hardware or software that they recommend for their solution. They need to show that they considered costs and worked with the client towards sticking to some agreed amount. If they were over or under, it would be useful here, or in the next criterion, to consider why.

5.2 I can test and evaluate the solution to meet the client's needs

Candidates should be able to make sure the solution works as expected.

Evidence: will be provided by portfolios and reports as well as assessor feedback.

Additional information and guidance:
Once the system is built, a series of tests of functionality and performance can be carried out against the targets set out in the planning stages. Is it as easy to use as expected? Does it solve the issues that the client identified with the candidate in the beginning? Does it exceed what the client wanted? If they set out a series of clear test markers, they can evaluate the solution against these and then recommend further development or ways to refine the system if it does not meet expectations. There is no such thing as a perfect system so this is an important phase in the life-cycle of a project.

5.3 I can evaluate the solution with respect to local conventions and legal requirements

Candidates should be able to show how and why they worked to legal requirements and local ways of doing things.

Evidence: will be provided by portfolios and reports as well as client feedback.

Additional information and guidance:
Many companies will have their own policies and procedures and ways of working and candidates need to show that their system adhered to these where appropriate. Some companies that are publicly funded and controlled might also be subject to very strict legal guidelines and conventions, so some analysis and evaluation of these needs to be shown in the working of the project.

Annexe E - Examples of unit combinations

Examples of unit combinations to achieve 24 credits at Level 3

The Level 3 Certificate requires 24 credits or more. These credits must be at Level 3. The examples below are possibilities for Level 3 and assessors are free to use any combinations of units that include the 3 mandatory units to provide sufficient credit. There are more details in the qualifications section of the web site and assessors are encouraged to discuss choices with their Account Manager. **All units require the mandatory Cloud based units and the real world project for 15 credits**.

Example 1 - Level 3 - Computing emphasis

Setting Up an IT System	- 5 credits
Specialist Software (e.g. Java, Python)	- 4 credits

Example 2 - Level 3 - Media emphasis

Video Software	- 4 credits
Audio Software	- 4 credits
Imaging software	- 5 credits

Example 3 - Level 3 - Internet emphasis

Using Collaborative Technologies	- 6 credits
Networking Essentials	- 5 credits

Example 4 - Level 3 Generic IT

Setting Up an IT System	- 5 credits
Optimise IT System Performance	- 5 credits
	- 3 credits

Example 5 - Level 3 Design and Technology

Understanding social and environmental impact of architecture and engineering construction - 5 credits
Imaging Software - 5 credits

These are just examples to illustrate the flexibility for assessors to use their professional judgement to best fit courses to the needs of their learners.

Annexe F - Useful links and supporting information

These qualifications are based on the national occupational standards for IT Users (NOS). eSkills designed a framework for qualifications based on the NOS called ITQ. There is more information on e-skills web site under ITQ. The link to this is
http://www.e-skills.com/standards-and-qualifications/it-user-qualifications---itq/

TLM learning site www.tlm.org.uk has a wealth of supporting information and practical tools for managing evidence, progress tracking and reporting. These are all free for participating schools. Contact TLM for further details or training if required.

TLM web site supports multiple languages and it is not very difficult to provide new translations. If you want to teach in the context of a modern foreign language it is possible and we will provide support where we can.

Making the transition from existing qualifications

It is rarely necessary to abandon all of the courseware of existing courses. The flexibility of the ITQ approach means that most centres find they can map current learning to the ITQ criteria or at least a great majority of them. This means that you can start gently and at more or less any time in the year. All we are interested in is the assessment outcome, the process to get there is up to the Principal Assessor and colleague assessors in the centre. So we can start by using evidence already available or in existing systems and you can decide for yourself how quickly you transition to TLM's evidence management if at all. We are not a software company trying to sell you technology, we are simply providing tools to make administration of our quality assurance service more convenient to users. If you think a different system is better for you, you are free to use it. All we need is ready access to evidence supporting the assessment criteria.

Annexe G - Coursework assessment flowchart