Award Arrangements for:

G7DX 15
Higher National Certificate

Computer Networking

G7DY 16
Higher National Diploma

Computer Networking and Internet Technology

A consortium qualification developed in conjunction with the Scottish Qualifications Authority.

Version 10 (May 2015)

History of changes

It is anticipated that changes will take place during the life of the qualification, and this section will record these changes. This document is the latest version and incorporates the changes summarised below.

Version number	Description	Date
11	**Revision of Unit** DV5M 34 Web Design: An Introduction has been replaced by H383 34 and finishes on 31/07/2015	17/07/15
10	**Revision of Unit:** DE1K 33 Workplace Communication in English has been revised by H8T2 33 and finishes on 31/07/2016.	19/05/15
	No History of Changes table when previous version changes were made.	

HNC Computer Networking G7DX 15
HND Computer Networking and Internet Technology G7DY 16

Contents **Page number**

Note: the units which make up the qualification are available separately

Appendices

HNC Computer Networking G7DX 15
HND Computer Networking and Internet Technology G7DY 16

1. Introduction

1.1.1 This is the Award Arrangements document for the Higher National Qualifications in Computer Networking and Computer Networking and Internet Technology which were validated in December 2003. The awards and units were validated separately in accordance with the new design rules. The validation meetings were organised by the SQA.

2. Background to the development of the qualifications

2.1 General background

2.1.1 SQA's predecessor bodies (SCOTVEC/SCOTEC/SCOTBEC) have been offering Higher National awards in the Computing area since the early 1980s. The HNC and HND awards in Computing have been offered in unitised format since 1989. They were last revised in 2001.

2.1.2 Fourteen Scottish colleges (i.e. roughly a third of the total) offer locally devised programmes in Computer Networking or Internetworking. In 2002 a consortium (led by Fife College) was set up with a view to drawing together collective experience in this area and producing a new National Framework. The existing uptake for courses and the ever-growing need for network professionals suggest that there will be a healthy demand for the proposed course.

2.1.3 Last session (2001 – 2002) 394 candidates enrolled for Higher National Certificate courses in Networking or Internetworking and 202 enrolled for Higher National Diploma courses. A further 53 enrolled for the Advanced Certificate in Computer Networking (Windows 2000). Thus the total demand for Advanced-level provision was 659 candidates. This is probably an underestimate as many colleges (e.g. Stevenson) effectively run the HND Computing (Technical Support) course as a Networking course. The new courses are likely to promote significant growth in this area.

2.1.4 Networking technology is changing rapidly. The last few years have seen enormous growth in the area of vendor certifications from companies such as Microsoft (MCSE, MCSA etc.), Cisco (CCNA, CCNP etc.) and CompTIA (A+, Network+ etc.). To some extent these developments have taken place outwith the main higher education framework, although SQA has tried to accommodate them by the introduction of a series of Professional Development Awards (PDAs) and many of the colleges offering HN awards in this area have attempted to coordinate these with vendor certifications. Other examining bodies, notably OCR, have also attempted to develop programmes in collaboration with vendors.

2.1.5 The new HNC/D programmes will allow integration with vendor qualifications in two ways: candidates following a traditional HNC/D programme will acquire the requisite knowledge and skills to enable them, if they so wish, to sit a range of vendor exams, in addition to obtaining their HNC/D. Conversely, candidates who have already undertaken vendor examinations will be able to use these to gain exemption from specified HN Units or groupings of units. Appendix 7 (page 47) of this document shows how the units in the new programmes can be matched to vendor certifications.

2.2 Demand for Networking / Internetworking skills

2.2.1 As part of the market research for the new awards, a review was undertaken to identify information on the networking 'skills gap', the number of networking vacancies and the networking skills most in demand. This review looked at a number of reports commissioned by industry bodies and considered aspects of the IT skills gap in Scotland, the UK, Europe and world wide. Details are given in Appendix 2 (page 17).

2.3 Advisory panel

2.3.1. Development of the awards was undertaken by members of an Advisory Panel which was formed specifically to deal with these qualifications. Membership of the Advisory Panel is given in Appendix 3 (page 18).

2.4 Consultation

2.4.1 Extensive consultation was carried out at all stages of the award.

This consultation involved:

- centres offering HN awards in Networking or Internetworking;
- employers and industry bodies in the networking field;
- students undertaking the current awards and prospective candidates for the new awards;
- Higher Education institutions to which successful candidates could articulate.

2.4.2 There was email consultation with centres, a postal / email / telephone survey of employers, an email survey of universities, and a classroom-based survey of current candidates. An on-line e-mail discussion group was also set up and attracted 150 members from colleges and other bodies (http://www.smartgroups.com/internetworking). Details of the consultation are given in Appendix 4 (page 21).

2.4.3 The consultation confirmed the considerable demand for the proposed awards, their relevance to the Networking industry and the attractiveness of the awards to candidates.

2.5 Links to vendor qualifications

2.5.1 There was overwhelming support from both employers and students for linking the awards to vendor qualifications and the awards cover the knowledge and understanding required for the following qualifications: A+, Network+, Server+, i-Net+, Security+, Microsoft Certified Systems Administrator (MCSA) and Cisco Certified Network Associate (CCNA). Depending on the options chosen at HND level, candidates can also cover the knowledge and understanding required for the Microsoft Certified Systems Engineer (MCSE) and/or Microsoft Certified Database Administrator (MCDBA) awards.

2.5.2 Candidates undertaking specified HN units using Microsoft software will gain appropriate knowledge and understanding and may sit examinations leading to the Microsoft qualifications once they have gained sufficient practical experience. Centres may apply to become Microsoft IT Academies, which will allow them to use Microsoft Official Curriculum (MOC) training materials. They may also apply to become Cisco Networking Academies, giving them access to Cisco's online learning materials.

2.5.3 Although the units have been written in such a fashion as to allow centres to make use of Microsoft and Cisco training materials, the have been kept as vendor-independent as possible and centres can choose to develop their own training materials or source them from other providers. They can also choose to deliver the awards using alternative platforms such as Unix/Linux, Novell or Oracle.

2.8 The Scottish Credit and Qualifications Framework (SCQF)

2.8.1 Due cognisance has been taken of the requirements of the Scottish Credit and Qualifications Framework (SCQF) in the design of these awards. This means that the HNC award will be broadly equivalent to the first year of a Scottish degree, while the HND awards will be broadly equivalent to the first and second years of a Scottish degree. All new units have been allocated a SCQF level, HNC being level 7, while HND is level 8.

2.8.2 The HN design principles given in Appendix 1 (page 14) dictate how HNC and HND awards may be composed of units at various levels.

2.8.3 Details of the SCQF Level Descriptors at levels 6, 7, 8 and 9 are given in the Guide for Validation Panel Members. These Level Descriptors clearly indicate the cognitive skills to be demonstrated at each level.

2.10 Core Skills

2.10.1 The importance of core skills has been recognised and these are developed throughout the awards. Recommended entry and mandatory exit levels for the core skills profiles, together with appropriate carrier units, are given in Tables A and B below.

Core Skill	Recommended Entry Level HNC/D	Recommended Exit Level HNC	Recommended Exit Level HND
Communication	Intermediate 2	Enhanced	Enhanced
Information Technology	Higher	Higher	Higher
Numeracy	Intermediate 2	Enhanced	Enhanced
Working with Others	Intermediate 2	Higher	Higher
Problem Solving	Intermediate 2	Higher	Higher

Table A: Core Skills Profile

Core Skill	Carrier Unit(s)	Level
Working with Others	HNC Graded Unit Credit – Project	Higher
Problem Solving	HNC Graded Unit Credit – Project HND Graded Unit Credit - Project	Higher Higher

Table B: Carrier Units for Core Skills

2.10.3 Higher Level is the most advanced level of core skill currently defined by SQA. The Advisory Panel considered it appropriate to recommend Intermediate 2 as entry level for core skills, other than Information Technology, for the HNC/D. The Panel considered that candidates who wished to attempt a highly-technical qualification in Computer Networking should already possess IT skills at Higher level. Candidates who had completed a Scottish Group Award at Higher would have Intermediate 2 or above in each of the core skills.

2.10.4 Core skills 'signposting'

Appendix 9 (page 42) gives some indication where it *may* be possible (depending on the mode of delivery) to enhance various core skills from units in the awards which have not been audited specifically for elements of core skills (or entire core skills). In this context, enhancement means that candidates will have the opportunity to exercise and develop these skills, but that no claim will be made for certification.

2.10.5 It is recognised that many candidates, particularly adult returners, may not have a specified Core Skills Profile on entry and hence the entry level is recommended only. The recommended exit level Core Skill Profile is an indication of what the Advisory Panel considered would denote the level of proficiency required to enable candidates to derive the maximum benefit from studying the HNC/D courses (in terms of opportunities for further study, personal development or employment).

2.10.6 The employer survey gave a high prominence to the importance of Core Skills, particularly Working with Others and Problem Solving. Accordingly, the Advisory Panel considered it important to develop the Core Skills within the HNC award. Thus the Recommended Exit Level for these Core Skills has been set at Higher for HNC.

2.10.7 Writers were able to embed the Working with Others and Problem Solving Core Skills comfortably in the HNC and HND Graded Units without forcing them artificially.

2.10.8 HNCs and HNDs are also expected to contribute towards the development of Generic Skills, such as Management, Finance, Leadership and Customer Care. Several of the course units provide opportunities for candidates to develop or exercise these skills, for example the Hardware Concepts and Operating Systems Concepts units have a customer care element and the second-year HND core units involve the pricing of network solutions.

3. Rationale and aims of the qualifications

3.1 Rationale

3.1.1 The awards are designed for those who will design, implement and support Computer Networks systems in a vast range of industries

3.1.2 HN awards in Computer Networking are already well established within Scottish FE (see paragraph 2.1.2) and are popular with students (paragraph 2.1.3). They help to satisfy the government's stated aims of developing the 'knowledge economy' and the IT industry, of enhancing the IT skills of the population and of closing the IT skills gap and so increasing economic competitiveness. The courses reflect the skills most in demand in the today's IT industry.

3.1.3 The *HNC Computer Networking* is a general award which allows candidates to gain skills and knowledge in PC hardware and software, client and server operating systems, computer networks, technical support and core skills. This award is aimed at those employed, or wishing to be employed, in roles such as computer or network technician or help-desk officer. The award has been designed to allow candidates to progress to HND Computer Networking and Internet Technology.

3.1.4 The *HND Computer Networking and Internet Technology* has an emphasis on the advanced use of the routing and switching technologies underlying computer networks and internetworks and the advanced use of the operating systems which support these. It also allows candidates to gain specialised knowledge of network security, or specific server roles, such as web servers or mail servers. As such, it is intended to prepare candidates for employment as Networking Technicians or Network Administrators. In addition, it enables successful candidates to progress to the third year of appropriate degree courses in Computer Networking or Computer Systems.

3.1.5 The HNC award is designed for both full-time and part-time candidates. It is anticipated that candidates already employed in IT may use work-based projects to undertake the Graded project unit. The HND award is usually undertaken by full-time candidates, but part-time and/or flexible provision is likely to be offered by some centres.

3.1.6 The awards may be delivered by open and distance learning methods, provided that adequate preparations are made. Additional planning and resources will be needed for candidate support, assessment and re-assessment. In respect of the latter, a combination of new and traditional authentication tools and techniques may have to be devised. Quality assurance procedures must also be sufficiently robust to support open and distance learning. Further advice and guidance is available in the SQA publication *Assessment and Quality Assurance for Open and Distance Learning* – SQA February 2001.

3.1.7 Evidence of market research is given in Appendix 2 (Skills gaps in the IT profession – page 17) and Appendix 4 (Details of consultation – page 21). The need for the qualifications has been clearly identified. These awards can contribute to an overall strategy for reducing the IT skills gap and enhancing Scottish prosperity by enabling further expansion of the 'knowledge economy'.

3.1.8 The evidence of support from employers (Appendix 5 –Evidence of support – page 38) indicates that the structure and content of the awards meet the needs identified

3.1.9 In designing the award, the Advisory Panel has been fully aware of the need for qualifications which will allow articulation to degree and Advanced Diploma courses while at the same time containing relevant technical and transferable skills which will enable immediate entry to employment. The Advisory Panel believes that an appropriate balance between 'academic' and 'vocational' (i.e. between knowledge and its practical application) has been achieved. The links with vendor qualifications (see Section 2.5) should ease the transition into employment.

3.1.10 The awards would form a natural progression from the Scottish Group Award at Higher in Computing and Information Technology.

3.1.11 The HND Computer Networking and Internet Technology award enables articulation to a range of Computer Networking and generic Computing degrees, some examples of which are listed in Appendix 6 (Examples of degree articulation – page 41).

3.1.12 There is great demand for employees with CompTIA, Microsoft and Cisco certifications. By building the underpinning knowledge for these into the HN frameworks, the Advisory Panel anticipates that candidates will be better able to sell their skills in the marketplace and hence help to reduce the skills gap.

3.2 General aims

3.2.1 These HNC and HND awards have a range of broad aims which are generally applicable to all equivalent Higher Education qualifications. Some of these general aims are:

- To develop the candidate's knowledge and skills such as planning, analysing and synthesising.
- To develop employment skills and enhance candidates' employment prospects
- To enable progression within the Scottish Credit and Qualifications Framework
- To develop study and research skills
- To develop transferable skills including core skills
- To provide academic stimulus and challenge, and foster an enjoyment of the subject.

3.3 Specific aims

3.3.1 The specific aims of the **HNC Computer Networking** award are:

1. To prepare candidates for employment in a networking-related post at technician level such as a technical support position or help-desk technician.

2. To develop a range of contemporary vocational skills (i.e. technical computing skills) relating to the use and support of networked computer systems appropriate to employment at technician (or equivalent) level.

3. To provide a flexible curriculum to meet the needs of candidates in employment, recognising their existing experience and skills.

4. To provide candidates with the underpinning knowledge and skills which may allow them to sit vendor certification examinations at entry and intermediate levels.

5. To prepare candidates for progression to further study in Computer Networking or a related discipline at HND level.

3.3.2 The specific aims of the **HND Computer Networking and Internet Technology** award are similar to those of the HNC above, except that diplomats would expect to enter employment in the IT field at a more senior or professional level and to have more in-depth technical skills and knowledge.

3.3.3 The specific aims of the **HND Computer Networking and Internet Technology** award are:

1. To prepare candidates for employment in a network-related post at technician or professional level in a technical support or administrative role.

2. To develop a range of specialist technical knowledge and skills in networking technologies and operating systems.

3. To provide candidates with the underpinning knowledge and skills which may allow them to sit vendor certification examinations at advanced level.

4. To prepare candidates for progression to further study in Computer Networking or a related discipline at third year degree level.

3.4 Realisation of Aims by Unit and Award

The table below gives an indication of where the specific aims of each of the three awards may be met in relation to individual units.

					Aims	
Unit No	**Title**	**Credit Value**	**SCQF Points**	**SCQF Level**	**HNC**	**HND**
DG0K 33	Hardware Concepts	1	8	6	1, 2, 3, 4, 5	-
DF9L 33	Operating System Concepts	1	8	6	1, 2, 3, 4, 5	-
DF9M 34/H1EM 34	Client Operating System	2	12	7	1, 2, 3, 4, 5	-
DF9N 34	Network Server OS	2	12	7	1, 2, 3, 4, 5	-
DG0J 34	HNC Graded Unit	1	8	7	1, 2, 3, 5	-
DF9P 34	Network Concepts	2	16	7	1, 2, 3, 4, 5	-
DF9R 35	Network Infrastructure 1: Implementation and Management	2	16	8	1, 2, 3, 4, 5	1, 2, 3, 4
DF9T 34	Internetworking Concepts 1: Development and Delivery Concepts	1	8	7	1, 2, 3, 4, 5	-
DF9V 34	Internetworking Concepts 2: Security and Business Concepts	1	8	7	1, 2, 3, 4, 5	-
DF9W 34	Server Concepts	2	16	7	1, 2, 3, 4, 5	-
DF9X 35/FR24 35	Networking Technology	2	16	8	1, 2, 3	1, 2, 3, 4
DF9Y 35/FR22 35	Routing Technology	2	16	8	1, 2, 3	1, 2, 3, 4
DG09 35/FR23 35	Switching Technology	2	16	8	-	1, 2, 3, 4
DG0A 35/FR25 35	Internetworking Technology	2	16	8	-	1, 2, 3, 4
DG0035	Network Infrastructure 2: Planning and Maintenance	2	16	8	1, 2, 3	1, 2, 3, 4
DG01 35	Directory Services Infrastructure	2	16	8	1, 2, 3, 4	1, 2, 3, 4
DG0D 36	Network Design: Directory	2		9	-	1, 2, 3, 4

					Aims	
Unit No	**Title**	**Credit Value**	**SCQF Points**	**SCQF Level**	**HNC**	**HND**
	Services and Network Infrastructure		16			
DG0E 36	Network Design: Security	1	8	9	-	1, 2, 3, 4
DG0H 35	HND Graded Unit	2	16	8	-	1, 2, 3, 4
DG02 34	Security Concepts	2	16	8	1, 2, 3	1, 2, 3, 4
DG0F 35	Database Server Administration	2	16	8	1, 2, 3	1, 2, 3, 4
DG0G 35	Database Design and Implementation	2	16	8	1, 2, 3	1, 2, 3, 4
DG03 34	Programming in SQL	1	8	7	1, 2, 3, 5	-
DG04 35	Wireless Local Area Networks	2	16	8	1, 2, 3	1, 2, 3, 4
DG05 34	Scripting	2	16	7	1, 2, 3, 5	-
DG06 35	Internet: Web Server Management	2	16	8	1, 2, 3	1, 2, 3
DG07 35	Mail Server Administration	2	16	8	1, 2, 3	1, 2, 3, 4
DG08 35	Network Security: Implementation and Administration	2	16	8	1, 2, 3	1, 2, 3, 4

4. Recommended conditions for entry to the qualifications (access)

4.1.1 As with all SQA qualifications, access will be at the discretion of the Centre and the following recommendations are for guidance only.

4.1.2 Some examples of appropriate formal entry qualifications are specified below. They are not exhaustive or mutually exclusive and may be offered in a variety of combinations.

Entry to HNC Computer Networking

(i) Scottish Group Awards in Computing and/or Information Technology at Higher.

(ii) Any other relevant Scottish Group Award at Higher.

(iii) Any relevant National Course at Higher together with two Standard Grade passes at level 3 or above.

(iv) An SVQ at level 2 or 3 in Computing, Information Technology or other relevant area.

(v) Relevant National Units at appropriate levels (e.g. core skills units at Intermediate 1 or 2) combined with any of the above.

Entry to HND Computer Networking and Internet Technology

(i) Scottish Group Awards in Computing and/or Information Technology at Higher.

(ii) Any other relevant Scottish Group Award at Higher.

(iii) Any two relevant National Courses at Higher together with three Standard Grade passes at level 3 or above.

(iv) An SVQ at level 2 or 3 in Computing, Information Technology or other relevant area.

(v) Relevant National Units at appropriate levels (e.g. core skills units at Intermediate 1 or 2) combined with any of the above.

4.1.3 Different combinations of relevant National Qualifications, Vocational Qualifications and equivalent qualifications from other awarding bodies may also be acceptable, as would suitable vendor qualifications at an appropriate level.

4.1.4 It would be advisable for candidates to have some prior knowledge of computing or information technology although formal qualifications may not be necessary if suitable experience had been gained informally or through work experience. Centres may wish to give consideration to inferred or actual evidence of candidates' core skills.

4.1.5 Mature candidates with suitable work experience may be accepted for entry provided the enrolling centre believes that the candidate is likely to benefit from undertaking the award.

5. Structure of the Qualifications

5.1 Higher National Certificate: Computer Networking

Total credit value of award: 12 credits

5.1.1 Mandatory units

A total of **7** credits must be gained by achieving the following mandatory units**.**

Unit No.	Unit Title	Credit Value	SCQF Points	SCQF Level
DG0K 33	*Hardware Concepts*	*1*	*8*	*6*
DF9L 33	*Operating System Concepts*	*1*	*8*	*6*
	OR			
F1XA 34 *H17E 34*	*Computing: PC Hardware and Operating System Essentials (finish date 31.07.2015)* ***OR*** *Computing: PC Hardware and Operating System Essentials*	*1*	*8*	*7*
F1X9 34 *H17F 34*	*Computing: PC Hardware and Operating System Support (finish date 31.07.2015)* ***OR*** *Computing: PC Hardware and Operating System Support*	*1*	*8*	*7*
DF9M 34 H1EM 34	Client Operating System (finish date 31.07.2012) **OR** Client Operating System	2 2	16 16	7 7
DF9N 34	Network Server Operating System	2	16	7
DG0J 34	HNC Graded Unit	1	8	7

Table 1 – all units must be undertaken (7 credits)

5.1.2 Optional units

A total of **5** credits must be gained from Table 2.

Unit No.	Unit Title	Credit Value	SCQF Points	SCQF Level
DF9P 34	Network Concepts	2	16	7
DF9R 35	Network Infrastructure 1: Implementation and Management	2	16	8
DF9T 34	Internetworking Concepts 1: Development and Delivery Concepts	1	8	7
DF9V 34	Internetworking Concepts 2: Security and Business Concepts	1	8	7
DF9W 34	Server Concepts	2	16	7
DF9X 35 FR24 35	Networking Technology (Finish date 31/07/2013) **OR** Networking Technology	2 2	16 16	8 8
DF9Y 35 FR22 35	Routing Technology (Finish date 31/07/2013) **OR** Routing Technology	2 2	16 16	8 8
DG0035	Network Infrastructure 2: Planning and Maintenance	2	16	8
DG01 35	Directory Services Infrastructure	2	16	8
DG02 34	Security Concepts	2	16	7

DG03 34	Programming in SQL	1	8	7
DG04 35	Wireless Local Area Networks	2	16	8
DG05 34	Scripting	2	16	7
DG06 35	Internet: Web Server Management	2	16	8
DG07 35	Mail Server Administration	2	16	8
DM34 34	Supporting Users and Troubleshooting Desktop Applications	1	8	7
DM 35 34	Supporting Users and Troubleshooting a Desktop Operating System	2	16	7
DG08 35	Network Security: Implementation and Administration	2	16	8
DE3R 34	Personal Development Planning	1	8	7
H8T2 33*	Workplace Communication in English	1	8	6
DM30 35	Project Management 1	1	8	7
DG0E 36	Network Design: Security	1	8	9
D85F 34	Using Software Application Packages	1	8	7
DH31 34	Computer Networks: Building Local Area Networks (finish date 31.07.2015) **OR**	2	16	7
H17C 34	Computer Networks: Building Local Area Networks	2	16	7
D75S 35	Computer Networks: Administering Network Systems	2	16	8
F4TJ 35	Software Development: Programming in PL/SQL	2	16	8
F577 34	Communication: Producing and Presenting Complex Information	1	8	7
F0N0 35	Professional Issues in Computing	2	16	8
D75V 35	Computer Networks: Network Technology and Data Communications (finish date 31.07.2015) **OR**	2	16	8
H16V 35	Network Technology and Data Communications	2	16	8
F6BM 35	Web Server Platform	2	16	8
DG6E 34 DG6G 35	Work Role Effectiveness **OR** Work Role Effectiveness	3	24	7 8
FK89 34	Configuring a Desktop Operating System	2	16	7
FK8A 34	Troubleshooting a Desktop Operating System	2	16	7
FK88 35	Managing a Desktop Operating System Deployment	2	16	8

Table 2: a total of 5 credits must be undertaken

***Refer to History of Changes Table**

5.2 Higher National Diploma – Computer Networking and Internet Technology

Total credit value of award: **30** credits of which a minimum of **15** credits (**13 + 2 Graded Unit Credits**) must be gained at SCQF Level 8.

5.2.1 Mandatory units

A total of **19** credits must be gained by achieving the following mandatory units.

Unit No.	Unit Title	Credit Value	SCQF Points	SCQF Level
DG0K 33	*Hardware Concepts*	*1*	*8*	*6*
DF9L 33	*Operating System Concepts*	*1*	*8*	*6*
	OR			
F1XA 34 *H17E 34*	*Computing: PC Hardware and Operating System Essentials (finish date 31.07.2015)* ***OR*** *Computing: PC Hardware and Operating System Essentials*	*1*	*8*	*7*
F1X9 34 *H17F 34*	*Computing: PC Hardware and Operating System Support (finish date 31.07.2015)* ***OR*** *Computing: PC Hardware and Operating System Support*	*1*	*8*	*7*
DF9M 34 H1EM 34	Client Operating System (finish date 31.07.2012) **OR** Client Operating System	2 2	16 16	7 7
DF9N 34	Network Server Operating System	2	16	7
DF9T 34	Internetworking Concepts 1: Development and Delivery Concepts	1	8	7
DF9V 34	Internetworking Concepts 2: Security and Business Concepts	1	8	7
DF9X 35 FR24 35	Networking Technology (Finish date 31/07/2013) **OR** Networking Technology	2 2	16 16	8 8
DF9Y 35 FR22 35	Routing Technology (Finish date 31/07/2013) **OR** Routing Technology	2 2	16 16	8 8
DG09 35 FR23 35	Switching Technology (Finish date 31/07/2013) **OR** Switching Technology	2 2	16 16	8 8
DG0A 35 FR25 35	Internetworking Technology (Finish date 31/07/2013) **OR** Internetworking Technology	2 2	16 16	8 8
DG0J 34	Computer Networking: Graded Unit 1	1	8	7
DG0H 35	Computer Networking and Internet Technology: Graded Unit 2	2	16	8

Table 3– All units must be undertaken (19 credits)

5.2.2 Optional units

11 credits must be selected from the following table to ensure that 30 credits (of which at least 15 must be at level 8) are achieved overall.

Unit No.	Unit Title	Credit Value	SCQF Points	SCQF Level
DF9P 34	Network Concepts	2	16	7
DF9R 35	Network Infrastructure 1: Implementation and Management	2	16	8
DF9W 34	Server Concepts	2	16	7
DG00 35	Network Infrastructure 2: Planning and Maintenance	2	16	8

DG0D 36	Network Design: Directory Services and Network Infrastructure	2	16	9
DG0E 36	Network Design: Security	1	8	9
DG02 34	Security Concepts	2	16	7
DG0F 35	Database Server Administration	2	16	8
DG0G 35	Database Design and Implementation	2	16	8
DG03 34	Programming in SQL	1	8	7
DG04 35	Wireless Local Area Networks	2	16	8
DG05 34	Scripting	2	16	7
DG06 35	Internet: Web Server Management	2	16	8
DG07 35	Mail Server Administration	2	16	8
DM34 34	Supporting Users and Troubleshooting Desktop Applications	1	8	7
DM 35 34	Supporting Users and Troubleshooting a Desktop Operating System	2	16	7
DG08 35	Network Security: Implementation and Administration	2	16	8
DE3R 34	Personal Development Planning	1	8	7
H8T2 33*	Workplace Communication in English	1	8	6
DM30 35	Project Management 1	1	8	7
H383 34*	Web Design: An Introduction	1	8	7
D85F 34	Using Software Application Packages	1	8	7
DM2X 35	Computer Operating Systems 2	1	8	8
DH31 34	Computer Networks: Building Local Area Networks (finish date 31.07.2015) **OR**	2	16	7
H17C 34	Computer Networks: Building Local Area Networks	2	16	7
D75S35	Computer Networks: Administering Network Systems	2	16	8
F0N035	Professional Issues in Computing	2	16	8
D75V 35	Computer Networks: Network Technology and Data Communications (finish date 31.07.2015) **OR**	2	16	8
H16V 35	Network Technology and Data Communications	2	16	8
F6BM 35	Web Server Platform	2	16	8
DG01 35	Directory Services Infrastructure	2	16	8
H16W 35	Software Development: Relational Database Systems	2	16	8
DG6E 34	Work Role Effectiveness **OR**	3	24	7
DG6G 35	Work Role Effectiveness	3	24	8
FK89 34	Configuring a Desktop Operating System	2	16	7
FK8A 34	Troubleshooting a Desktop Operating System	2	16	7
FK88 35	Managing a Desktop Operating System Deployment	2	16	8
DK2L 33	Marketing Skills for the Entrepreneur	1	8	6
DP8F 34	Mathematics: Calculus and Matrices for Computing	1	8	7

Table 4 – a total of 11 credits must be undertaken

6. Assessment and Delivery Issues

As far as possible, a consistent approach to assessment has been maintained across all the units comprising the course. Evidence for the knowledge and/or skills component of each Unit must be produced using a set of restricted-response questions to assess candidates' knowledge and understanding. This may be administered as a single end-of unit test, or as several subtests, each covering one or more outcomes. Single-credit units have 30 questions and double-credit unit 50 questions. The questions have a similar format to those used in vendor examinations.

Candidates must answer at least 70% of the questions correctly in order to obtain a pass. If subtests are used, they must also score at least 70% in each subtest.

Testing must take place in a closed-book environment where candidates have no access to books, handouts, notes or other learning material. Testing can be done in either a machine-based or paper-based format and must be invigilated by a tutor or mentor. There must be no communication between candidates and communication with the invigilator must be restricted to matters relating to the administration of the test.

If a candidate requires to be reassessed, a different selection of questions must be used. At least half the questions in the reassessment must be different from those used in the original test

The suggested time allocation for a restricted response test is 2 minutes for each question plus 5 minutes starting-up time and 5 minutes finishing-off time, thus a total of 70 minutes should be allocated for a 30-question end-of-unit test and 110 minutes for a 50-question test.

Although individual outcome tests are permissible, it is suggested that if subtests are to be used, outcomes should be combined to produce tests of no fewer than 10 questions. A 10-question test would therefore have a time allocation of 30 minutes.

If an outcome has a practical component, this must be assessed by having the candidate use a logbook to record the practical tasks successfully completed. The logbook can be in paper or electronic form and must be authenticated by the tutor or mentor.

For some outcomes only a sample of the practical tasks needs to be completed and recorded for assessment purposes, e.g. three out of five. This is clearly indicated in the logbook instructions for the outcomes involved. Where this occurs, tutors must inform candidates of the tasks to be completed.

An Assessment Exemplar and Guidelines on the Delivery of the Unit will be produced for all mandatory units produced to indicate the national standard of achievement required at the appropriate SCQF level.

The content of many units may be delivered using vendor-supplied materials, such as Microsoft Official Curriculum (MOC). As these materials are under continuous development, centres should check carefully to ensure that such materials meet all the requirements for the Unit. If vendor-supplied materials are used, some of the practical tasks involved may contribute towards the practical assessments required for the unit.

Appendix 1

Design principles for developing HNCs and HNDs

Appendix 1: Design principles for developing HNCs and HNDs

HNCs and HNDs have supported technician, technologist and first line manager occupations for over 75 years, including progression in professional qualifications and other higher education awards. More recently, some HNs have been specifically designed to support progression from Modern Apprenticeships and to degrees.

In order to continue serving these occupations, HN programme designers should adhere to the following design principles. Design teams must always conduct market research, particularly among candidates and employers to ensure the continuing fitness for purpose of the HNs. Where this clearly indicates that any of those design principles marked with an asterisk needs to be re-interpreted or modified, SQA will work with the design team to develop alternatives, which are coherent with the other principles.

The validity of the market research and the fitness for purpose of the proposed alternatives will be confirmed at validation.

Further considerations for design teams are also indicated.

a Design Principles

SCQF Level and SCOTCAT points

1. HNCs shall be designed to be at SCQF level 7 and shall comprise 96 SCOTCAT credit points

2. HNDs shall be designed to be at SCQF level 8 and shall comprise 240 SCOTCAT credit points

3. HNCs should incorporate (a minimum of) 48 SCOTCAT credit points at SCQF level 7

4. HNDs should incorporate (a minimum of) 64 SCOTCAT credit points at SCQF level 8

Core Skills

5. HNC and HND programmes shall incorporate opportunities for candidates to develop Core Skills

6. *HNCs and HNDs should clearly include opportunities for candidates to develop Core Skills to levels required by the occupations or progression pathways the HNs support. This would normally mean all five Core Skills should be developed in every HN programme

Mandatory Section

7. HNCs should normally include a mandatory section of at least 48 SCOTCAT credits points including a Graded Units. (See Principles 9 and 10 *under 'Graded Units (formerly Integrative Assessments*) below).

8. HNDs should normally include a mandatory section (which may include alternatives) of at least 96 SCOTCAT points, including Graded Units.

Graded Units (formerly Integrative Assessments)

9. *HNCs should normally include one Graded Unit of 8 SCOTCAT credit points at SCQF level 7.

10. *HNDs should normally include one Graded Unit of 8 SCOTCAT credit points at SCQF level 7 plus 16 SCOTCAT credit points of Graded Unit (s) at SCQF level 8.

The purposes of Graded Units will be to assess the candidate's ability to integrate and apply the knowledge and/ or skills gained in the individual HN Units to demonstrate that they have the principal aims of the group award, and grade candidate achievement.

b Further considerations

HN Unit and group award Graded Unit Specifications

SQA produces guidance on how to write HN Unit and group award Graded Unit Specifications. These include templates and examples of how the specifications should be laid out. This guidance should always be used in developing new or revised HN Unit or group award Graded Unit Specifications. The minimum change to current Unit specifications would be to remove the merit statement and to add an SCQF level and SCOTCAT credit points.

Validation of HN Unit Specifications

A key part of validation is to confirm the proposed allocation of SCQF levels and SCOTCAT credit points to each Unit, and this needs to be seen to be done consistently. Until the process of devolving this to centres is fully worked out, SQA will validate all new or revised HN Unit specifications. Centres may continue to develop HN Unit specifications for validation by SQA.

Validation of HN Group Awards and group award Graded Units

Group award validation may continue to be done by those centres with devolved powers to do so. As Graded Units relate to the principle aims of a group award, these too may be validated by devolved centres as part of Group Awards.

Validation periods

HN Units, Graded Units and Group Awards will be kept under review by design teams in order to ensure continuing fitness for purpose. Normally, these will be reviewed every five years or more frequently if recommended by validation panels. However, specific time periods of validation will not be specified.

Appendix 2

Skills gaps in the IT profession

Appendix 2: Skills gaps in the IT profession.

The IT Skills Gap

Much has been written about the IT Skills Gap and the inhibiting effect the skills gap has on economic development. In many cases, there is more specific information about networking available.

The IDC report "Europe's Growing IT Skills Crisis" (IDC UK, 2000) concludes that, although the supply of IT professionals will increase between 1999 and 2003, the demand for IT professionals will increase at a more rapid rate and therefore the shortage of IT professionals will continue to grow.

A subsequent IDC report "Networking Skills shortages in EMEA" estimates that the shortage of skilled networking staff in the UK will rise from 169,437 in 1999 to 349,801 in 2004, representing 28% of the available jobs.

A more recent report, 'Despite Weak Economy, Skilled ICT Staff Still Needed in Europe' (IDC, UK 2002) suggests that the IT skills shortage in the UK will increase from 214,456 in 2000 to 293,551 in 2005, an increase of 11%. It also highlights the fact that "The shortage of skilled networking professionals (engineers or consultants specializing in designing, implementing, and supporting networks) will increase by a 19% CAGR (compound Annual Growth Rate), indicating the growth in use of the Internet in European organizations".

Another recent report "e-skills Regional Gap: Scotland" (e-skills UK, July 2003) highlighted Operating Systems and Networking as key skill-shortage area. A UK-wide report, published at the same time, reached similar conclusions.

Appendix 3

Membership of Advisory Panel

Appendix 3: Membership of Advisory Panel

The awards were designed by the Advisory Panel listed below. This group included representatives from Further and Higher Education, the IT industry, Her Majesty's Inspectorate and the Scottish Qualifications Authority.

- Bobby Elliott: Qualifications Manager, SQA
- Ted Hastings: Consultant, SQA
- Peter Bradbeer: Consortium Chairman, Fife College
- Tony Dyer: Falkirk College
- Colin Foster: Ayr College
- Fergus Lang: James Watt College
- Deryck Nutley: Cardonald College
- Fares Samara: Central College
- Michael Smith: Stevenson College
- John Sweeney: Reid Kerr College
- Jane Lewis: Cisco
- Sarah Lennox: CompTIA
- Walter Patterson: HMIE
- Peter Lowitt: Robert Gordon's University
- Joe Wilson: SFEU

Appendix 4

Details of consultation

Appendix 4: Details of Consultation

The Advisory Panel considered that it was important to consult widely on the content of the awards. Accordingly, the following consultation took place.

1. An online discussion forum was set up to discuss the revision of the framework. This attracted 75 members and was a very valuable means of disseminating information and obtaining feedback
2. Contact was established with all colleges currently offering Networking or Internetworking awards.
3. A total of 15 Scottish IT companies were surveyed. Due to the amount of national and international market research information available on networking skills shortages the Advisory Panel felt that a small sample of local employers was sufficient.
4. A total of 80 current students were surveyed.
5. All Universities in Scotland were contacted.

Summaries of the responses to the questionnaires to employers and students are given on the following pages.

HNC Networking
HND Internetworking
Employer Questionnaire

SCOTTISH QUALIFICATIONS AUTHORITY

Summary of Results (with comments)

1. When recruiting new IT staff is it your company's policy to consider:

School Leavers	3 (20%)
Higher National Certificate (HNC) qualifications	9 (60%)
Higher National Diploma (HND) qualifications	9 (60%)
Graduates Only	2 (13%)
Combination of Above	10 (67%)
Experienced Only	6 (40%)
Vendor Certified (MCSE, CCNA etc)	10 (67%)

It is encouraging to note the high proportion of employers who will consider candidates with HNC/D qualifications and the low proportion who will only accept graduates. It is also interesting to see the high proportion who will consider vendor-certified candidates and the relatively low proportion who will only consider experienced candidates.

2. If you recruit individuals with HNC/HND qualifications, do you:

No Answer	5 (33%)
accept any HNC/HND qualifications	3 (20%)
accept only HNC/HND Computing / Computer Networking qualifications	7 (47%)

*It is interesting to note that employers are looking for candidates with a **relevant** HNC/D, not simply a generic qualification. If we exclude those who did not answer (presumably those who don't accept HNC/Ds at all) then the proportion looking for an HNC/D in Computing or Computer Networking is 70%.*

3. Which of the following vendor certifications are relevant to your organisation?

	Very Relevant	Relevant	Not Relevant
A+	4 (27%)	3 (20%)	5 (33%)
Server+	5 (33%)	7 (47%)	2 (13%)
Network+	5 (33%)	7 (47%)	1 (7%)
i-Net+	3 (20%)	3 (20%)	5 (23%)
Security+	2 (13%)	9 (60%)	1 (7%)
MCSA (Microsoft Certified Systems Administrator)	7 (47%)	4 (27%)	2 (13%)
MCSE (Microsoft Certified Systems Engineer)	9 (60%)	4 (27%)	2 (13%)
MCDBA (Microsoft Certified Database Administrator)	3 (20%)	5 (33%)	3 (20%)
CCNA (Cisco Certified Network Associate)	6 (40%)	5 (33%)	
CWNA (Certified Wireless Network Administrator)	4 (27%)	8 (53%)	3 (20%)
Unix/Linux Certification	2 (13%)	7 (47%)	6 (40%)
Novell Certification	3 (20%)	2 (13%)	8 (53%)
Oracle Certification	2 (13%)	3 (20%)	7 (47%)
Other (Please state: CCNP)	1 (7%)		

The results suggest that most employers place a high value on vendor certifications, confirming the related data in Q1.

If we merge the Very Relevant and Relevant categories and sort by score, the following table emerges:

	Relevant or Very Relevant
MCSE (Microsoft Certified Systems Engineer)	87%
Server+	80%
Network+	80%
CWNA (Certified Wireless Network Administrator)	80%
Security+	73%
MCSA (Microsoft Certified Systems Administrator)	73%
CCNA (Cisco Certified Network Associate)	73%
Unix/Linux Certification	60%
MCDBA (Microsoft Certified Database Administrator)	53%
A+	47%
i-Net+	40%
Novell Certification	33%
Oracle Certification	33%

This shows that employers value MCSE highly and also have a high regard for the Server+, Network+ and CWNA certifications. CWNA is particularly interesting as it suggests that employers see Wireless Networking as a growth area. Security+, MCSA and CCNA are slightly lower placed. Unix/Linux certification comes in surprisingly high at 60%, while MCDBA comes in at only 53%, perhaps reflecting the fact that only some employers are involved in Database work. A+ and i-Net+ come in fairly low, probably because employers consider these as low-end certifications. Novell and Oracle certifications rate poorly, perhaps due to decline in the use of Novell networks and the relatively small number of employers using Oracle.

4. Do you believe it is a good idea to embed vendor certifications in HNC/D programmes?

Yes	No	Don't Care
13 (87%)	2 (13%)	

The vast majority of employers believe it is a good idea to embed vendor certifications in HNC/D programmes.

5. Should students who have already obtained vendor certifications be able to use these to gain credit towards an HNC or HND?

Yes	No	Don't Care
14 (93%)	1 (7%)	

An even larger majority believe that students who have already obtained vendor certifications be able to use these to gain credit towards an HNC or HND.

For questions 6 to 12 please show against the following subject list how relevant to your business would student knowledge and skills be in the given areas?

4 - very significant
3 - significant
2 - quite significant
1 - not significant

6.

Hardware & Operating Systems	4	3	2	1
PC Hardware and Software	9 (60%)	4 (27%)	2 (13%)	
Network Server Hardware	9 (60%)	4 (27%)	2 (13%)	
Client Operating System	10 (67%)	3 (20%)	2 (13%)	
Network Server Operating System	10 (67%)	2 (13%)	3 (20%)	

All topics were seen as significant or very significant by a high proportion of employers. Merging these categories gives the following table:

Hardware & Operating Systems	Very Significant or Significant
PC Hardware and Software	87%
Network Server Hardware	87%
Client Operating System	87%
Network Server Operating System	80%

7.

Networking / Internetworking Technology	4	3	2	1
Network Concepts	10 (67%)	4 (27%)	1 (7%)	
Internetworking Concepts	7 (47%)	4 (27%)	3 (20%)	1 (7%)
Networking Technology	10 (67%)	5 (33%)		
Routing Technology	9 (60%)	2 (13%)	4 (27%)	
Switching Technology	8 (53%)	5 (33%)	2 (13%)	
Internetworking Technology	10 (67%)	2 (13%)	2 (13%)	1 (7%)
Wireless Local Area Networks	5 (33%)	4 (27%)	4 (27%)	2 (13%)

All topics were seen as significant or very significant by a high proportion of employers. Merging these categories gives the following table:

Networking / Internetworking Technology	Very Significant or Significant
Network Concepts	94%
Internetworking Concepts	74%
Networking Technology	100%
Routing Technology	73%
Switching Technology	86%
Internetworking Technology	80%
Wireless Local Area Networks	60%

The relatively low score awarded to Wireless LANs is slightly puzzling, given the high score awarded for the CWNA certification.

8.

Network Administration	4	3	2	1
Network Infrastructure 1: Implementation and Management	8 (53%)	6 (40%)	1 (7%)	
Network Infrastructure 2: Planning and Maintenance	9 (60%)	5 (33%)	1 (7%)	
Directory Services Administration	6 (40%)	3 (20%)	5 (33%)	1 (7%)
Web Server Management	4 (27%)	5 (33%)	5 (33%)	
Mail Server Administration	6 (40%)	5 (33%)	4 ((27%)	

Again, all topics were seen as significant or very significant by a high proportion of employers. Merging these categories gives the following table:

Network Administration	Very Significant or Significant
Network Infrastructure 1: Implementation and Management	93%
Network Infrastructure 2: Planning and Maintenance	93%
Directory Services Administration	60%
Web Server Management	60%
Mail Server Administration	73%

The relatively low scores awarded to Directory Services administration and Web Server Management may reflect the fact that these are seen as specialist activities.

9.

Network Security	4	3	2	1
Security Concepts	8 (53%)	6 (40%)	1 (7%)	
Network Security: Implementation and Administration	7(47%)	6 (40%)	2 (13%)	

Again, all topics were seen as significant or very significant by a high proportion of employers. Security is obviously seen as a high-priority area. Merging these categories gives the following table:

Network Security	Very Significant or Significant
Security Concepts	93%
Network Security: Implementation and Administration	87%

10.

Network Design	4	3	2	1
Network Design: Infrastructure	10 (67%)	3 (20%)	1 (7%)	1 (7%)
Network Design: Security	8 (53%)	5 (33%)	1 (7%)	1 (7%)
Network Design: Directory Services	7 (47%)	5 (33%)	1 (7%)	1 (7%)

Once again, all topics were seen as significant or very significant by a high proportion of employers. Merging these categories gives the following table:

Network Design	Very Significant or Significant
Network Design: Infrastructure	87%
Network Design: Security	86%
Network Design: Directory Services	80%

11.

Database Administration	4	3	2	1
Database Server Administration	3 (20%)	5 (33%)	4 (27%)	3 (20%)
Database Design and Implementation	3 (20%)	3 (20%)	6 (40%)	3 (20%)
SQL Programming	2 (13%)	5 (33%)	5 (33%)	3 (20%)
Scripting	3 (20%)	4 (27%)	5 (33%)	3 (20%)

A wider spread here, perhaps reflect the fact that only some employers take part in Database activities. Merging the Significant and Very Significant categories gives the following table:

Database Administration	Very Significant or Significant
Database Server Administration	53%
Database Design and Implementation	40%
SQL Programming	46%
Scripting	47%

12. How relevant to your business would the following skills be?

	4	3	2	1
Communication	9 (60%)	6 (40%)		
Numeracy	6 (40%)	9 (60%)		
Working with Others	14 (93%)	1(7%)		
Problem Solving	15 (100%)			

All skills were regarded as important, with a higher priority given to Working with Others and Problem Solving. Merging the Significant and Very Significant categories gives the following table:

	Very Significant or Significant
Communication	100%
Numeracy	100%
Working with Others	100%
Problem Solving	100%

This speaks for itself and suggests that employers hold core skills in very high regard.

13. If you employ individuals with HNC/HND qualifications, which eventual roles do they usually take up?

Computer Technician	10 (67%)
Network Technician	10 (67%)
Network Engineer	9 (60%)
Network Administrator / Manager	8 (53%)
Database Administrator / Manager	7 (47%)
Other (please state)	3 (20%)

This shows that HNC/D holders can find employment in a variety of relevant roles, including some fairly senior ones. The main entry in the "Other" category was "Help Desk Technician".

Summary

Overall the results show exceptionally strong support from employers, confirming the trends shown in National and International surveys.

HNC Computer Networking
HND Computer Networking and Internet Technology

Student Questionnaire

HNC/D Students: Summary of Results (with comments)

Note: *A total of 80 questionnaires were received from advanced level (HNC/D) students. Some students did not answer all questions so results may not always total 80. All percentages have been rounded to the nearest whole number.*

Gender:	**Male**	49 (61%)
	Female	31 (39%)
Age:	**16 – 20**	12 (15%)
	21 – 25	14 (18%)
	26 – 30	17 (21%)
	31 – 35	15 (19%)
	36 – 40	7 (9%)
	41 – 45	8 (10%)
	46 – 50	3 (4%)
	Over 50	-
Attendance:	**Full-Time**	57 (71%)
	Part-Time	3 (4%)
	Evening	20 (25%)
Do you work in Computing?	**Yes**	20 (25%)
	No	60 (75%)
Reason for taking present course?	**To obtain work in Computing**	28 (35%)
	To progress to next level	40 (50%)
	To improve career prospects	50 (56%)

1. Do you believe it is a good idea to embed vendor certifications such as A+, MCSA and CCNA in HNC/D programmes?

Yes	No	Don't Care
78 (98%)	2 (3%)	

The vast majority of HNC/D students surveyed believed that it was a good idea to embed vendor certifications.

2. Should students who have already obtained vendor certifications be able to use these to gain credit towards an HNC or HND?

Yes	No	Don't Care
71 (89%)	6 (8%)	3(4%)

A slightly smaller majority believed that students who have already obtained vendor certifications be able to use these to gain credit towards an HNC or HND.

3. Which of the following vendor certifications should be embedded in an HND in Internetworking?

	Yes	Maybe	No
A+	47 (59%)	10 (13%)	-
Server+	40 (50%)	18 (23%)	-
Network+	49 (61%)	15 (19%)	-
Inet+	29 (36%)	30 (38%)	-
Security+	48 (60%)	12 (15%)	-
MCSA (Microsoft Certified Systems Administrator)	59 (74%)	4 (5%)	3 (4%)
MCSE (Microsoft Certified Systems Engineer)	47 (59%)	23 (29%)	-
MCDBA (Microsoft Certified Database Administrator)	47 (59%)	23 (29%)	-
CCNA (Cisco Certified Network Associate)	46 (58%)	14 (18%)	-
CWNA (Certified Wireless Network Administrator)	47 (59%)	16 (20%)	-
Unix/Linux Certification	57 (71%)	15 (19%)	2 (3%)
Novell Certification	35 (44%)	27 (34%)	2 (3%)
Oracle Certification	28 (35%)	32 (40%)	8 (10%)

Perhaps the main conclusion that can be drawn from this table is that students like all certifications! One point worth noting is the popularity of Linux/Unix certification, perhaps reflecting the relatively high popularity of these systems in the college environment, as opposed to the commercial environment. Another point is the popularity of Novell certification, again perhaps reflecting the continued popularity of Novell networks in colleges. Merging the Yes and Maybe categories and sorting by popularity yields the following table:

	Yes or Maybe
Unix/Linux Certification	90%
MCSE (Microsoft Certified Systems Engineer)	88%
Network+	80%
MCSA (Microsoft Certified Systems Administrator)	79%
CWNA (Certified Wireless Network Administrator)	79%
MCDBA (Microsoft Certified Database Administrator)	78%
Novell Certification	78%
CCNA (Cisco Certified Network Associate)	76%
Security+	75%
Oracle Certification	75%
Inet+	74%
Server+	73%
A+	72%

For questions 4 to 10 please show against the following subject list how relevant you think it would be to acquire knowledge and skills in the given areas?

4 - very significant
3 - significant
2 - quite significant
1 - not significant

4.

Hardware & Operating Systems:	4	3	2	1
PC Hardware and Software	49 (61%)	20 (25%)	-	3 (4%)
Network Server Hardware	37 (46%)	41 (51%)	-	-
Client Operating System	33 (41%)	42 (53%)	4 (5%)	-
Network Server Operating System	40 (50%)	37 (46%)	-	-

Strong support for all topics with the vast majority of students regarding them as Very Significant or Significant. Merging the Significant and Very Significant categories gives the following table:

Hardware & Operating Systems:	Very Significant or Significant
PC Hardware and Software	86%
Network Server Hardware	97%
Client Operating System	94%
Network Server Operating System	96%

5.

Networking / Internetworking Technology	4	3	2	1
Computer Networking	54 (68%)	35 (21%)	7 (9%)	-
Internetworking Concepts	44 (55%)	26 (33%)	11 (14%)	-
Networking Technology	47 (59%)	28 (35%)	5 (7%)	-
Routing Technology	29 (36%)	30 (38%)	13 (16%)	-
Switching Technology	29 (26%)	42 (53%)	6 (8%)	4 (5%)
Internetworking Technology	41 (51%)	34 (43%)	9 (11%)	-
Wireless Local Area Networks	28 (35%)	35 (44%)	13 (16%)	3 (4%)

Again, strong support for all topics with the vast majority of students regarding them as very significant or significant. Only a very small proportion of students regard any of the topics as not significant. Merging the Significant and Very Significant categories gives the following table:

Networking / Internetworking Technology	Very Significant or Significant
Computer Networking	89%
Internetworking Concepts	88%
Networking Technology	94%
Routing Technology	74%
Switching Technology	79%
Internetworking Technology	94%
Wireless Local Area Networks	79%

6.

Network Administration	4	3	2	1
Network Infrastructure 1: Implementation and Management	41 (51%)	26 (33%)	11 (14%)	-
Network Infrastructure 2: Planning and Maintenance	31 (39%)	34 (43%)	7 (9%)	-
Directory Services Administration	18 (23%)	44 (55%)	13 (16%)	-
Web Server Management	31 (39%)	21 (26%)	18 (23%)	-
Mail Server Administration	37 (34%)	26 (33%)	13 (16%)	-

A similar picture: strong support for all topics with the vast majority of students regarding them as very significant or significant. The remaining students regard all topics as significant, with no-one regarding any topic as not significant. Merging the Significant and Very Significant categories gives the following table:

Network Administration	Very Significant and Significant
Network Infrastructure 1: Implementation and Management	84%
Network Infrastructure 2: Planning and Maintenance	92%
Directory Services Administration	78%
Web Server Management	65%
Mail Server Administration	67%

7.

Network Security	4	3	2	1
Network Security 1: Security Concepts	45 (56%)	26 (33%)	6 (8%)	-
Network Security 2: Implementation and Administration	39 (49%)	32 (40%)	6 (8%)	-

Once again: strong support for all topics with the vast majority of students regarding them as very significant or significant. The remaining students regard all topics as significant, with no-one regarding any topic as not significant. Merging the Significant and Very Significant categories gives the following table:

Network Security	Very Significant and Significant
Network Security 1: Security Concepts	89%
Network Security 2: Implementation and Administration	89%

8.

Network Design	4	3	2	1
Network Design: Infrastructure	24 (30%)	47 (57%)	10 (13%)	
Network Design: Security	23 (29%)	52 (65%)	10 (13%)	
Network Design: Directory Services	18 (23%)	49 (61%)	10 (13%)	

Yet again: strong support for all topics with the vast majority of students regarding them as very significant or significant. The remaining students regard all topics as significant, with no-one regarding any topic as not significant.

Merging the Significant and Very Significant categories gives the following table:

Network Design	Very Significant and Significant
Network Design: Infrastructure	87%
Network Design: Security	94%
Network Design: Directory Services	84%

9.

Database Administration	4	3	2	1
Database Server Administration	31 (39%)	34 (43%)	8 (10%	3 (4%)
Database Design and Implementation	29 (36%)	41 (51%)	8 (10%)	3 (4%)
SQL Programming	25 (31%)	35 (44%)	13 (16%)	5 (6%)
Scripting	22 (28%)	33 (41%)	11 (14%)	9 (11%)

A wider spread here, perhaps reflecting the fact that some colleges / courses place a higher emphasis on database skills than others. Merging the Significant and Very Significant categories gives the following table:

Database Administration	Very Significant and Significant
Database Server Administration	82%
Database Design and Implementation	87%
SQL Programming	75%
Scripting	69%

19. How relevant do you think the following skills are?

Core Skills	4	3	2	1
Communication	29 (36%)	37 (46%)	6 (8%)	6 (8%)
Numeracy	36 (45%)	27 (34%)	12 (15%)	6 (8%)
Working with Others	29 (36%)	31 (39%)	8 (10%)	7 (9%)
Problem Solving	48 (60%)	36 (45%)	3 (4%)	-

Surprisingly strong support from students for Core Skills, especially Problem Solving. Merging the Significant and Very Significant categories gives the following table:

Core Skills	Very Significant and Significant
Communication	82%
Numeracy	79%
Working with Others	75%
Problem Solving	95%

20. If you are currently attending an advanced course (HNC or HND) do you think this is an improvement over your present course?

Yes	No	Don't Care
80 (100%)		

Not much ambiguity here!

HNC Computer Networking
HND Computer Networking and Internet Technology

Student Questionnaire
Employer Questionnaire

Comparison of Results

1. Do you believe it is a good idea to embed vendor certifications such as A+, MCSA and CCNA in HNC/D programmes?

Yes (Employers	Yes (Students)
87%	98%

The vast majority of both employers and students surveyed believed that it was a good idea to embed vendor certifications.

2. Should students who have already obtained vendor certifications be able to use these to gain credit towards an HNC or HND?

Yes (Employers	Yes (Students)
93%	89%

The vast majority of both employers and students surveyed believed that students who have already obtained vendor certifications be able to use these to gain credit towards an HNC or HND.

3. Which of the following vendor certifications should be embedded in an HND in Computer Networking and Internet technology?

	Very Significant or Significant (Employers)	Yes or Maybe (Students)
MCSE (Microsoft Certified Systems Engineer)	87%	88%
Network+	80%	80%
CWNA (Certified Wireless Network Administrator)	80%	79%
Server+	80%	73%
MCSA (Microsoft Certified Systems Administrator)	73%	79%
CCNA (Cisco Certified Network Associate)	73%	76%
Security+	73%	75%
Unix/Linux Certification	60%	90%
MCDBA (Microsoft Certified Database Administrator)	53%	78%
A+	47%	72%
Inet+	40%	74%
Novell Certification	33%	78%
Oracle Certification	33%	75%

There is a high degree of consensus at the top of the table, with both employers and students rating MCSE, Network+, CWNA, Server+, MCSA, CCNA and Security+ highly, and with very similar ratings. The first major discrepancy occurs with Unix/Linux, which students rate at 90% and employers at 60%, perhaps due to the high regard in which Unix/Linux is held in the college environment, as opposed to the commercial environment. Employers also rate MCDBA lower than students, perhaps because only some employers are involved in database work. Employers rate A+ and i-Net+ lower than students, probably because they are considered low-level certifications. Finally, employers rate Novell and Oracle certifications much lower than students, probably because of the decline in the use of Novell and the low usage of Oracle amongst the employers surveyed.

For questions 4 to 10 please show against the following subject list how relevant you think it would be to acquire knowledge and skills in the given areas?

4 - very significant
3 - significant
2 - quite significant
1 - not significant

4.

Hardware & Operating Systems	**Very Significant or Significant (Employers)**	**Very Significant or Significant (Students)**
PC Hardware and Software	87%	86%
Network Server Hardware	87%	97%
Client Operating System	87%	94%
Network Server Operating System	80%	96%

A high degree of consensus, with students generally giving a slightly higher rating.

5.

Networking / Internetworking Technology	**Very Significant or Significant (Employers)**	**Very Significant or Significant (Students)**
Computer Networking	94%	89%
Internetworking Concepts	74%	88%
Networking Technology	100%	94%
Routing Technology	73%	74%
Switching Technology	86%	79%
Internetworking Technology	80%	94%
Wireless Local Area Networks	60%	79%

Again, there is a high degree of consensus.

6.

Network Administration	Very Significant and Significant (Employers)	Very Significant and Significant (Students)
Network Infrastructure 1: Implementation and Management	93%	84%
Network Infrastructure 2: Planning and Maintenance	93%	92%
Directory Services Administration	60%	78%
Web Server Management	70%	65%
Mail Server Administration	73%	67%

Once again, there is a high degree of consensus.

7.

Network Security	Very Significant and Significant (Employers)	Very Significant and Significant (Students)
Network Security 1: Security Concepts	93%	89%
Network Security 2: Implementation and Administration	87%	89%

Another high degree of consensus.

8.

Network Design	Very Significant and Significant (Employers)	Very Significant and Significant (Students)
Network Design: Infrastructure	87%	87%
Network Design: Security	86%	94%
Network Design: Directory Services	80%	84%

Yet again, a high degree of consensus.

9.

Database Administration	Very Significant and Significant (Employers)	Very Significant and Significant (Students)
Database Server Administration	53%	82%
Database Design and Implementation	40%	87%
SQL Programming	46%	75%
Scripting	47%	69%

There are some major differences here, with employers rating database skills far lower than students. As suggested earlier, this is probably due to the fact that some employers do not engage in database work and therefore rate it low.

19. How relevant do you think the following skills are?

Core Skills	Very Significant and Significant (Employers)	Very Significant and Significant (Students)
Communication	100%	82%
Numeracy	100%	79%
Working with Others	100%	75%
Problem Solving	100%	95%

There is a fair degree of consensus here, particularly given the traditional distaste of Core Skills amongst students.

20. Overall Subject Ratings (Sorted by Employer Rating)

Overall Subject Ratings	Very Significant or Significant (Employers)	Very Significant or Significant (Students)
Networking Technology	100%	94%
Computer Networking	94%	89%
Network Infrastructure 1: Implementation and Management	93%	84%
Network Infrastructure 2: Planning and Maintenance	93%	92%
Network Security 1: Security Concepts	93%	89%
PC Hardware and Software	87%	86%
Network Server Hardware	87%	97%
Client Operating System	87%	94%
Network Security 2: Implementation and Administration	87%	89%
Network Design: Infrastructure	87%	87%
Switching Technology	86%	79%
Network Design: Security	86%	94%
Network Server Operating System	80%	96%
Internetworking Technology	80%	94%
Network Design: Directory Services	80%	84%
Internetworking Concepts	74%	88%
Routing Technology	73%	74%
Mail Server Administration	73%	67%
Web Server Management	70%	65%
Wireless Local Area Networks	60%	79%
Directory Services Administration	60%	78%
Database Server Administration	53%	82%
Scripting	47%	69%
SQL Programming	46%	75%
Database Design and Implementation	40%	87%

There is an astonishing degree of consensus here. By far the largest discrepancy is the low priority given by employers to the database units, probably for the reasons given earlier.

Appendix 5

Evidence of support

Appendix 5: Evidence of support

Letter from CompTIA

7 October 2003

Joan Morris
Scottish Qualifications Authority
Hanover House
24 Douglas Street
Glasgow
G2 7NQ

Dear Ms Morris

I wanted to write to you and offer CompTIA's support for the proposed HNC Networking /HND Internetworking.

We are very pleased to be working with you to help match industry requirements and standards to qualifications offered by SQA. I think it will be a great addition to the framework and demonstrates well the SQA's flexibility and forward thinking approach to the framework.

CompTIA are delighted to be involved with this new SQA qualification and have received many enquiries as to the inclusion of vendor awards in the framework from both learning providers and industry. Industry recognise these certifications and use them as benchmarking and hiring standards and learning providers want to enable their students to achieve the right skills to find jobs. We believe that the SQA is moving in the right direction with this new HNC/HND and that this is the start of an exciting future together.

Having already received numerous enquiries on the advancement of the qualification and with the increasing demand for network professionals I am sure the demand for this qualification will be extremely high. We look forward to learning about its successful adoption.

Yours sincerely

Matthew Poyiadgi
Regional Director, UK and Scandinavia

Email from e-Skills NTO

From: Chris Morrow [mailto:Chris.Morrow@e-skills.com]
Sent: 23 November 2003 22:25
To: Ted Hastings
Subject: HNC/D Internetworking

Ted

I am pleased to offer our (belated!) support for the proposed HNC/D in Internetworking.

e-skills UK are very much in favour of aligning public courses and qualifications with vendor and industry awards where it is appropriate. I do however have some reservations with the proposals for automatic credit transfer. While the Cisco (and other vendor) materials are very good they tend to over focus on the 'how to' aspects with less emphasis on the 'when' and 'why'. As an example 8 out of the required 12 credits for an HNC could be gained via Cisco certification, leaving only a third to deliver these broader competencies.

Regards

Chris

Dr C Morrow MBCS CEng
Standards Manager

Tel: 01389 876642
Mob: 07768 690270

e-skills UK are revising the National Occupational Standards for IT; Telecoms; Call Handling; we need your comments and feedback.
To find out more, visit www.e-skills.com/nos

Email from Bob McGonigle (Microsoft)

This is an outstanding piece of work which I would very much support.

Regards
Bob

Appendix 6

Examples of degree articulation

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Appendix 6: Examples of degree articulation

Institution	Articulation
Abertay	Currently revalidating degree programmes. New provision likely to include a networking degree to which candidates can articulate – this may incorporate CCNP.
Bell College	Candidates can articulate to the third year of a generic BSc Applied Computing programme which will broaden their general Computing skills, rather than deepen Networking Skills.
Glasgow Caledonian	Candidates can articulate to third year of a generic Computing programme, with possible later progression to an MSc incorporating CCNP.
Napier	Candidates can articulate to the third year of BSc Network Computing, as offered at Napier and franchised colleges, e.g. James Watt. HND Internetworking developments will be taken into account when revalidating course – possible inclusion of CCNP.
Paisley	Candidates can articulate to the third year of BSc Computer Networking.
Robert Gordon's	Candidates can articulate to the third year of a generic BSc Applied Computing programme which will broaden their general Computing skills, rather than deepen Networking Skills.
UHI	Candidates can articulate to the third year of the BSc Computing (Networking) degree.

Emails from University of Abertay

From: I.Marshall@abertay.ac.uk [mailto:I.Marshall@abertay.ac.uk]
Sent: 09 April 2003 13:20
Subject: FW: SQA HNC/D Internetworking

A SQA HNC/D is likely to lead to articulation on to one or more of our level 2 for HNC and level 3 for HND computing programmes. However we are currently revalidating most of programmes over the next 6 months. This information will prove valuable in assisting articulation arrangements.

Ian

From: I.Marshall@abertay.ac.uk [mailto:I.Marshall@abertay.ac.uk]
Sent: 30 September 2003 17:52
Subject: RE: SQA HNC/D Internetworking

We are looking at a degree which will articulate with the proposed HND. Still early days but we are in discussions with CISCO.

Ian

Email from Glasgow Caledonian University

From: Foley Richard [mailto:R.Foley@gcal.ac.uk]
Sent: 08 April 2003 10:44
Subject: RE: SQA HNC/D Internetworking

Ted,

I attach our information booklet for HND students. It include the programmes for Internetworking students. It is our plan from 2003 to incorporate CCNA within our year3 and year 4. Separately we have an advanced MSC in Networking which explicitly provides CCNP. The Programme Organiser for that is Hadi Larijani (H.Larijani@gcal.ac.uk <mailto:H.Larijani@gcal.ac.uk>)if you are looking for more info on that. We have developed our BSC Networking and Computer Support programme (which was first offered in Sept 2001) to essentially cover CCNA and explicitly feed into an advanced MSc which also gives CCNP.

Richard

Letter from Bell College

MB/ECM

10 October 2003

Mr Ted Hastings
c/o Joan Morris 374
Scottish Qualifications Authority
Hanover House
24 Douglas Street
GLASGOW
G2 7NQ

Dear Ted

Thank you for the information on the HNC/D Internetworking course developments. In response to your question as to whether students with these awards could articulate to the BSc Applied Computing course at Bell College, I am pleased to say that I do not perceive any problems with this.

We currently take students with the HND Computing: Software Development and the HND Computing: Technical Support on to the degree course. If we feel that students need to update their knowledge in a particular subject area we ask them to take part in a bridging programme prior to the start of their course.

I would like to wish you and your team well with the development of these courses and hope you have a successful validation.

Please do not hesitate to contact me if you require any further information.

Yours sincerely

Miriam Birch
Senior Lecturer
School of Science and Technology

Email from the University of Paisley

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From: John Anderson [mailto:ANDE-EE0@wpmail.paisley.ac.uk]
Sent: 09 April 2003 14:52

Mr Hastings

I have looked at the type of work covered in the HND and it would be
appropriate for entry to the 3rd year of the BSc Computer Networking
degree.

They would NOT be suitable for the BSc Communication  Technologies due
to the overlap in the use of CCNA material.

We have no plans to introduce a degree programme based on CCNP.

Dr. Anderson
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Email from UHI Millennium Institute

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From: George Banks [mailto:George.Banks@lews.uhi.ac.uk]
Sent: 10 October 2003 12:40

Dear Ted,

Thanks for the information.  From the details supplied these students would
be direct entrants to third year of the BSc Computing (Networking) degree
programme offered by the UHI MI.

Regards

George Banks
UHI BSc Computing Course Leader

Tel  : 01851 770367
Fax : 01851 770001
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Email from Robert Gordon's University

From: p.lowit@rgu.ac.uk [mailto:p.lowit@rgu.ac.uk]
Sent: 30 September 2003 17:36

I have been following the progress of the Internetworking HNC/D with interest, and have to say that as a Computing department, we do not have such an in-depth coverage of networks as your course - the bulk of our computing courses are built on a foundation of Java programming & UML OO design so direct entry into 3rd year would be very difficult for diplomates from the Internetworking HND. However we are developing a new, more general course with more flexible routes (tentatively called BSc (Hons) Information Systems), which could provide a possible viable direct entry route into 3rd year for Internetworking HND diplomates.

It would be useful to know what level of 'programming' will be done in the scripting and SQL modules of the HND (I note they are not core)

As for embedding vendor qualifications in our own courses, I am afraid that we do not have any modules that cover CCNA/CCNP type materials, we do have some 3rd & 4th yr modules based on MCSD & MCSE courseware, and these may be available for direct entry students.

I have attached the course documentation for the proposed BSc (Hons) Information Systems coure, but at present this is all subject to validation etc. (the course is planned for a 2004/05 start, so validation will take place in the next 4 months).

Peter

[Peter Lowit (cmspl)]

Email from Napier University

Hi Ted

I'm happy to confirm that the proposed HND Internetworking will be a suitable qualification for entry to our BSc Network Computing (direct entry level 3). This applies equally whether application is made to study here at Napier or any of the other institutions where the programme is delivered.

Best wishes,

Tim

Tim Musson
School of Computing
Napier University

Appendix 7

Guidance on unit choice for matching vendor certifications

Appendix 7: Guidance on unit choice for matching vendor certifications

CompTIA Certifications

Unit No.	Unit Title	Linked Vendor Certification	Vendor Exams
To Be Confirmed			

For details of CompTIA Certifications see: **http://www.comptia.com/certification/default.asp**

Cisco Certifications

Unit No.	Unit Title	Linked Vendor Certification	Vendor Exam
DF9X 35	Networking Technology	CCNA	CCNA
DF9Y 35	Routing Technology	CCNA	CCNA
DG09 35	Switching Technology	CCNA	CCNA
DG0A 35	Internetworking Technology	CCNA	CCNA
DGOH 35	HND Graded Unit 2	CCNA	-

For further details of Cisco certifications see: **http://cisco.netacad.net/public/index.html**

Microsoft Certifications

Unit No.	Unit Title	Linked Vendor Certification	Vendor Exam	
			2000 Track	2003 Track
DF9M 34	Client Operating System	MCSA/MCSE	70-210	70-270
DF9N 34	Network Server Operating System	MCSA/MCSE/ MCDBA	70-215	70-290
DF9R 35	Network Infrastructure 1: Implementation and Management	MCSA/MCSE	70-218	70-293
DG00 35	Network Infrastructure 2: Planning and Maintenance	MCSE/MCDBA	70-216	70-291
DG01 35	Directory Services Infrastructure	MCSE	70-217	70-294
Dg0d 36	Network Design: Directory Services and Network Infrastructure	MCSE	70-219 70-221	70-297
DG0E 36	Network Design: Security	MCSE	70-220	70-298
DG07 35	Mail Server Administration	MCSE	70-224	70-284
DG0F 35	Database Server Administration	MCSE/MCDBA	70-228	70-228
DG0G 35	Database Design and Implementation	MCSE/MCDBA	70-229	70-229
DG03 34	Programming in SQL	MCSE/MCDBA	-	-
DG0E 36	Network Design: Security	MCSE	70-214	70-299

For full details of Microsoft examination requirements see:

http://www.microsoft.com/traincert/mcp/mcse/default.asp

Appendix 8

Recommended Prior Units Access Grid

Appendix 8: Recommended prior units access grid

No.	Title	1	2	3	4	5	6	7	8a	8b	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	Hardware Concepts																												
2	OS Concepts																												
3	Client OS	X	X																										
4	Network Server OS			X																									
5	HNC Graded Unit	X	X	X	X																								
6	Network Concepts	X	X																										
7	Network Infrastructure 1		X		X		X																						
8a	Internetworking Concepts 1	X	X				X																						
8b	Internetworking Concepts 2	X	X				X																						
9	Server Concepts				X		X																						
10	Networking Tech						X		X	X																			
11	Routing Tech											X																	
12	Switching Tech											X	X																
13	Internetworking Tech											X	X	X															
14	Network Infrastructure 2				X		X	X																					
15	Directory Services Infrastructure				X			X								X													
16	Network Design: DS & NI				X			X								X													
17	Network Design: Security				X			X								X													
18	HND Graded Unit											X	X	X	X														
19	Security Concepts	X	X				X																						
20	DB Server Admin				X		X																						
21	DB Design and Imp.				X		X																						
22	Programming in SQL	X	X																										
23	Wireless LANs						X		X	X																			
24	Scripting	X	X																										
25	Web Server Mgt.																												
26	Mail Server Admin				X		X																						
27	Network Security: I and A				X		X														X								

Note: this grid shows the recommended prerequisites for undertaking each unit. To identify the prerequisites for a given unit, the unit should first be located in the list at the left-hand side of the table. The row leading from that unit should then be followed towards the right. The columns containing an X indicate the numbers of the recommended prerequisites. The numbers refer to the same units as noted at the left-hand side. For example, if a candidate wishes to undertake Unit 17: Network Design: Security, then it can be seen from the Xs in table that the recommended prerequisites are units 4 (Network Server OS), 7 (Network Infrastructure 1) and 14 (Network Infrastructure 2).

Appendix 9

Opportunities for Developing Core Skills

Appendix 9: Opportunities for enhancing the core skills of Numeracy and Communication in HNC Computer Networking and HND Computer Networking and Internet Technology

This document deals only with the core skills of numeracy and communication. Candidates are expected to enter the HNC with the IT core skill at Higher level and the core skills of Working with Others and Problem Solving are embedded in the HNC and HND Graded Units.

Reference to the current National Core Skills Units (NUs) at the appropriate levels may be helpful.

The tables below (which are not exhaustive) attempt to outline the opportunities available to enhance the above core skills in the mandatory units only, since these are the units that must be undertaken by all candidates. Further opportunities may be available within the optional units, depending on the options selected.

Numeracy within HNC Computer Networking

The units in the tables below could provide opportunities for enhancement of the core skill of numeracy. Certain units have numerical concepts within the recommended knowledge and skills, although these skills are not clearly listed as a requirement within the unit evidence requirements. These units are included in the tables below and the skills and knowledge areas are described within the tables.

Title of unit	Numeracy: opportunities for enhancement	Detailed description
Network Server Operating System	Outcome 4: Manage and maintain a server environment.	In Evidence Requirements candidates are required produce documentary evidence that they can use system monitoring tools to monitor and analyse events and system performance. This involves the use of numerical and statistical information.

Communication within HNC Computer Networking

The units in the tables below could provide opportunities for enhancement of the core skill of Communication. Certain units have communication concepts within the recommended knowledge and skills, although these skills are not clearly listed as a requirement within the unit evidence requirements. These units are included in the tables below and the skills and knowledge areas are described within the tables.

Title of unit	Communication: opportunities for enhancement	Detailed description
Hardware Concepts	Outcome 2: Diagnose and troubleshoot hardware problems.	In Evidence Requirements candidates are required to keep a record of the questions used by to elicit problem symptoms from customers, including the justification for asking particular questions in a given scenario. This enhances both spoken and written communication.
Hardware Concepts	Outcome 3: Carry out preventive maintenance.	In Evidence Requirements candidates are required to keep a record of preventive maintenance, safety and environmental protection measures carried

		out. This enhances written communication.
Operating System Concepts	Outcome 3: Diagnose and troubleshoot client operating system problems.	In Evidence Requirements candidates are required to produce documentary evidence that they can interpret error messages and identify steps to correct problems. This enhances written communication.
HNC Graded Unit	Case Study	Candidates are required to produce a document outlining the design of a small network. This enhances written communication.

Numeracy within HND Computer Networking and Internet Technology

The units in the tables below could provide opportunities for enhancement of the core skill of numeracy. Certain units have numerical concepts within the recommended knowledge and skills, although these skills are not clearly listed as a requirement within the unit evidence requirements. These units are included in the tables below and the skills and knowledge areas are described within the tables.

Title of unit	Numeracy: opportunities for enhancement	Detailed description
Networking Technology	Outcome 1: Describe the characteristics of local area networks.	In Evidence Requirements candidates are required to carry out networking calculations including number systems, binary, hexadecimal, network addresses and masks. This enhances numeracy.
Networking Technology	Outcome 7: Describe IP addressing and routing.	In Evidence Requirements candidates are required to describe IP addressing and routing, including IPv4, IPv6 and subnetting. This topic is highly mathematical and enhances numeracy.
Routing Technology	Outcome 4: Describe the operation of common routing protocols.	In Evidence Requirements candidates are required to describe static routing, dynamic routing, routing protocols and distance vector routing. This topic is highly mathematical and enhances numeracy.
Switching Technology	Outcome 7: Describe redundancy and spanning tree.	In Evidence Requirements candidates are required to describe spanning tree protocol basics, including operation of spanning tree, root bridge, port states and recalculating spanning tree. This topic is highly mathematical and enhances numeracy.
Internetworking Technology	Outcome 5: Describe frame relay technology.	In Evidence Requirements candidates are required to describe frame relay concepts, including addressing, mapping and LMI. This topic is highly mathematical and enhances numeracy.

Communication within HND and HND Computer Networking and Internet Technology

The units in the tables below could provide opportunities for enhancement of the core skill of Communication. Certain units have communication concepts within the recommended knowledge and skills, although these skills are not clearly listed as a requirement within the unit evidence requirements. These units are included in the tables below and the skills and knowledge areas are described within the tables.

Title of unit	Communication: opportunities for enhancement	Detailed description
HND Graded Unit	Case Study	Candidates are required to produce a substantial document outlining the networking requirements for a fictitious college. This enhances written communication.