

The specification for
**TLM/NAACE Level 2 Certificate in
Open Systems IT Management**

Ian Lynch



Naace



This is version 1.0 of the specification for TLM/NAACE Level 2 Certificate in Open Systems IT Management developed in partnership with the National Association for Advisers in Computer Education, the Open Source Consortium of Companies and the Linux Professional Institute. While providing a general qualification in its own right, referenced to the European Qualifications Framework through the UK RQF, it can also be used to prepare students for the Linux Professional Institute Exams.

© Ian Lynch 2014 Some rights reserved. You may copy some or all of this publication under the terms of the Creative Commons AttributionShareAlike license 3.0.

The assessment model for the qualification presented in this publication was designed by TLM in consultation with other awarding organisations, schools, OSC and NAACE. It is designed to be inclusive, low in administration and suitable for informing general competence as well as differentiating knowledge and understanding.

The Learning Machine Ltd, Unit 4D Gagarin, Lichfield Road Industrial Estate, Tamworth, Staffordshire, B79 7GN (www.theingots.org)

Contents

1. Introduction and purpose	Page 4
2. Summary of the Qualifications Specification	Page 7
3. Qualifications Content	Page 10
4. Assessment	Page 14
5. Other Considerations	Page 24
6. Employer input	Page 26
7. Grade Descriptions	Page 27
Annexe A – Example Examination	Page 29
Annexe B – Units and guidance	Page 37
Annexe C – Summary of units and assessment.	Page 71
Annexe D – Links and supporting information	Page 72
Annexe E – Coursework assessment flowchart	Page 73
Annexe F – Open Standards and Principles	Page 74

1. Introduction and purpose

- 1.1 This new and innovative qualification provides the quality assurance for learning in the expanding market for technical skills in managing computing systems and networks running free and open source software. It is a “Substantial Vocational Qualification” as classified by the DfE in England for post 16 study. It also prepares the candidate for the Linux Professional Institutes’s “Linux Essentials Examination”, a global qualification not included in the UK national qualifications frameworks. This in turn provides progression to the higher level LPIC1 and LPIC2 professional exams.
- 1.2 This is a substantial Level 2 Vocational Qualification of 150 guided learning hours. It is designed for students that want to work as systems or network managers in organisations deploying Posix based infrastructure. This includes Linux, and BSD derivatives such as Mac OS. A typically related standard occupation code is 3131 Administrator, computer. The content of the qualification is specifically related to the tasks required to administer computer systems running open source network operating software. While not mandatory, a Level 1 or equivalent qualification in computing, computer science or IT will be an advantage and candidates should have achieved or be realistically in the process of achieving at least grade Cs in mathematics and English at GCSE. There is more about the purpose of the qualification on the community website in the qualifications section at https://theingots.org/community/endorse#Purpose_LPI.
- 1.3 There are two assessment components. One requires the candidates to demonstrate practical competence at RQF Level 2 in managing computer systems and networks including employer input. The other is designed to grade the students' on knowledge and understanding in the field. There is a clear intention to reduce the bureaucratic overhead on teachers while preserving the benefits of practical coursework in authentic workplace situations to maintain the validity of practical assessment essential to any rigorous approach to practical and vocational skills and activities. We have demonstrated that we

can provide Level 2 qualifications that are accessible to all learners while still differentiating the top performing students leaving informed routes to further academic as well as practical learning.

1.4 This qualification enables coverage of a wide range of the general background knowledge, understanding and competences needed for systems management. It is different from computer science and IT qualifications with the former targeted on computational thinking and its relationship with the fundamental workings of software and hardware and the latter focused on using IT applications to support general work. Taking qualifications in either of these related complementary fields will strengthen the learner's digital competence and potential skills transfer. This qualification is about whole systems maintenance and management and aimed specifically at network managers and technicians that look after digital infrastructure. They will benefit any young person aspiring to progress into a career in managing digital systems or adults needing to shift careers, perhaps moving from obsolete careers to the professional IT sector. While anyone with a reasonable educational background at Level 1 will find this qualification accessible, those that have taken TLM/NAACE computing and IT qualifications at Entry Level, Level 1 or Level 2 will be best prepared with background learning.

1.5 This specification has the following key benefits.

1. Provides a progression route from generic L1 and 2 qualifications related to digital technologies pre-16.
2. Devised in consultation with the National Association for Advisers in Computer Education, the OSC industry trade body and the global Linux Professional Institute.
3. Clear and flexible unit based structure referenced to the European Qualifications Framework (EQF).
4. Straightforward assessment of competence in real rather than contrived contexts.
5. Grading through simple controlled on-line exam.
6. Provides a focus for continuing professional development for teachers through moderation/verification feedback.

7. Moderation/verification of coursework on demand.
8. Unrestricted examination opportunities per year.
9. Reduced bureaucracy for teachers and flexibility for them to target specific interests.
10. Use of open source cloud based technologies to reduce costs and add value for schools.

1.4 These qualifications lend themselves to formative assessment practices allied to 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 a short academic style examination of related knowledge and understanding.

1.5 All candidates must complete the coursework including employer assessment before being eligible to take the exam. This provides an incentive to complete the coursework and makes it less likely that those sitting an exam are ill-prepared.

1.6 The exam grades candidates across a range from Pass through Merit and Distinction to Distinction*. Level 2 coursework is assessed directly against criteria interpreted in the context of the general RQF level descriptor for RQF level 2. If coursework is completed to the Level 2 standard the candidate can go on to take the examination which will provide grading.

1.7 In this way we can provide valid competence based assessment and rigorous testing of knowledge and understanding at a lower cost than both traditional vocational and academic methods applied separately. If replicated across schools and colleges it would potentially save significantly on current expenditure on assessment and examinations as well as freeing more time for teachers to teach.

2. Summary of the qualifications specifications

2.1 This Level 2 certificate is graded across 4 levels from Pass to Distinction* with Distinction* the highest grade equating to 80%+ of the available marks and a pass equating to a minimum of 50%.

Content

2.2 The qualification content is based on the industry defined needs for systems management and contextualised in open source software. It is a qualification designed to enable learners to meet the needs of employers, through consultation with the Open Source Consortium of Companies, Linux Professional Institute, NAACE partner companies and Mirandant partner companies. All of these organisations have a need for computer systems support and all deploy Linux based systems. Guidance for coursework is aligned with the CBI employment criteria. Guidance takes into account the lack of experience of many teachers in this area ensuring that the most academically able students can be stretched and routed to appropriate employment routes or academic progression at Level 3 or a directly vocational route such as the internationally recognised Linux Professional Institute exams and Red Hat Certified Engineer exams. The links with NAACE and its professional development activities provide the potential for low cost staff development and keeping teachers up to date in what continues to be a rapidly changing field. Unlike purely academic qualifications, regular reference is made to practical open standards and the use of real equipment rather than simulations or generic terms only. There is an emphasis on increasing understanding of the importance of open systems in keeping with recent Cabinet Office policy. See Annexe H.

Assessment

2.3 The qualification at Level 2 has two assessment components with each component covering the full qualification content.

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 knowledge and understanding that underpins user competence.

Both of these assessment components cover the full range of content as far as it is validly assessable by the particular method. There are 70 marks available from externally set externally marked assessment and 30 marks from externally moderated internally assessed coursework.

2.4 The qualification consists of 3 units. Units have credit values in the regulated qualifications framework (RQF). A minimum of 15 credits is needed equating to 150 Guided Learning Hours. Each unit is designed to be 5 credits and 40 GLH.

The synoptic examination of knowledge and understanding that is used for grading is based on a syllabus related to **all** the available criteria in **all** units. The design does not allow candidates to compensate for weak coursework by doing well in the exam only. The coursework guarantees a minimum standard of competence across all the learning outcomes and the exam grades performance based on knowledge and understanding. Candidates must complete the coursework to a satisfactory standard at the level to be eligible to take the examination. It is likely that candidates with a satisfactory coursework performance will at least pass but that is not inevitable and they must take the the exam to pass overall. 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 learners judged to be satisfactory on coursework yet failing to gain sufficient marks in the examination flags up a need for further investigation and will help prioritise CPD.

Summary of the rationale

2.5 The assessment is specifically designed to motivate learning that will support the highest grade(s) attainable by each candidate. Learners must demonstrate competence across all units before being eligible for the examination with both coursework and exam covering the entire subject

content. There is considerable flexibility in context enabling individual interests to be explored in depth while giving all a thorough grounding across the content. Those that have completed the coursework 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 general knowledge and understanding in the more academic sense. There is scope to include weaker candidates while fully stretch the brightest and most academically orientated leaving open progression route for further academic study for those that have the potential.

Aggregation of marks

2.6 Level 2 candidates will gain 30 marks from providing coursework evidence that meets the Level 2 assessment criteria as determined by their assessor with independent moderation/verification samples. They are then eligible to take the the examination which provides a further potential 70 marks. If the candidate achieves a total score of 50 marks from the coursework and the examination they will be awarded a grade pass. For 60 marks or more pass with merit, for 70 marks or more pass with distinction and for 80 marks pass with distinction*. In this way those candidates that are potentially able to cope with academic work at Level 3 will be identified, as will those more likely to benefit from further practically based study at Level 2 or Level 3. The examination questions get progressively more difficult and those achieving the highest marks will demonstrate the required knowledge and understanding for level 3 work. All those that pass can be fairly judged to have gained level 2 competence which is sufficient for an assisting role in network or systems management. With two or three years more practical experience and progression to Level 3 and beyond, the candidate will be competent to take over management of smaller straight forward network installations.

2.7 One resit of the the examination is permitted before claiming the final award.

2.8 If the school or college is part of a TLM subscription model that covers these qualifications they 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.

3. Qualification Content

3.1 The qualification is made up from units in the Regulated Qualifications Framework (RQF). It is founded in the syllabus for the **Linux Professional Institute Linux Essentials Examination** and will therefore prepare learners for this international qualification as well as the TLM Ofqual regulated qualification. The RQF is referenced to the European Qualifications Framework (EQF), the largest system for referencing nationally accredited qualifications in the world. Unit credit is designed to be compatible with the European international credit transfer system ECVET. The units were designed by TLM in collaboration with teachers currently working in the classroom, NAACE, the Open Source Consortium of companies and the Mirandanet global community. In order to provide learners with the skills needed by employers, especially the small and medium sized enterprises that employ 60% of the private sector workforce. Extensive consultation with small business leaders has taken place. The qualification provides the grounding needed for future systems administration professionals in the IT industry. Specialist vocabulary supports technical English at a level beyond that of most adults.

Key subject aims

3.2 The overarching aim is to enable learners to become competent managers of computers and networks at a level where they can provide useful assistance to experienced network managers and those responsible for managing computers in general. Learners will broaden their understanding of technical open systems so they are better equipped decision makers in a technological age. Those seeking careers in digital technologies will have an appropriate grounding in open systems technologies to enable them to make rational decisions about their progression routes into employment in this sector.

Subordinate aims include:

1. developing the knowledge and skills needed for employment.
2. gaining practical experience needed to underpin lifelong learning.
3. increasing the knowledge needed to transfer skills and understanding between technically based contexts.
4. reinforcement of learning in the core subjects of English, mathematics and science.
5. developing practical skills in creativity and problem solving in technological contexts in operational environments.
6. developing an understanding of their place in the community and society.
7. developing safe, secure and responsible attitudes to working with other people.
8. developing the skills to working collaboratively with IT.
9. developing knowledge in the field of critical evaluation and feedback related to technical systems.
10. developing an understanding of open systems and the dangers of lock-in to specific proprietary technologies.

Knowledge and understanding

3.3 The following knowledge and understanding will be required to support learning. The level of understanding needed is in keeping with the QCF general description of the qualification level.

Demonstrate knowledge and understanding associated with the following terms related to systems management in an open source context:

3/4G, acceptable use policy, analogue, Android, Apache OpenOffice, Apache software license, application, apt-get, Audacity, Avidemux, bandwidth, Bash, beta, binary code, BIOS, boot, boot device, boot loader, BSD license, Bus, C++, Calc, Chart, chgrp, chmod, chown, Chrome, client, cloud, desktop, command line, commercial open source, compatible, compiler, contention, copyleft, copyright, cp, CPU, Creative Commons license, cross platform, CUPs, data, deb, Debian, desktop, Desktop recorder, Dia, digital, digital lock-in, directory, distro, DNS, Draw, Embedded, encryption, e-safety, exe, executable code, fibre optic, file, file

properties, fileswitch, filesystem, filetype, Finger, Firefox, firewall, firmware, Flash memory, FLOSS, format, FOSS, Free Software foundation, Gedit, GIMP, Gnome, GNU, GPL, Graphical User Interface, GTK, GUI, Hard Drive, home, Impress, information, Inkscape, interface, Internet Explorer, interoperable, iOS, IP address, IPv4, IPv6, Java, javascript, KDE, Kwrite, lib, library, LibreOffice, license, license, Linux, local area network, login, Lookup, malware, man, mobile, mv, MySQL, Netmask, network bottleneck, OpenShot, open source, open system, operating system, operating system kernel, OSI, package manager, partition, Perl, permissions, PHP, Ping, pixel, Port, Portscan, PostgreSQL, proprietary, Proprietary application, protocol, proxy, python, Qt, RAID, RAM, RaspberryPI, RDP, Red Hat, release candidate, repository, RJ45, rm, ROM, root, router, rpm, Safari, Scribus, script, SD card, SDRAM, search, search engine, security, security update, server, software as a service, software cycle, software freedom, software package, software platform, Source code, Sourceforge, spam, SSD, strong password, subsystem, Sudo, super user, Suse, switch, System Settings, tar, Transmageddon, Ubuntu, URL, USB, user directory, UTP, validity, versioning system, virus, web server, Whois, wide area network, widget, terminal, wifi, Windows, Writer, YouTube, zip.

3.4 Candidates will be expected to demonstrate knowledge and understanding related to the learning outcomes and assessment criteria in Annexe B including the guidance there. The examination questions in Annexe A provide an illustration of the ways knowledge and understanding will be assessed under controlled conditions.

3.5 Opportunities are provided to support the following skills, the great majority of which will be assessed directly in coursework in valid contexts in keeping with the criteria.

1. Diagnose network problems
2. Set up boot priorities and sequences
3. Set up system security
4. Assess system security for risk
5. Solve problems systematically and rationally.
6. Think creatively, logically and critically.

7. Communicate data and information in a form fit for purpose and audience.
8. Evaluate their own and others' work and roles in teams and in computing projects.
9. Adopt enterprising approaches to new situations.

Unit contents

3.6 The unit learning outcomes and assessment criteria are presented in Annexe B below with some examples of how to interpret 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 as these become available. NAACE/Mirandanet and OSC members are invited to make contributions under Creative Commons licensing to promote sharing and improvement of the resources.

- 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”. 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.
- We also encourage coursework to be carried out in valid and real contexts rather than as contrived simulations. Practical competence is best assessed in context. All assessors must sign an agreement to uphold standards and feedback from moderation/verification will support consistency.

3.7 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.

3.8 The use of the community learning site is optional at no additional cost. It provides 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 and reports that can be shared securely online with parents. 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. As far as possible we want assessment of real tasks in real contexts that are truly representative of a real working environment. This is a fundamental goal for the competence based assessment at the heart of the Qualifications and Credit Framework and European Vocational Education and Training policy (ECVET). It is the way in which most employers will judge the effectiveness of individuals in their tasks at work.

3.9 Telephone and e-mail support is available to all Centres. There is a general convention of firstname.secondname@theingots.org 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.

4. Assessment

4.1 Evidence has to be provided against the unit assessment criteria from realistic practical tasks related to the learners' everyday work. This is likely to be from specialist lessons related to managing computer systems technologies but can and should include evidence from other sources

including non-formal learning as long as the assessor vouches for its authenticity. This is a complex field for level 2 study so as much supervised practical experience as possible with reinforcement of key principles is the priority. The way evidence is gathered is up to the assessor, the only requirement is that it clearly supports the judgements made against the assessment criteria and the relevant learning outcomes in keeping with the general level descriptor and is endorsed by the assessor to be the candidates' own work. If on moderation the account manager finds gaps in evidence related to a particular candidate they will request more evidence before approving the security of judgements in relation to the assessment criteria and learning outcomes. Assessors must then adjust their work to ensure all their learners are providing the appropriate level and breadth of evidence and in keeping with the level 2 descriptor at [http://readonpublications.co.uk/pdf/Qualification%20and%20Component%20Levels%20\(RQF\),%20Ofqual%202015.pdf](http://readonpublications.co.uk/pdf/Qualification%20and%20Component%20Levels%20(RQF),%20Ofqual%202015.pdf)

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 at the right level. (and not over-kill). In this way we can maintain standards while supporting improved efficiency.

4.2 Synoptic assessment has become a popular term. In essence all the coursework assessment is potentially synoptic in that the evidence provided is in the working context against a range of mandatory assessment criteria underpinning the learning outcomes for the unit in the context of a synoptic level descriptor. Competence can and should be evidenced through projects and activities that draw upon all or large subsets of the content. Synoptic evidence of competence to a minimum value of 20 credits across the four units is mandatory. This equates to a minimum of 150 guided learning hours, 40 hours for each 5 credits in 3 units and 30 hours for 5 credits in unit 4. Dividing into a unit structure is for convenience and compatibility with international conventions for referencing national qualifications frameworks and to enable credit transfer eg 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 linearly in sequence. We encourage the use of the flexibility provided to target

particular interests of learners to motivate them in persevering in difficult areas to up the level of expectation in cognitive development.

4.3 Level 2 learners will have the capacity to tackle academic style questions requiring explanations and more detailed understanding and insight as well as carrying out direct practical tasks. Grouping learners is up to the school but the design enables maximum flexibility. Differences in attainment in knowledge and understanding will be evidenced in the grading exam at the end of the course which goes across all four mandatory units.

Progression and inclusion

4.4 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.

4.5 In most cases the competence profile of a learner is “spikey” and so some evidence will be sufficient for the level above providing hooks to it. This also encourages able candidates to “go the extra mile” in areas of particular interest. Such organisation is up to the assessor and Centre policy locally, the qualification design simply enables this. It is **NOT** about simplistically dividing the curriculum into discrete units to be minimalistically ticked off and then forgotten. The terminal exam can not be passed until the coursework is completed to a satisfactory level and that exam is synoptic across all the assessment criteria and supporting content.

4.6 These strategies can make this Level 2 certificate more accessible to a wider range of candidates if progression routes are planned earlier. Unit certificates provide shorter term goals and also recognition of practical competences demonstrated even if academic exam performance is weak.

4.7 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 with a progression route from where they end up to higher levels. This inclusion is achieved without sacrificing rigour for the highest attainers since the questions in the examination targeting the Dist* grades can be as difficult as necessary without risking weaker candidates dropping out of a grade altogether. There is also the option to take the Linux Professional Institute Exam that is internationally recognised.

4.8 Beyond Level 2 it is possible for Level 2 units to be converted to Level 3 by candidates if they provide evidence that is clearly at the higher level. For the highest attainers this provides an accelerated route to Level 3 so that they are not just marking time.

4.9 Coursework, particularly at Level 2 should reflect useful and meaningful activities. We want to encourage work that reflects contemporary society and the free tools and technologies that enable ALL individuals to contribute, not only those that can afford to. Projects lend themselves to cross-curricular work supporting raising attainment in other subjects, numeracy, literacy and information skills. It is far better to learn through creating original work (or original remixes of other people's work) that has a real and practical purpose than to do simulations or theoretical exercises and that is fundamental to TLM's coursework philosophy.

4.10 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. Work smarter not harder!

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. There are no moderation deadlines except for the end of a course. TLM operates an on-line system for coursework moderation and a policy of moderation on demand. Most academic syllabuses are divided up into sections. That is no different in practice to labelling the sections units. There is no requirement to assess units at a particular time and the terminal exam goes across all units. If most evidence is provided at the end of the course across all units why is that any different in principle from a controlled synoptic terminal examination? 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, the scope of unit based qualifications organised in a levelled framework provides a better support for progression when the unit content and structure is designed for that purpose. Where qualifications are opportunistically designed to simply target one level in a terminal examination that is only representative of a subset of the learning, 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 descriptor. 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. The competence based component of these qualifications is intended to provide a baseline consistent with the level. Grading is achieved by a terminal examination. This means we can match the assessment method to the aspect of attainment such that we cover all aspects of learning but we also provided reliable differentiation that can accurately inform progression routes for individuals and do it by the most efficient means.

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

Written 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 eg 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 such 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

4.11 The purpose of the examination is primarily for grading. The details of the way grades relate to marks are provided above in section 2.

Weightings

4.12 There are two 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.

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.

4.13 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.

The synoptic examination provides a terminal summary of the knowledge and understanding directly related to the unit learning outcomes and assessment criteria. It uses the content definitions in section 3, designed to be broadly representative of the aspects of the learning outcomes testable in a written controlled examination. The examination provides a means of testing associated knowledge and understanding, powers of analysis and reasoning and of grading the qualification whereas the coursework ensures that there is basic competence in their practical implementation in real and relevant contexts across the range of the subject matter.

4.14 The examination is weighted 20% AO1 and 80% AO2. The coursework is weighted approximately equally across AO1, AO2 and AO3.

4.15 The overall weighting of the objectives varies depending on the grade because for higher grades AO2 contributes a greater proportion of the marks. This is a deliberate strategy because AO2 is the most important learning when it comes to academic learning at Level 3 and higher. The assessment will therefore better inform progression pathways while still having the characteristic of inclusion.

At level 2.

Pass approximately weighted AO1 - 50%, AO2 - 30%, AO3 20%.

Dist* approximately weighted AO1 - 30%, AO2 - 60%, AO3 10%

4.16 This then provides evidence that the Grade Dist* candidate is likely to be more suited to future academic study whereas the Pass Grade candidate is likely to find it difficult to cope with courses highly dependent on academic testing. We are preparing learners for competence in particular working tasks required of systems administrators but also leaving routes open to higher levels and further academic study because individual progress is very difficult to predict based on prior performance.

Learner entry and costs

4.17 TLM/NAACE subscription model enables schools to enter learners at times convenient to them. There are no late entry fees This can reduce costs to the Centre by more than 50% when compared to similar vocational qualifications. 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

4.18 The examination is delivered on-line through a secure web user interface that requires no software installation. It 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.

Examination timing

4.19 The exam will be available on demand subject to a minimum of 6 weeks notice. It is the Centre's Principal Assessor's responsibility in line with the agreement signed with TLM to ensure that security is maintained for the examination. No candidate should have prior access to the questions in an examination paper either directly or indirectly, before they sit the paper. We 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 the examination once if they have not claimed a qualification based on a previous result.

Linux Professional Institute Examination

4.20 The LPI Linux Essentials Examination is available to any candidate. It is provided by the Linux Professional Institute. The main difference between it and the TLM/NAACE assessment is that the TLM/NAACE assessment is designed to meet all the specific requirements of the regulators in England and Wales and involves assessing practical coursework as well as a terminal examination. TLM/NAACE questions are likely to be more generic than those in the LPI exam but overall the assessment content and structure is suitable for supporting both. The LPI examination is under the control of LPI, is international and does not require any particular national regulatory framework or conditions. It is a separate entity belonging to LPI and therefore out of the control of UK accredited awarding organisations. Centres can contact TLM for details of how to take the LPI examination or they can contact LPI separately.

Internal standardisation of coursework

4.20 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

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

4.22 Certificates can be authenticated directly online 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.

5. Other considerations

Access arrangements and special requirements

5.1 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/ofqual_policies RQF D2

Centres should contact TLM if they have any questions related to accessibility issues.

Language

5.2 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 and some cultural alterations will be needed. TLM will actively support any work in this line that can be shown to cover costs.

Malpractice

5.3 TLM has comprehensive policies and procedures for dealing with malpractice. These are documented with links on the web site at https://theingots.org/community/ofqual_policies RQF A8 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

5.4 TLM promotes equality of opportunity through policies and procedures. These are again documented in detail on the web site at https://theingots.org/community/ofqual_policies RQF D2

Resources, support and training

5.5 A clear goal of this qualification is to enable learners to become increasingly able to support their own learning and to reduce dependency in order to become “lifelong learners”. The information technology revolution makes this progressively easier and as far as possible we encourage the use of technology and up to date methods especially those based on empirical evidence.

5.6 TLM encourages the use of Free and Open Source applications to reduce costs and to further inclusion. All of the key software applications needed to support any of the assessed units are available freely from the web including operating systems, supporting tools, office suites, graphics and sound editing. As a nation we could save hundreds of millions if not billions of pounds in software licensing fees by providing users with the skills, knowledge and confidence to migrate to free and open source applications. YouTube, OpenClipart.org, Wikipedia and many other sites provide free content that supports learning and the number and range of such sites is increasing. Please use them.

5.7 Any numerate, literate and information savvy youngster with the motivation to learn can probably get to PhD level entirely using free resources **IF** they are highly digitally literate as well as literate and numerate in the more conventional sense. The mission of TLM and its qualifications, is to increase take up of learning by empowering the learners to enter a training and qualifications market on their terms at a price that they can afford. This qualification is specifically designed to aid entry into the digital professional employment arena with an emphasis on systems management.

6. Employer input

6.1 Centres must provide each candidate with a minimum of 1 day working alongside a professional systems or network manager. This professional must assess the candidates competence against at least 3 of the criteria and agree them with the assessor. This is a mandatory requirement before the candidate is eligible to take the grading exam.

7. Grade Descriptions

A **Distinction** 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 systems management.

7.2 They apply knowledge, understanding and skills to a variety of situations, 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. They work creatively exploring and developing ideas. They adopt systematic approaches to safety, promoting secure and responsible practices.

7.3 They use scientific methods to analyse problems such as control of variables and observations to identify needs and opportunities. They set hypotheses in relevant contexts and critically analyse and evaluate the knowledge they gain. They review their own work and that of others making supportive and constructive criticism where appropriate. They communicate effectively, demonstrating a clear sense of purpose and audience.

A **Pass** 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 well-defined tasks and address straightforward problems. They take responsibility for completing tasks and procedures and exercising autonomy and judgement subject to overall direction or guidance.

7.5 They use understanding of facts, procedures and ideas to complete well-defined tasks and address straightforward problems in supporting their learning. They interpret information and ideas related to the social and commercial impact of their actions, showing awareness of the types of information that are relevant to their areas of study. They identify, gather and use relevant information to inform their actions and make judgements about how effective their actions have been.

7.6 They work safely and securely, identifying key risks, taking reasonable actions to avoid them. They collaborate in reviewing their work evaluating the way they and others use IT and they take positive actions to improve. They use IT to communicate, demonstrating consideration of purpose and audience.

Annexe A - Example examination Level 2

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 units and cover all 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 2 as defined by the RQF global level descriptors. Each multiple choice question is worth 1 mark and the last 4 questions are worth 10 marks each.

Questions

1. Software freedom is mostly about
 - a) Not having to pay for using software.
 - b) Applications that run on Linux.
 - c) Being able to see how software works and share it.
 - d) Being able to criticise companies that own software.

2. GNU/Linux is sometimes called free software because
 - a) It is much less expensive than iOS or Windows.
 - b) It is not tied to any particular hardware set up.
 - c) It is supported by a wide international community.
 - d) It has a license that is in keeping with freedom.

3. A good way to distribute open source software is to.
 - a) Put it on the Sourceforge web site.
 - b) Divide it into parts and zip them into separate files.
 - c) Sell it on ebay.
 - d) Attach it to a virus so it spreads quickly.

4. An essential difference between the GPL and Apache software licenses is.

- a) The GPL makes you contribute back any improvements you make under the same license.
- b) The GPL allows you to convert open source to closed source software.
- c) Apache licenses are only legal in the USA.
- d) Apache licenses are closed source licenses.

5. Which of these is not a large scale open source project?

- a) Linux kernel development.
- b) Google Drive development.
- c) Apache OpenOffice project.
- d) Libre Office Project.

6. Ubuntu and Android are both

- a) Operating systems based on the Linux kernel.
- b) Owned by Google.
- c) Only useful on mobile devices.
- d) Licensed with the Apache license version 2.0

7. Applications that run on more than one operating system are referred to as

- a) Proprietary applications.
- b) Neutral applications
- c) Windows applications
- d) Cross platform applications

8. Which of these is not a Linux distro

- a) Debian
- b) Unix
- c) Red Hat

d) SUSE

9. A file with lib in its title is probably

- a) A software library used by other applications.
- b) Free software for Windows.
- c) Software licensed in Britain.
- d) Software written by the programmer Leon I Brown.

10. GTK and Qt are

- a) Command line programmes for routine operations.
- b) Development frameworks for GUIs.
- c) Automated routines triggered by the clock of the computer.
- d) Tools for resolving dependencies when installing software.

11. Open source equivalents of Photoshop, Corel Draw, and MS Word are

- a) GIMP, Inkscape and AOO Writer
- b) Audacity, Gedit, Dia
- c) Inkscape, OpenShot, LO Writer
- d) Kwrite, Scribus, LO Calc

12. Many airliner entertainment systems use Linux embedded systems. Which of the following statements is false.

- a) With hundreds of seats there will be a significant saving in license fees.
- b) It is relatively simple to customise the software for the specific task.
- c) The kernel is stable and very well tested.
- d) The memory footprint is extremely efficient compared to a dedicated solution.

13. A graphical user interface is

- a) An abstraction of a physical desktop used to help manage files without having to remember hundreds of commands.

- b) A way of plotting points on graphs and charts so that they represent mathematical functions.
- c) Used on desktop computers only.
- d) Unnecessary for most users of Linux based computers.

14. You are supporting someone with a laptop that has a very short battery life even though it has a new battery. A good place to start checking is

- a) In the battery compartment.
- b) In the system settings.
- c) In the user directory.
- d) In the desktop background applications.

15. A widget for providing quick access to commonly used files and applications is

- a) the desktop.
- b) the close icon.
- c) the rubbish bin.
- d) the help centre.

16. A terminal is

- a) a window in the desktop used to access the command line.
- b) a button on the desktop for closing down the computer.
- c) an error made by the user that crashes the machine.
- d) closing down a program to save memory.

17. two ways of installing packaged software from the Linux command line are

- a) .exe and .rpm
- b) .rpm and .deb
- c) .svg and .deb
- d) .deb and .exe

18. typing `man ls` at the command line will

- a) manipulate the directory structure.
- b) manipulate the boot login procedure.
- c) provide information on listing the directory contents.
- d) provide information on linux software.

19. `-rwxrwxrwx` is printed next to a file. This is most likely

- a) an error caused by the file needing more space than is available.
- b) a list of permissions set for the file.
- c) a hexadecimal number representing the size of the file.
- d) the address of the file in physical memory.

20. `apt-get` is

- a) a command-line tool for handling packaged software.
- b) a means of finding data files lost in the directory tree.
- c) advanced program termination for rogue software.
- d) a way of preventing a virus entering the system.

21. `cp -r /home/hope/files/* /home/hope/backup` will copy

- a) all the files called `*` to a backup directory.
- b) all the files in the files directory to a backup directory.
- c) all the files directories and subdirectories in the files directory to a backup directory.
- d) all the files in the files directory to a backup directory and then remove all the original files.

22. the effect of adding the `-f` switch to the copy command is

- a) to add a file to each copy path
- b) free up as much memory as possible
- c) print an error message if the command fails
- d) if an existing destination file exists remove it and try again.

23. The command to delete a file is

- a) rm
- b) del
- c) delete
- d) kill

24. A script file is edited in a text editor and saved with the name myscript. In order to make it possible to execute the file as a script which command would be used?

- a) chmod 100
- b) chmod 755
- c) chmod 755 myscript
- d) chmod myscript execute

25. To execute a script called myscript located in the current directory type at the command line.

- a) ./myscript
- b) myscript
- c) myscript.exe
- d) myscript/.

26. Which of the following computer devices is the odd one out?

- a) RAM
- b) USB Flash memory
- c) Hard drive
- d) CPU

27. The purpose of a bus in a computer system is to

- a) remove excess heat.
- b) move data between different components.
- c) store data temporarily before it is used.
- d) backup important data.

28. When upgrading a computer to a new version of the operating system the sound stops working. This is most likely because the

- a) sound chip has been damaged by the upgrade.
- b) speaker has changed its power characteristics.
- c) software needs more time to bed in.
- d) sound driver software has changed.

29. A Linux kernel module is found to blank the computer screen on boot. What action is most appropriate to solve this issue?

- a) Edit the file in /etc that controls which modules to autoload.
- b) Replace the computer screen.
- c) Edit the boot loader file.
- d) Adjust the power settings and the display in system settings.

30. A web site has an address www.example.com. This is translated to the numeric address 208.77.188.166 by

- a) URL
- b) BSD
- c) DNS
- d) RDP

The following 4 questions are worth **10 marks** each. Try and ensure you provide 10 relevant and different pieces of information in your answer.

31. Describe 5 settings available in a desktop computer graphical user interface and say why you might change each one.

32. List 5 hardware components in a desktop computer and for each explain its importance in the computer.

33. Name 5 Open Source software projects and for two with different licenses explain the differences between the licenses.

34. Explain how a computer filing system works including public, private and hidden files, and paths. Use the commands `cp`, `mv`, `rm`, and `mkdir` to support your answer.

Annexe B – Units and guidance

Open Systems IT Management

L2 Unit 1

Understanding Global Software Communities and their Products

5 credits - 40 GLH

1. Understand community philosophy and ethics.	2. Know key software platforms and associated applications .
1.1 describe the principles of software freedom.	2.1 identify large scale open source projects.
1.2 compare open source and closed source licenses.	2.2 explain differences between software platforms.
1.3 describe the distribution methods for open source software.	2.3 explain the terms platform, cross-platform and application.
1.4 explain differences in open source licenses.	2.4 explain the terms distro, cycle, beta, release candidate, repository and library.
	2.5 describe computer development languages and supporting tools.
	2.6 identify open source applications that are equivalent to closed source products in the work place.
	2.7 identify embedded systems and describe their function.

Assessor's guide to interpreting the criteria

General Information

QCF general description for Level 2 qualifications.

1. Achievement at RQF level 2 (EQF Level 3) reflects the ability to select and use relevant knowledge, ideas, skills and procedures to complete well-defined tasks and address straightforward problems. It includes taking responsibility for completing tasks and procedures and exercising autonomy and judgement subject to overall direction or guidance.
2. Use understanding of facts, procedures and ideas to complete well-defined tasks and address straightforward problems. Interpret relevant information and ideas. Be aware of the types of information that are relevant to the area of study or work.

Requirements

3. Standards must be confirmed by a trained Level 2 assessor or higher
4. Assessors must at a minimum record assessment judgements as entries in the online mark book on the INGOTs.org certification site.
5. 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 online work. Assessors should ensure that relevant web pages are available to their Account Manager on request by supply of the URL.
6. 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.
7. This unit should take an average level 2 learner 40 guided hours of work to complete.
8. Once the candidate has satisfied all the criteria by demonstrating practical competence in realistic contexts they achieve the unit certificate.
9. 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.

Assessment Method

Assessors can score each of the criteria N, L, S or H. N indicates no evidence and it is the default setting. L indicates some capability but some help still required to meet the standard. S indicates that the candidate can match the criterion to its required specification in keeping with the overall level descriptor. 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 unit award.

Expansion of the assessment criteria

1. Understanding global software communities and their products.

1.1 I can describe the principles of software freedom.

Candidates should be able to describe the principles of being able to copy, modify and distribute software.

Evidence from assessor observations, content of learner portfolios.

Additional information and guidance The free software foundation describes 4 fundamental freedoms for software.

1. To be able to view the source code.
2. To be able to modify the code.
3. To be able to copy the code.
4. To be able to distribute the code.

There is some ambiguity in the term free because it can mean free as in no charge (gratis) or free as in freedom to do things. Free of charge is a consequence of freedom but there is no technical reason why free software can not be sold. It will probably be difficult to do so since the software is freely copiable. Due to this ambiguity the term Open Source is now more commonly used. The emphasis is that the software source code is open and can be viewed, modified, copied and distributed. In essence open source and free software are the same thing and sometime referred to as FOSS or FLOSS. Free and Open Source Software or Free, Libre, Open Source Software. What makes FOSS FOSS is the license and there are quite a number of different ones.

1.2 I can compare open source and closed source licenses.

Candidates should be able to distinguish between genuine free and open source licenses and those that are restricted by proprietary licenses.

Evidence: from assessor observations, documentation in portfolios.

Additional information and guidance Candidates should understand that there are commercial licenses that try to use the Open Source label for marketing reasons. To be open source the license needs to meet the fundamental criteria of the four freedoms. Failure to meet any of them means the software is not FOSS. A label such as “Commercial Open Source” does not mean that the software is open source even if some of the criteria are met. For example, if viewing the source code is restricted to people paying for the software, it is not open source software even though the source code is viewable by perhaps a large number of people.

In most proprietary licenses, software can be used only by the buyer of the license and often only on one computer. The source code is not available and copying and redistributing the software is prohibited. In some cases this might be relaxed for making backups. The difficulty with these restrictions is that they cause considerable inconvenience to users beyond the cost of the license. Upgrades often cost money so there is an incentive to produce software that will need upgrading especially if there is a monopoly supply. Genuine installation problems can cause problems and there are fewer people to identify bugs. Costs for upgrades mean old versions get used for a long time meaning increased costs and reduced security.

1.3 I can describe the distribution methods for open source software.

Candidates should be able to describe the main ways that open source software is distributed.

Evidence from assessor observations, content of learner portfolios.

Additional information and guidance

Computer programs are written using high level languages that humans can easily understand. Compiler then converts these into executable code. A principle of FOSS is that the source code is distributed with any executable code. The source code is readable by humans whereas the executable code is the suitable form for a

CPU. It is very difficult to work out what a program does from its executable code and therefore very difficult to design an exact equivalent. For this reason proprietary software companies often guard their source code as they would any secret invention. In contrast FOSS projects freely encourage source code distribution by any method that will help enable others to see and improve or add to the code. This is much more efficient than having to start from the beginning and design a better version of something that is mostly good enough for the tasks. Before the internet, software was distributed on discs and the source code was always provided on the disc with the executable code. With the internet, programs are more securely distributed from software repositories and the source code is then directly available from servers to anyone that wants to use it. The internet has added the ability to make the source code available globally and immediately and for many people to contribute to it from anywhere in the world using version control systems. These ensure that contributions to the code are controlled so that there is coordination of what goes into the final product. Sourceforge is the biggest library of FOSS code and is freely accessible www.sourceforge.org.

1.4 I can explain differences in open source licenses.

Candidates should be able to explain differences between the most common FOSS licenses..

Evidence: from assessor observations, schemes of work, content of learner portfolios.

Additional information and guidance The GPL (Gnu Public License) is the license used for the Linux kernel and most of the supporting applications. It allows anyone to take and use the code in their own products as long as they license their own products the same way. The license is sometimes referred to as viral because applications using the code have to then use the GPL thus spreading it. The Apache and BSD licenses allow code to be re-licensed in proprietary products. This is why Apple used BSD Unix and not Linux for iOS. It enabled the company to build products on the BSD code without having to contribute them back or share them with others. Some people say this is unethical and some say it is a necessary part of the global software ecosystem. This is the most fundamental difference between FOSS licenses. The condition of the GPL and similar licenses is to contribute back to the community, with Apache and BSD there is freedom to use the code in both FOSS and commercial proprietary products.

Open Office illustrates the difficulty of different licenses. Apache Open Office is licensed using the Apache license. Libre Office is based on the same code base but

licensed with the GPL. Libre Office can use Apache Open Office code because the Apache license allows anyone to use its code and relicense it in any way. Libre Office code cannot be used by Apache Open Office because any code adaptations from LibreOffice have to be relicensed using the GPL.

2. Candidates will know key software platforms and associated applications

2.1 I can identify large scale open source projects.

Candidates should be able to identify the most important open source projects

Evidence: Assessor observations, local testing, portfolios.

Additional information and guidance The Linux kernel is developed in a project of its own led by Linus Torvalds, its creator. GNU/Linux is a combination of the Linux Kernel and many other projects from the GNU foundation. An entire Linux distribution adds many other applications from yet more projects. Key projects are

The Kernel, Gnome Desktop, KDE Desktop, X Windows, CUPS (Combined Unix Print System), Pulse Audio, GIMP, Inkscape, Audacity, Apache OpenOffice (Apache License), Libre Office (GPL), Firefox.

Key distributions are Debian, Red Hat, Ubuntu,, Suse, Mandriva. There are many derivative and specialist projects based on the larger distributions. Ubuntu is derived from Debian and Linux Mint from Ubuntu. Some distributions are designed to be compact and therefore run on old and low specification hardware.

Berkley Standard Distribution Unix is very similar to GNU/Linux but it is a separate code base and licensed differently. It is most notably the basis of IOS, the operating system in Apple products such as the ipad, iphone and MacBookAir. BSD is an operating system in its own right and operates as a FOSS project.

Android is Google's operating system for mobile phones. It is based on the Linux kernel but it also has proprietary support programs. It is a mixture of FOSS and proprietary applications.

Google's Chrome OS is also based on Linux but geared towards web applications.

Apache web server is the most popular web serving application on the internet and it is licensed with the Apache license.

MySQL is the database behind a very large number of web sites and content management systems.

2.2 I can explain differences between software platforms.

Candidates should appreciate that the term software platform has been traditionally associated with an operating system with Windows dominating. Now the web is arguably the dominant platform.

Evidence: Assessor observations, local testing, portfolios.

Additional information and guidance The term software platform is a little vague and used when discussing operating systems but also web based environments. Now mobile computing has added to an increasing range of platforms. Essentially a software platform is a set of standards that enables users to run applications. In the 1990s Windows dominated the desktop computer space and Symbian mobile phones in the early 2000s. As the internet's importance increased web environments started to be marketed as "platforms" The adherence of most of the web to open standards means interoperability across different web platforms has become relatively straightforward and so the web itself has become a super platform for running applications and "stacks" of applications. Eg The LAMP stack Linux, Apache, MySQL, PHP. These FOSS applications operate together to provide database management systems that operate through webpages. More recently Stacks that involve newer applications with databases not dependent on SQL and using server side Javascript are becoming popular. Server side Javascript allows the same source code environment for writing web page software for client machines web browsers and code for managing the server side of things. The dominant mobile platform is now Android. For a while it was Symbian, briefly Apple iOS and now Android. Android is free and open to multi-vendors and therefore likely to increase its dominance in the mobile space as Windows did in the desktop space and for the same reason. Windows is still dominant on desktop computers but the number of these is diminishing in terms of the overall computer device markets as mobile devices proliferate.

A summary of web platforms is The World Wide Web, free and open supporting collaborative applications over the internet; Windows, proprietary OS, based on proprietary and some open standards but enabling a wide range of proprietary and open source desktop applications to run on desktop computers, laptops and

servers and Android, Open Source based operating system for mobile devices. Apple's iOS for mobile through to desktops but proprietary, restricted to Apple as the vendor. Chrome OS, various Linux distros, BSD Unix, Solaris and other minority platforms also persist. While the number of platforms shrank from the 1980s to 1990s with Windows becoming almost totally dominant, open standards have enabled innovation to spring up and the result is an increase in the number of platforms and their combined share of the market. As hardware continues to develop and become less expensive the differences between mobile and desktop platforms is likely to decrease. Windows is moving down into the mobile space and Android/Chrome OS up towards the desktop space. At the time of writing Unix based operating systems seem likely to dominate through GNU/Linux servers, Android and iOS. There has probably never been a better time to learn about Linux based platforms from an employment point of view.

2.3 I can explain the terms platform, cross-platform and application.

Candidates should be able to define the terms and discuss examples.

Evidence: From local testing and portfolios

Additional information and guidance An application is a program or group of programs that support a particular job. Platforms have been described above. Cross platform means that an application can run on more than one platform. In the desktop space this usually means Windows, MacOS and GNU/Linux. For mobile computers iOS and Android. An advantage of writing applications for the Web is that they are then almost certainly cross platform since web browsers in which they run are cross platform themselves. It is also easier with more modern software tools to modify software to run on more than one operating system. This is another reason why Windows is losing its dominance. Windows costs money and puts restrictions on users that are not inherent to Open Source platforms. The Windows monopoly also resulted in a degree of complacency in responding to the new opportunities presented by mobile technologies and the internet. It is now perfectly feasible to run an entire large scale business without Windows which was probably if not impossible, very difficult 20 years ago.

2.4 I can explain the terms distro, cycle, beta, release candidate, repository and library.

Candidates should be able to explain these terms together with illustrative examples.

Evidence: From assessor observations and portfolios

Additional information and guidance A distro is a short way of saying GNU/Linux distribution. These are usually a whole range of packaged software that can be installed and run on a desktop computer or server. Examples are Red Hat, Ubuntu, Suse, and Debian. The distribution can be done in a number of ways but a popular method is to provide the software as an “iso” disk image so that it can be run directly from a DVD or a USB pen drive. This enables the software to be tried and tested on the target hardware without disturbing any other installed software and if everything works, install the software to the machine's local storage. Most distros provide free software applications over the internet and free patches and updates.

Distros are usually released at regular intervals known as release cycles. One of the characteristics of FOSS is to release software often so that interested parties can test new code and new features. When new features are thought to be reasonably stable but still need testing a beta release is made. This is an early view so that more expert users can test the software and feedback on any bugs or issues. There is specialist open source software such as bugzilla to support this. Once there are no “show stoppers” the software goes to release candidate stage and then finally release and the cycle starts again.

A repository is a secure place for storing the software usually accessible securely over the internet. A library is a set of functions and routines that can be used by several different applications. In Linux they normally have lib in the title, in Windows they have the extension .dll or dynamic linked library. Libraries make writing software quicker because common routines can simply come from the library. The downside is that if a library is missing or out of date the software using it might not run. This is called a dependency because the application depends on the library in order to be able to run. Software packaging is designed to resolve any dependencies and again the internet helps a lot by providing the possibility to search for any missing library and automatically install it. Open Source licensing makes this easier because there are fewer restrictions on installation and distribution.

2.5 I can describe computer development languages and supporting tools.

Candidates should be able to describe common development languages and tools including frameworks for development,

Evidence: Assessor observations and portfolios.

Additional information and guidance Unix is highly associated with the C programming language and Linux and many of its applications have been developed using C++. Traditionally text editors have been used for developing source code and the two classic examples for Linux are emacs and vi but other text editors such as gedit are now popular. Languages need compilers to turn the source code into executable code. These files of code are referred to on Unix systems as binary files or with the letters bin. A directory called bin is used to store binary files. Tools to manage the process of submitting code to a development project are called versioning systems. A very popular one is GIT and another Subversion. They allow patches to be submitted to the project and tested before being finally committed to the final version.

Other languages that are popular with developers include Java, PHP, Python, and Perl. Linux includes shell scripts that allow automation of common management processes directly from a terminal. This means that a systems administrator can use a text editor to write scripts to automate commonly needed processes and save the scripts as text files and then execute them when needed. The operating system shell interprets the instructions and converts them to binary code for the processor.

2.6 identify open source applications that are equivalent to closed source products in the work place.

The candidate should know a range of the most common Open Source productivity tools and their closed source popular equivalents.

Evidence: Internal testing, portfolios

Additional information and guidance We are using equivalent to here to mean nearest to rather than identical features. Equivalent in the sense of intended to perform the same tasks. The Open Source equivalent of Microsoft Office is Apache Open Office and the GPL version Libre Office. Koffice is another office suite maintained and developed in the KDE community. For graphics editing there is GIMP (Gnu Image Management Project) which is equivalent to Photoshop and similar closed source raster editing programs. Inkscape is an editor for scalable vector graphics (.svg) files and performs the tasks needed by graphic designers similar to Corel Draw, Freehand and Adobe Illustrator, Audacity is a multitrack audio editor. Firefox is an open source web browser similar to Google Chrome and Internet Explorer. Most of the main open source productivity tools are cross platform and can be run on Linux or Windows. There are an increasing number of web applications that run in web browsers and even though these are not open source, they are free to use and can be run from Linux using either Google

Chromium which is an open source version of the popular Chrome browser, Chrome itself (proprietary but free to install the binary code and use it), Firefox and several others. Linux also has an application called wine that enables many single platform Windows applications to be run.

2.7 I can identify embedded systems and describe their function.

The candidate should be familiar with embedded systems where the software is dedicated to a narrow set of tasks as opposed to the general purpose use of mobile and desktop computers.

Evidence: Assessors observations, portfolios

Additional information and guidance Typical examples are airline entertainment systems, car engine management systems, code in firmware in devices such as printers, CNC machines, televisions, and other household goods. Open source software is attractive for many embedded uses because the source code is available to be modified to fit the particular purpose without having to start from a blank sheet and if many millions of devices need to be manufactured containing the embedded code there is no license fee to pay. This can save substantial sums of money.

Open Systems Management

L2 Unit 2

Using an operating system efficiently

5 Credits - 40 GLH

1. Use a range of desktop management tools	2. Use the command line for systems management.
1.1 navigate a graphical user interface.	2.1 open a terminal and set suitable permissions for operations.
1.2 use help and searches to extend learning.	2.2 Install applications from the command line.
1.3 adjust systems settings	2.3 get help from the command line.
1.4 improve productivity using tools and widgets.	2.4 perform common operations on files from the command line.
	2.5 produce short scripts to automate sequences of instructions.

Assessor's guide to interpreting the criteria

General Information

QCF general description for Level 2 qualifications.

1. Achievement at RQF level 2 (EQF Level 3) reflects the ability to select and use relevant knowledge, ideas, skills and procedures to complete well-defined tasks and address straightforward problems. It includes taking responsibility for completing tasks and procedures and exercising autonomy and judgement subject to overall direction or guidance.
2. Use understanding of facts, procedures and ideas to complete well-defined tasks and address straightforward problems. Interpret relevant information and ideas. Be aware of the types of information that are relevant to the area of study or work.

Requirements

3. Standards must be confirmed by a trained Level 2 Assessor or higher

4. Assessors must at a minimum record assessment judgements as entries in the online mark book on the INGOTs.org certification site.
5. 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 online work. Assessors should ensure that relevant web pages are available to their Account Manager on request by supply of the URL.
6. 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.
7. This unit should take an average level 2 learner 40 guided hours of work to complete.
8. 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.

Assessment Method

Assessors can score each of the criteria N, L, S or H. N indicates no evidence and it is the default setting. L indicates some capability but some help still required to meet the standard. S indicates that the candidate can match the criterion to its required specification in keeping with the overall level descriptor. 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 unit award. Once the candidate has satisfied all the criteria by demonstrating practical competence in realistic contexts they achieve the unit certificate.

Expansion of the assessment criteria

1. The candidate will be able to use a range of desktop management tools

1.1 I can navigate a graphical user interface.

Candidates should be fluent in using the desktop including coping with differences in set up and configuration in different desktops.

Evidence: from assessor observations.

Additional information and guidance Candidates should have a lot of experience of exploring the options provided on the desktop including configuring the appearance, adjusting systems settings and using desktop tools such as system monitor, disc management tools and other system utilities. In principal a central purpose of navigating a graphical user interface is to find and run applications related to managing the system. It will be an advantage to teach more than one graphical user environment eg KDE and Gnome on Linux and Windows in order to instil confidence in switching between them. Another option is to compare desktop and mobile GUIs.

1.2 I can use help and searches to extend learning.

Candidates should be able to use a variety of techniques to find out how to do things related to the user interface.

Evidence from assessor observations, content of learner portfolios.

Additional information and guidance There are a number of search strategies that all should be taught. There is help available on most applications. It is unrealistic to memorise how to do everything in all applications but experienced users can usually find what they need using a combination of the help provided with the application and internet searches. Taking some unfamiliar applications and finding out how they operate is a good way to do this. Candidates should be shown how to search the web for information, look for social media discussion groups and search YouTube for tutorials. They will need significant guidance because although it sounds obvious to search the internet or help, adopting particular strategies make success and speed of success much more likely.

1.3 I can adjust system settings

Candidates should be able to alter the way the system behaves by making adjustments through the desktop interface.

Evidence: from assessor observation and content of learner portfolios.

Additional information and guidance Candidates should be taught systematically what adjustments can be made using the desktop. They should be aware that the facilities for making adjustments are generally small programs that sit on top of the command line programs to make it easier to remember what to do without having to learn the details of the syntax but the price to pay for this is sometimes flexibility in the range of operations that can be carried out. Ideally the candidate should be

provided with a computer where there is no lock-down so that they are free to configure it to any degree they want. A RaspberryPI or similar device or older computer that is out of commission are suitable targets. One exercise might be to work out what additional features an up to date operating system offers over one that is 5 years old and what the resource penalty is for running the additional facilities and whether they consider it worth it.

1.4 I can improve productivity using tools and widgets

Candidates should be able to identify tools and utility applications that can support their productivity.

Evidence: From content of learner portfolios.

Additional information and guidance Candidates should be guided to a range of applications that they might find useful in supporting general productivity. The range should be more extensive than their immediate needs to demonstrate potential. Typical tools might include a text editor for script management, desktop recorder to support producing user guides, file format changers to enable interoperability of files eg video or audio between applications. A graphics program such as Inkscape will help them draw diagrams and illustrate work, audacity for sound editing and openshot for video. The exact tools will be down to individual preference but since there are abundant open source applications try to use these in preference.

2. Use the command line for systems management

2.1 I can open a terminal and set suitable permissions for operations.

The candidate should know how to open a terminal and operate as the super user to set permissions for files and users.

Evidence: from assessor observations, internal assessments, schemes of work.

Additional information and guidance Candidates will need structured guidance in specific techniques including CTR ALT T to open a terminal. The use of sudo and password to authorise their commands, and chmod, chown, chgrp. A useful resource for the whole of this learning outcome is <http://linuxcommand.org/index.php>.

2.2 I can install applications from the command line.

The candidate should be familiar with at least one package management system and understand it well enough to install, remove and update software.

Evidence: from assessor observations, internal assessments, schemes of work.

Additional information and guidance Candidates should understand that software is often made up of several components that are packaged in a consistent way so that a program called a package manager can automate the process. The two systems most likely to be encountered are APT on Debian derived distros and RPM on RedHat derived distros. Candidates should know both exist but detailed practice one of the is sufficient. Typical activities will include searching for software managing repositories, updating sources, installing and removing software, updating, cleaning unwanted cached packages from the system.

2.3 I can get help from the command line.

The candidate should be able to use help from the command line as well as the man command.

Evidence: from assessor observations, internal assessments, schemes of work.

Additional information and guidance Candidates should be able to use -h and -help switches from the command line to get help on specific commands. Introduce the use of pipes and the use of the man command for manual pages. There is a useful guide at <http://www.howtogeek.com/108890/how-to-get-help-with-a-command-from-the-linux-terminal-8-tricks-for-beginners-pros-alike/>

2.4 I can perform common operations on files from the command line.

The candidate should be able to copy, move, delete and rename single files and groups of files.

Evidence: from assessor observations, internal assessments, schemes of work.

Additional information and guidance Candidates should cover the basic file operations and useful switches such as recursive copying and deleting. They should understand equivalences such as copy and deleting the source is the same as moving. It would be useful to compare command line file operations with desktop equivalents and which is most efficient in different circumstances.

2.5 I can produce short scripts to automate sequences of instructions..

The candidate should be able to produce shell scripts to automate commonly used sequences of instructions.

Evidence: from assessor observations, internal assessments, schemes of work.

Additional information and guidance The main objective is to get a basic grasp of shell scripts. Bash is a good starting point as it is commonly the default on Linux systems. A useful guide is at <http://www.freeos.com/guides/lst/>

Moderation/verification

The assessor should keep a record of assessment judgements made for each candidate and make notes of any significant issues for any candidate. They must be prepared to enter into dialogue with their Account Manager and provide their assessment records to the Account Manager through the online mark book. They should be prepared to provide evidence as a basis for their judgements through reference to candidate e-portfolios and through signed witness statements associated with the criteria matching marks in the online mark-book. Before authorizing certification, the Account Manager must be satisfied that the assessors judgements are sound.

L2 Unit 3 – Managing Computer Hardware, Data and Networks.

Unit 3 - 5 Credits - 40 GLH

1. Understand computer hardware	2. Understand the computer on a network	3. Manage systems effectively
1.1 identify the main hardware components in computing devices	2.1 describe the purpose of a Domain Name Service (DNS)	3.1 review security for users and groups.
1.2 match discrete components in computing devices to purpose	2.2 identify a range of network services.	3.2 identify important systems files and directories.
1.3 associate software drivers with hardware.	2.3 use common services to diagnose problems.	3.3 archive and de-archive files using compression.
1.4 format and partition discs	2.4 create new user and group accounts	3.4 describe the purpose of file and directory types (public, private, hidden).
1.5 install an operating system	2.5 use a browser with appropriate attention to privacy.	3.5 manage files within a directory structure.
	2.6 connect a computer to a network.	3.6 explain a directory structure in terms of its function.
		3.7 explain the difference between an absolute and relative path.
		3.8 make and restore simple backups and archives.

Assessor's guide to interpreting the criteria

General Information

QCF general description for Level 2 qualifications.

1. Achievement at RQF level 2 (EQF Level 3) reflects the ability to select and use relevant knowledge, ideas, skills and procedures to complete well-defined tasks and address straightforward problems. It includes taking responsibility for completing tasks and procedures and exercising autonomy and judgement subject to overall direction or guidance.
2. Use understanding of facts, procedures and ideas to complete well-defined tasks and address straightforward problems. Interpret relevant information and ideas. Be aware of the types of information that are relevant to the area of study or work.

Requirements

3. Standards must be confirmed by a trained Level 2 Assessor or higher
4. Assessors must at a minimum record assessment judgements as entries in the online mark book on the INGOTs.org certification site.
5. 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 online work. Assessors should ensure that relevant web pages are available to their Account Manager on request by supply of the URL.
6. 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.
7. This unit should take an average level 2 learner 40 guided hours of work to complete.
8. 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.

Assessment Method

Assessors can score each of the criteria N, L, S or H. N indicates no evidence and it is the default setting. L indicates some capability but some help still required to meet the standard. S indicates that the candidate can match the criterion to its

required specification in keeping with the overall level descriptor. 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 unit award. Once the candidate has satisfied all the criteria by demonstrating practical competence in realistic contexts they achieve the unit certificate.

Expansion of the assessment criteria

1. The candidate will understand computer hardware

1.1 I can identify the main hardware components in computing devices

Candidates should be able to identify CPU, micro and standard USB ports, audio and video ports, RJ45 network ports, SD Cards, Memory modules, USB memory, hard drive, keyboard, mouse, displays for commonly used computer devices.

Evidence: from assessor observations, internal testing and documentation in portfolios.

Additional information and guidance Candidates should be familiar with commonly used hardware components through hands on use. Raspberry PI, building a PC or taking apart disused machines will all provide experience. A good little game is to provide a hardware specification for a computer and ask the candidates to use the web to source the parts at the best possible price. The winner is the one who can get the components to build a machine at the best price. If you want to make it more difficult take shipping costs into account and say you need 50 pieces. This will make it less likely that shipping costs will swamp the costs if components are bought from different suppliers. This will help prepare them for sourcing components to service the network.

1.2 I can match discrete components in computing devices to purpose

Candidates should be able to match a component to a description of its purpose

Evidence from internal testing and portfolios.

Additional information and guidance Candidates should know the different purposes of common components. CPUs for processing instructions, USB ports for connecting peripherals including different speeds. Note USB 3 compatibility does not necessarily mean the component will operate at the full speed of USB 3. RAM for storing programs and data that is in operation, SDRAM and hard discs for storing programs and data while not being used. A heat-sink is for taking heat away

from active components to stop them being damaged by getting too hot. Heat-sinks might incorporate a fan. Power supplies to convert mains voltages to the lower levels needed in the devices, Batteries for portable power. Main board to hold and enable connections between the components.

1.3 I can associate software drivers with hardware

Candidates should know that pretty well any hardware will work with any type of computer if the software drivers are available.

Evidence: from internal tests and content of learner portfolios.

Additional information and guidance Candidates should understand that software drivers are necessary to make hardware operational. Open Source drivers mean that anyone with the technical knowledge could make a driver for any piece of hardware making the hardware usable by different types of computer. The drivers generally operate in layers communicating with the operating system at the top layer and with the hardware itself at the lower layers. This means in principle that only the middle layers need changing if there are standard hooks between it and the layers above and below. Common examples of hardware that needs drivers are printers. The printer will have its own software to control the print heads etc The CUPS print server is a system that takes a common approach to printing so that it is easier to manage printer drivers from many different manufacturers.

1.4 I can format and partition discs

Candidates should be able to carry out formatting and partitioning of discs under guidance.

Evidence: From internal testing, portfolios, assessor observations.

Additional information and guidance Candidates should be given opportunities to format a disc and partition it. They should know that a swap partition is used for extending the computers memory should it run out. This is a lot more important with eg 2 GB and less RAM and is probably never going to be used in machines with 8 GB or more. Nevertheless, it is worth reserving about the same size swap partition as there is memory in the computer, just in case unless for some reason the disc space is very precious which is unlikely. Partitioning is very flexible. The main function is to enable you to separate and categorise different types of file eg separate system program files from user data files. Candidates should appreciate

that organising files logically on large complex systems is important for efficient management.

1.5 I can install an operating system

Candidates should be able to download an iso image and use it to create a USB or similar image to test hardware compatibility and then install the operating system.

Evidence: From assessor observations and learner portfolios

Additional information and guidance It is relatively straight forward to install Linux but it is best to test all the hardware drivers are appropriately available for the target machine. Popular distros such as Ubuntu come with a wide range of pre-installed drivers so that most hardware will work but there are always exceptions. Sometimes it simply requires some minor adjustments. Discussion forums are a good place to ask questions about installation problems and candidates should get some practice in doing this. It also means they will be communicating directly with industry professionals.

Once an operating system is running satisfactorily from a USB key, it can be installed more permanently on the machine's internal hard drive. Care will need to be taken if there is already an operating system installed. Candidates should be shown how to “dual boot” so that they can choose which operating system they want to use when they start up the machine. This implies they will need to be shown how to set the boot options. The new EUFI boot system can cause more work. There is useful support documentation at <https://help.ubuntu.com/community/UEFI> candidates are not expected to remember all the details but they should be able to use the supporting information to get a working operating system running on the machine.

2. The candidate will understand the computer on a network

2.1 I can explain the purpose of a domain name service.

Candidates should be able to explain the broad principles of DNS and how IP addresses are mapped to names.

Evidence: local testing, portfolios

Additional information and guidance Candidates should be able to explain that DNS is a way of relating meaningful and memorable (to humans) names such as www. MyWebsite.com to an IP address in the form of numbers. In the case of IPv4 something like 93.184.216.119 and in IPv62606:2800:220:6d:26bf:1447:1097:aa7. IPv6 is necessary because there are not enough addresses for every device in the world using the IPv4 system. DNS is explained in more detail at http://en.wikipedia.org/wiki/Domain_Name_System but at this stage a basic understanding of what DNS does is sufficient.

2.2 I can identify a range of network services.

Candidates should know that a server provides a range of services including running programs and presenting results to clients, storing client data and information, enabling communication between clients.

Evidence: From local testing and portfolios

Additional information and guidance In the early days of microcomputers, servers were often called file servers because that was their main function. They stored files and shared them between clients subject to permissions to access them. They would provide shared printing services and perhaps email but they did not run general applications programs. Increasingly servers do both jobs. They run programs and the results are displayed on the client computer and they store files and handle e-mail. It is very expensive to have software applications stored and run individually on every network client, not only in the cost of multiple software licenses but in having to manage the software on every machine. Even though to an extent this management can be made more efficient using the server to update machines, in practice constantly upgrading hardware with different specifications that can not all cope with exactly the same software results in expensive complexity. Running everything from servers is potentially much more efficient and much less expensive but two things made this difficult. One is that the servers needed to be very powerful (expensive) to cope with running very large applications often designed at the limit of hardware capacity and the other is that the network connections have to be fast too.

The internet has changed the way we think of servers and the key is the web browser. Web browsers can run client side applications in the client eg in Javascript and also support transactions on the server side eg executing PHP code to process database information and then present it on the client through the browser. It is very much easier to manage a large server farm with consistent software than to manage many distributed client computers, scattered all over the world each

running an unpredictable range of applications. The browser has effectively standardised the operating platform removing licensing fees and enabling competition based on service. At the time of writing we are in a transition to mobile clients where power consumption is just as important as performance and perhaps more so when servers can provide almost unlimited storage and raw processing power. Clients can still run their own apps but the main productivity tools can be provided and managed centrally.

For this criterion, candidates need to be able to identify the services that servers provide to the network, from processing data, storing and making information available and enabling communications.

The most obvious case of programs running locally is the client operating system such as GNU/Linux installed on the local machine. An example of a server running the program on behalf of the client is a search engine like Google. You make the query in the web browser and the search engine somewhere on the web then runs a program to find things linked to the query and returns the results in the local browser. An obvious data server is a file sharing application such as Dropbox. Dropbox enables the sharing of data files over the internet. The distinctions between running programs locally and running them on the server is now much less clear-cut than at any time in the past. Web pages use HTML files to tell the browser what to display but there is generally no interaction for the user. To provide that Javascript is built into the browser. Programs that run in the browser are running locally but these are usually small and could be downloaded into the browser from the server or they could be a plug-in on the local machine. The cooperation between server and client in running programs has become much more closely linked with the internet. Peer to peer systems are effectively making any machine on the network a potential server. The trend is to racks of many low cost machines, often just the main boards and components, sharing the tasks and so what is represented as a server by a box on a diagram might in fact be very many servers not just one machine.

2.3 I can use common services to diagnose problems.

Candidates should be starting to adopt systematic strategies to diagnose problems on individual computers and networks.

Evidence: From assessor observations and portfolios

Additional information and guidance At this stage it is enough to be able to match common problems to system settings and similar facilities in order to look for

possible remedies. They should be aware of applications such as SysMon that can be used to view how much memory is being used and which services are active. They should know that the system keeps logs and that these can be examined to look for possible problems.

2.4 I can create new user and group accounts.

Candidates should be familiar with the way accounts can be set up and relate this to work on permissions and security.

Evidence: Assessor observations and portfolios.

Additional information and guidance Linux systems are multiuser on networks but also on individual machines. Several people can be logged onto the same machine at the same time.

2.5 I can use a browser with appropriate attention to privacy.

The candidates should use more than one browser to learn the common and different features and any differences in privacy settings.

Evidence: Assessor observations and portfolios.

Additional information and guidance

<http://www.20thingsilearned.com/en-GB/browser-privacy> This is a useful resource on web browsers and general aspects of the web.

2.6 I can connect a computer to a network.

The candidate should gain practical experience of setting up a computer in different network scenarios.

Evidence: Assessor observations and portfolios.

Additional information and guidance Candidates should understand that connecting to a network requires a means of connecting either using a cable or wireless. Ethernet cable using RJ45 connectors and UTP cable is by far the most common cable method. Wireless is usually via a Wifi access point or it could be through a mobile telephone. Smartphones can be configured to become wireless access points for laptops. The laptop connects to the phone using Wifi and the phone uses the phone network (3G or 4G) to connect to the internet. USB 3 is

faster than UTP networking but is limited to 3m cables. This means that on laptops without an RJ45 connector (Many ultrabooks and super slim machines), a cable connection can still be made buying a USB to RJ45 connector although they will usually use a wifi connection. To connect to the internet via a router, DHCP is used to allocate IP addresses to devices that connect automatically. All that is usually needed is the pass code required by the router.

3. The candidate will be able to manage systems effectively.

3.1 I can review security for users and groups.

The candidate should be able to make routine checks of user accounts to ensure that the security settings are set appropriately.

Evidence: Portfolios, personal log, assessor observations.

Additional information and guidance Candidates should appreciate the need for security including strong passwords, careful practice and advice to users eg not leaving themselves logged in and leaving the machine unattended, checking firewall settings and appropriate permissions.

3.2 I can identify important systems files and directories.

The candidate should be familiar with where to find important files.

Evidence: From assessor observations, internal assignments.

Additional information and guidance Typical examples are the system log, grub, bin for program files, boot for files related to booting, dev for device drivers. There is a good and straightforward description at <http://www.thegeekstuff.com/2010/09/linux-file-system-structure/>

3.3 I can archive and de-archive files using compression.

The candidate should be able use archiving tools to reduce the size of files and package them for easy transfer..

Evidence: From portfolios and assessor observations.

Additional information and guidance Candidates should be familiar with Linux tar gzip system and zip files. The main benefit from using tar gzip is it will preserve

permissions on files. This might or mightnot be important. Candidates should appreciate that this is lossless compression unlike compressing video, audio and jpg images which is lossy compression trading some quality to get a smaller file. They should appreciate why this is not possible in program files, for example, where losing any data will stop the program from working. They should also appreciate that archiving a video or similarly compressed file is very unlikely to make any further saving in size because the files are already compressed about as far as is possible.

3.4 I can describe the purpose of file and directory types (public, private, hidden).

The candidate should be able to describe the ways different types of directory can be used.

Evidence: From local testing, portfolios, assessor observations.

Additional information and guidance This is simply a matter of understanding the properties of directories. It is not so obvious on a standalone computers but very obvious why shared and public directories are of value on the internet. Systems like Dropbox are examples of using a directory and permissions to make information shareable. Hidden files prevent rarely used files adding to the number seen in a directory.

3.5 I can manage files within a directory structure.

The candidate should demonstrate that they can organise their files in a logical way within a directory structure.

Evidence: From images of their directories

Additional information and guidance

Directories and files should have meaningful names with files in places that help their management.

3.6 I can explain the difference between an absolute and relative path.

The candidate should be able to explain absolute and relative paths and why they are used.

Evidence: From portfolios, internal assessments.

Additional information and guidance There is a description at <http://www.linuxnix.com/2012/07/absolute-path-vs-relative-path-in-linuxunix.html>

3.7 I can make and restore simple backup.

The candidate should demonstrate a sound personal backup strategy.

Evidence: From portfolios, internal assessments, assessor observations.

There are very many different backup strategies depending on the circumstances. Any sound system is acceptable but it would be a good learning process to consider strengths and weaknesses in several options. One clear benefit of cloud computing is that entire data systems can be backed up without the user having to do anything. It can be argued that if you store everything on line with a reputable service provider there is no need for a separate backup system. On the other hand loss of the internet then prevents access to your files. One way round this is to synchronise the on-line store with a backup on a local hard drive so that if you lose the internet connection you can work on the files on the local drive and when the connection is restore the files will be automatically be updated.

L2 Unit 4 – Systems management project.

Unit 4 - 5 Credits - 30 GLH

1. Plan systems management projects	2. Apply practical skills and knowledge in a synoptic context	3. Present results effectively
1.1 make a project proposal and justify it	2.1 set up hardware and software to meet needs.	3.1 organise results into a logical structure.
1.2 carry out a risk assessment for a project.	2.2 record process and procedures.	3.2 use media to enable updates for a wide audience.
1.3 produce a project plan.	2.3 evaluate process and procedures.	3.3 make a presentation to a critical audience.
	2.4 make improvements based on evaluation.	3.4 receive feedback and act on it.

Assessor's guide to interpreting the criteria

General Information

QCF general description for Level 2 qualifications.

1. Achievement at RQF level 2 (EQF Level 3) reflects the ability to select and use relevant knowledge, ideas, skills and procedures to complete well-defined tasks and address straightforward problems. It includes taking responsibility for completing tasks and procedures and exercising autonomy and judgement subject to overall direction or guidance.
2. Use understanding of facts, procedures and ideas to complete well-defined tasks and address straightforward problems. Interpret relevant information and ideas. Be aware of the types of information that are relevant to the area of study or work.

Requirements

1. Standards must be confirmed by a trained Level 2 Assessor or higher.
2. Assessors must at a minimum record assessment judgements as entries in the online mark book on the INGOTs.org certification site.
3. 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 online work. Assessors should ensure that relevant web

- pages are available to their Account Manager on request by supply of the URL.
4. 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.
 5. 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.
 6. This unit should take an average level 2 learner 30 guided hours of work to complete.

Assessment Method

Assessors can score each of the criteria N, L, S or H. N indicates no evidence and it is the default setting. L indicates some capability but some help still required to meet the standard. S indicates that the candidate can match the criterion to its required specification in keeping with the overall level descriptor. 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 unit award. Once the candidate has satisfied all the criteria by demonstrating practical competence in realistic contexts they achieve the unit certificate.

Expansion of the assessment criteria

1. The candidate will plan systems management projects

1.1 I can make a project proposal and justify it.

Candidates should use interests and experience generated on the course to propose a project that will take 50 hours including taught time and guidance to complete.

Evidence: Portfolios and assessor observations

Additional information and guidance The project can be anything as long as it is focused on systems management and has potential to draw on learning from across the assessment criteria. It could be research into systems management methods or it could be something very practical such as setting up a RaspberryPI network. Assessors should ensure that there is scope for 50 hours work and that

the proposal is realistic and likely to reinforce personal management skills as well as learning across all the criteria.

1.2 I can carry out a risk assessment for a project.

Candidates should analyse the risks before setting out on their project and use these as part of the evidence to justify their project.

Evidence: from assessor observations, documentation in portfolios.

Additional information and guidance Candidates should be familiar with the concept of risk assessment and cover at least health and safety issues and risks of running out of time or hitting difficult obstacles. Some background lessons in risk, target setting and time management are likely to be necessary.

1.3 I can produce a project plan.

Candidates should produce a plan explaining the sequence of tasks, the approximate time scales and any resources needed.

Evidence from assessor observation and portfolios.

Additional information and guidance The plan should be realistic and clearly structured. The method of putting it together is optional but we recommend using web pages and dynamic links for referencing. They can use the Learning site Blogging and evidence management facilities for this but it is not mandatory. If plans go wrong it is perfectly reasonable to modify them and document the events. Explanations can be written but we also encourage the use of screencasts eg with GTKrecordmydesktop audio and other media for both planing explanations and ultimately presentation of the plan. If the plans do not look sufficient to justify 50 hours of work the candidate should be informed (If in doubt consult your account manager at TLM) because failure to complete a project to a level 2 standard will make them ineligible to take the grading examination.

2. The candidate will apply practical skills and knowledge in a synoptic context

2.1 I can set up hardware and software to meet needs

Candidates should demonstrate practical competence in setting up any hardware and software related to their project.

Evidence: Portfolios and assessor observations

Additional information and guidance Even if it is a research project there should be applied practical elements even if it is to check that in practice something found out actually works as expected. Candidates should draw on their learning from the course and extend it where relevant through their project. They might for example research ways of automating routine tasks and build a set of scripts to support this. That would require them to use the related scripting language eg bash. A synoptic context means that the project should cut across each of the other assessment units at least to some extent.

2.2 I can record process and procedures

Candidates should record the processes and procedures they carry out for their project.

Evidence: Blogs or similar records

Additional information and guidance It is recommended that candidates produce a series of blog entries describing their actions on a day to day basis. Assessors should explain to them that if they are in employment and they can't justify the time they are spending on productive work they are likely to lose their job. Here they need to justify their work in order to be eligible to take the grading examination.

2.3 I can evaluate process.

Candidates should produce an evaluation report of the process they went through.

Evidence from assessor observation and portfolios.

Additional information and guidance The evaluation should classify strengths and weaknesses related to their day to day working and what they found to work well and what did not work as expected. Finding difficulties and overcoming them might or might not be a result of a weakness in a method. They are encouraged to use social networking groups focussed on technical issues to get feedback on process and methods that enable them to make improvements. This is widely used in the Open Source world to learn from others in the community.

2.4 I can make improvements based on evaluation.

Candidates should provide evidence of improvements that they have made to their work based on evaluation.

Evidence from assessor observation and portfolios.

Additional information and guidance There should be clear evidence of changes made to improve their work. This could be using different tools, using different or newly learnt techniques with tools or changes to procedures, times, order of doing things, who to ask and where. We want them to understand that all the answers are out there, it's knowing how to get them quickly and be sure they are valid that matters.

3. The candidate will present results effectively

3.1 I can organise results into a logical structure.

Candidates should demonstrate practical competence in structuring the presentation of their results.

Evidence: Portfolios and assessor observations

Additional information and guidance Results should be presented by starting with an initial abstract or project summary and then providing the outcomes in a logical sequence or set of linked objects eg in a web book. There should be some specific conclusions or personal judgements about the content beyond generalisations such as it went well or I think my project was good. Assessors should expect to be provided with reasons

3.2 I can use media to enable updates for a wide audience.

Candidates should use internet based media with appropriate permissions so that updating their presentation will provide the updates immediately to the entire audience.

Evidence: Web based presentation

Additional information and guidance The INGOT community Learning Site provides the tools to do this but its use is not mandatory, any web based environment will enable sharing presentations and their updates widely. Using Powerpoint or OpenOffice Impress on a desktop will not do this so it should be discouraged unless they have a strategy eg incorporating the distribution with a cloud based repository such as Dropbox. It could be useful to consider using free

on-line publishing sites such as Lulu.com to produce a professional book that is distributed on the web. Updating the book would then enable wider distribution.

3.3 I can make a presentation to a critical audience

Candidates should present their work to a knowledgeable audience

Evidence from assessor observation and portfolios

Additional information and guidance This might be an opportunity to involve employers/professionals in the field. The candidates should be given at least 20 minutes to make their presentation and answer questions on it.

3.4 I can receive feedback and act upon it.

Candidates should receive feedback graciously and show evidence of making some change as a result.

Evidence from assessor observation.

Additional information and guidance The assessor should observe the behaviour of the candidate on receiving feedback and they should check that there has been some positive action as a result.

Annexe C – Summary of the units and their assessment.

Level 2

Unit 1 - Understanding global software communities and their products 5 credits - 40GLH

Unit 2 - Using an operating system efficiently - 5 credits – 40 GLH

Unit 3 - Managing Computer Hardware, Data and Networks. - 5 Credits - 40 GLH

Unit 4 - Carrying out an IT systems management project. - 5 Credits – 30 GLH.

All four units are mandatory

150 GLH in total for the full certificate. Units can be assessed concurrently or consecutively enabling the assessor to decide how to organise teaching.

Before an exam entry can be accepted, the assessor must ensure that practical competence is demonstrated through coursework in keeping with the global level 2 descriptor at

[http://readonpublications.co.uk/pdf/Qualification%20and%20Component%20Levels%20\(RQF\),%20Ofqual%202015.pdf](http://readonpublications.co.uk/pdf/Qualification%20and%20Component%20Levels%20(RQF),%20Ofqual%202015.pdf)

All assessment criteria and learning outcomes must be secure at a fundamental level and employer input must be evidenced. The exam will then differentiate grades Pass, Merit, Distinction and Distinction* based on the under-pinning knowledge and understanding of the candidate. Your account manager will be pleased to answer any questions you have with regard to the specification and its requirements. Please use e-mail if possible for specific questions and telephone if your query needs more general discussion. A Google Hangout or similar video conference can be arranged for screen sharing.

Annexe D - Useful links and supporting information

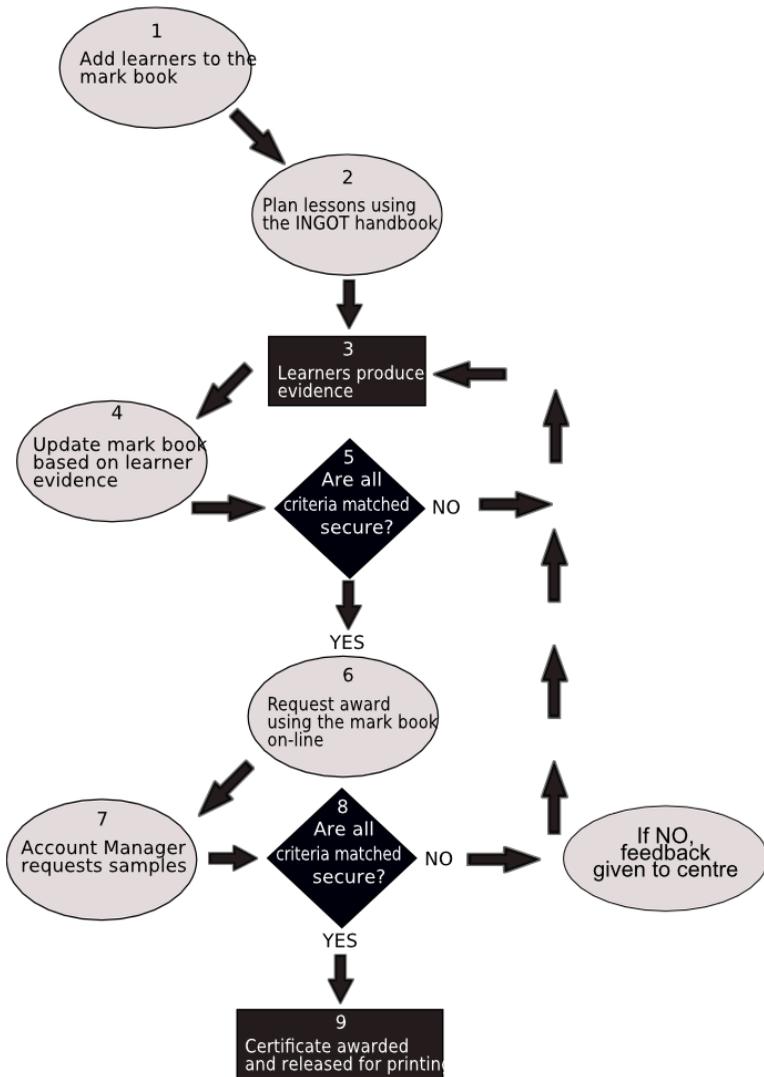
The INGOT community learning site www.theINGOTs.org has a wealth of supporting information and practical tools for managing evidence, progress tracking and reporting. These are all free for participating schools. Contact TLM for further details or training if required. We will update and add to supporting materials as time goes on.

The INGOT 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.

Linux Professional Institute - Linux Essentials

This specification is designed to be compatible with the Linux professional Institute Linux Essentials exam. There are relevant resources on the LPI website at <https://www.lpi.org/> There is no obligation to take the Linux Essentials exam but it is a globally recognised qualification and will add value to the TLM Level 2 certificate in systems management.

Annexe E - Coursework assessment flowchart



Annexe F – Cabinet Office

Open Standards Principles

These principles are the foundation for the specification of standards for software interoperability, data and document formats in government IT:

1. **We place the needs of our users at the heart of our standards choices**
2. **Our selected open standards will enable suppliers to compete on a level playing field**
3. **Our standards choices support flexibility and change**
4. **We adopt open standards that support sustainable cost**
5. **Our decisions on standards selection are well informed**
6. **We select open standards using fair and transparent processes**
7. **We are fair and transparent in the specification and implementation of open standards**

From Open Standards and Principles (Cabinet Office) (2012)

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/78892/Open-Standards-Principles-FINAL.pdf