



University of the
West of England

CORPORATE AND ACADEMIC SERVICES

PROGRAMME SPECIFICATION

Part 1: Basic Data	
Awarding Institution	UWE
Teaching Institution	UWE
Delivery Location	UWE
Faculty responsible for programme	Environment and Technology
Department responsible for programme	CSCT
Modular Scheme Title	
Professional Statutory or Regulatory Body Links <i>Name of PSRB</i> <i>Type of approval</i> Dates	BCS Accreditation to be sought at the next scheduled validation in January 2014
Highest Award Title	MSc Network Systems
Default Award Title	MSc Network Systems
Interim Award Titles	Postgraduate Certificate in Computing Postgraduate Diploma in Network Systems
UWE Progression Route	
Mode(s) of Delivery	Full time, Part time
Codes	UCAS: JACS: G420 ISIS2:G42C1 HESA:
Relevant QAA Subject Benchmark Statements	Masters Degrees in Computing (2011)
CAP Approval Date	26/6/2012
Valid From	01/09/2012
Valid until Date	01/09/2018
Version	1

Part 2: Educational Aims of the Programme

General aims

Part 2: Educational Aims of the Programme

The principal aim of the MSc Network Systems programme is to equip its students with the knowledge, practical and cognitive skills and personal attributes to allow them to make a valuable contribution to the growing *enterprise networking* industry. Enterprise class networks are characterised by complex network infrastructures in large enterprises with multiple computer systems and their complex internetworking. The planning, configuration, operation and integration of such large-scale network systems require specialised knowledge. In addition to imparting theoretical and practical education at higher levels of domain-relevant study, the programme aims to prepare graduates to assume management positions within the industry. In general therefore, the programme aims to provide students with:

1. The intellectual, professional, practical and transferable skills required of a networking professional
2. An understanding of organisational structures, management, values and practices such that they can appreciate the contribution that they can make both on graduation and as their careers develop.
3. The development of inter-personal skills to enable them to work and communicate appropriately with the full range of individuals with whom they interact in their working and personal lives.
4. The intellectual curiosity to allow them to engage in life-long learning, to contribute to the wider community of networking professionals and to society as a whole.

In addition, the programme specifically aims to:

5. Offer students a modern industry-relevant curriculum, devised in collaborative association with Juniper Networks, to prepare them for roles relating to enterprise level network systems and related hardware and software technologies.
6. Give students the opportunity to explore new emerging technologies that commercial organisations could be exploiting in the proximate future.
7. Prepare graduates for a role in enterprise networking, management and networks security.
8. Facilitate the students to achieve additional, industry-recognised, professional certification.
9. Innovative curriculum delivered through a unique learning environment with access to state of the art networking hardware and software technologies available only in select institutions across the globe

Part 3: Learning Outcomes of the Programme

The award route provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas:

Learning Outcomes	Teaching, Learning and Assessment Strategies
A Knowledge and Understanding	
<p>A Knowledge and understanding of</p> <ol style="list-style-type: none"> 1. complex, enterprise level computer networks 2. the mechanisms of switching and routing in enterprise level networks 3. on-going investigations and progress in relevant fields of technological development 4. the design, role and function of a operating system in the context of network devices 5. the data structures and process that support the operation of a network operating system 6. the management of network security within the organisational context 	<p>Teaching/learning methods and strategies: <i>The 30 credit taught modules of the programme are holistically focussed to specific subject areas of specialism. Acquisition of learning outcomes (LO) 1 and 2 is gained through UFCF6S-30-M module, with UFCF6V-30-M contributing to LO 2 as well. LOs 4 and 5 deal with the concepts and processes of network operating systems, provided by UFCF6U-30-M with contribution from UFCF6V-30-M due to interplay between the network operating system and its security</i></p>

Part 3: Learning Outcomes of the Programme

7. project/team management and budgetary issues in the context of enterprise operations

related functions. A combination of lectures and practical work consolidates this knowledge.

LO 6 is focused on providing an advanced knowledge base of securing enterprise networks through integrated networking, operating systems and network security concepts and is again developed through a combination lectures/seminars that are underpinned by practical work. LO 7 has a narrow yet significant focus on project/team management aspects of enterprise operations and is achieved through lectures, seminars, case studies and group based project work. Keeping in view the scope (Masters level) of learning outcomes, the specific outcome of grasping the state of the art and progress in related technological fields (LO 3) is addressed in all modules and is achieved through the integration of knowledge developed in all the modules.

All LOs in this category are reinforced through seminars/lectures from industry professionals and domain experts. Additionally, the students are encouraged to undertake independent reading both to supplement and consolidate what is being taught/learnt and to broaden their individual knowledge and understanding of the subject. References to relevant reading material are provided for this purpose with the modules specs. Professional/industry based literature will also be available to the students in electronic form.

Assessment:

With regard to the taught part of this programme, assessment is weighted approximately 50:50 exam:coursework. In general, the exams focus is on assessing the conceptual understanding of the fundamental and advanced domain concepts, expertise of subject-specific problem solving and analysis and application of the acquired knowledge in practical scenarios. Much of the coursework involves the development of practical pieces of work, This work is then assessed through a demonstrations, reports and portfolios

B Intellectual Skills

B Intellectual Skills

Teaching/learning methods and strategies:

Part 3: Learning Outcomes of the Programme

1. problem analysis and solution evaluation
2. reconciliation of information inconsistencies
3. planning, estimating and costing
4. critical thinking and debate
5. the determination of system requirements

Intellectual skills are developed throughout the programme, mostly through the presentation of subject-specific practical problems that the students are required to solve (Skill 1). The problems are presented in a complexity curve using a series of practical sessions during the delivery of the modules, which intrinsically brings in the element of identifying and resolving inconsistencies in the presented problems/solution sets. The practical sessions in each module initially focus on subject-specific problems e.g. UFCF6V-30-M brings initially forth problems and established solutions concerning network security, progressing to broader problems that require grasp and integration concepts in the network operating system (UFCF6U-30-M) and routing domains (UFCF6S-30-M) for proper resolution (Skill 2).

Planning, team management and budgetary skills (Skill 3) are introduced via lectures, group project and exercises especially in UFCF6T-30-M, which mostly focuses on planning, costing and estimating projects. Case studies are used to support the listed intellectual skills, in addition to discussion, debate and analysis of established mechanisms in subject areas and scholarly pursuit of improved mechanisms (Skill 4). Students are encouraged to apply critical thinking and progress beyond the problem scenarios for which solutions can be fairly readily developed using the technologies to which they have been exposed during the module. The critical thinking is enforced through practical coursework, reflection on group work and interaction with industry/domain experts.

Skill 5 is imparted across all modules by highlighting key system requirements in all subject areas pertaining to networking, security, network operating systems and project/team management issues in modern enterprises. The elicitation of requirements in devising a problem solving solution, establishing the boundaries between inadequate, acceptable and optimal solutions, identifying key players and evaluating alternatives are enforced throughout the lectures and practical exercises in all modules.

Assessment:

Skills 1,3 and 5 are assessed by practical exercises in almost all of the modules, with

Part 3: Learning Outcomes of the Programme

UFCF6T-30-M placing detailed focus on Skill 3. Skills 2 and 4 are assessed by exam, coursework, project work and presentation

C Subject, Professional and Practical Skills

<p>C Subject, Professional and Practical Skills</p> <ol style="list-style-type: none"> 1. understanding and analyses of enterprise level network switching and routing mechanisms 2. demonstration of the acquired knowledge through practical design, configuration and implementation of enterprise networking solutions 3. using acquired knowledge to plan and implement enterprise routing and security policies 4. designing enterprise networks with high-availability features 5. configuration, administration and management of commonly used enterprise routing hardware and software solutions 6. project and team management in the context of global enterprise operations 7. awareness and management of ethical and legal issues of import to a knowledge based enterprise 	<p>Teaching/learning methods and strategies: <i>Subject specific practical skills of this programme are principally developed through the use of lectures and associated practical laboratory work. The theory behind the practical work is introduced in the lectures and followed up with on-hands exercises on actual hardware or virtualised software systems that simulate networking hardware. Students are encouraged to keep record of and reflect on their progress in the lab sessions. Furthermore, technological resources are made available to the students so that they can repeat laboratory experiments to solidify their knowledge base through resolution and repetition. Skills 1 to 5 are focussed on specific topics that are addressed in separate modules, but are linked due to the common technological base. UFCF6S-30-M, UFCF6U-30-M and UFCF6V-30-M contribute significantly to Skills 1, 2, 3, 4 and 5 through lectures, seminars and hands on exercises in practical laboratory sessions. Skills 6 and 7 are specifically addressed by UFCF6T-30-M and imparted through lectures, coursework and group based project work.</i></p> <p>Assessment: <i>, and 5 are assessed by coursework, practical work and examination. Skills 6 and 7 are principally assessed by reflection on group work and written report. Assessment of the skills acquisition will be based on the evaluation of the configuration and software development exercises, network design, problem solving and demonstration of completed activities</i></p>
-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

D Transferable Skills and other attributes

D Transferable Skills and other attributes

Graduates will be able to:

1. plan and manage their own work schedule and so meet deadlines
2. identifying and correctly utilising available resources in the course of knowledge development
3. ability to plan and organise projects/budgets involving distributed teams
4. identification of intellectual property exploitation opportunities and protection of such IP
5. lead and work as a team

Teaching/learning methods and strategies:

Transferable skills 1, 2 and 5 are developed throughout the programme in all modules. Development of Skill 1 is contributed by participation in group work, practical sessions, course work, reports and exams. The conduct and timely submission of coursework, examination, following the teaching material, planning and adhering to the teaching material, regular class attendance, timetable management and orderly conduct of the practical sessions all contribute to the development of Skill 2. Similarly, working in groups during tutorials, group project in UFCF6T-30-M and working in groups to discuss ideas and refining solutions develop Skill 5. Skill 3 and 5 are specifically focussed developments achieved through targeted measures in UFCF6T-30-M through the project management and budgetary planning activities of the module. The focal element of identification, protection and exploitation of intellectual property in UFCF6T-30-M contributes to the development of Skill 4.

Assessment:

Management of coursework and practical sessions assess Skill 1 and 2, since the students are required to attend and submit on time and thus to plan their work in order that the deadline will be met. Skill 3 and 4 are assessed in the reporting of reflection on group work. The completion of group work, reflections on the student's individual role in that work and assessment of the student's conduct of the practical sessions assess Skill 5.

Part 4: Programme Structure

ENTRY ↓	Level M	Compulsory / Core modules	Optional modules None	Target/highest Award: • Credit requirements MSc - 180 credits Default title: None
		UFCF6S-30-M Advanced Networking UFCF6T-30-M Global Enterprise Management UFCF6U-30-M Network Operating Systems UFCF6V-30-M Securing Networks		
		UFCFSB-60--M Dissertation		
→ GRADUATION				

Part 5: Entry Requirements

Applicants will normally be a UK graduate with a first degree (2:2 or above) in a cognate discipline e.g. computing, IT, networking, OR an international graduate with equivalent qualifications.

Standard UWE English language requirements for international students apply.

(<http://www1.uwe.ac.uk/comingtouwwe/internationalstudents/internationalstudyatuwe/englishlanguage/requirements.aspx>)

Part 6: Assessment

Delete one of the following statements as appropriate

A: Approved to University Regulations and Procedures

Assessment Map

The programme encompasses a range of **assessment methods** including; exams, presentations, reports. These are detailed in the following assessment map:

Assessment Map for *MSc Network Systems*

Type of Assessment*

Part 6: Assessment

Instructions:

Add the Component (A or B) to the appropriate column for each Module Number and add the weighting for that assessment in brackets (as per the examples given)

Add further columns as necessary*

		Unseen Written Exam	Open Book Written Exam	In-class Written Test	Practical Exam	Practical Skills Assessment	Oral assessment and/or presentation	Written Assignment	Report / Project	Dissertation	Portfolio
Compulsory Modules Level 1	UFCF6S-30-M Advanced Networking	A (50)				B (40)			B (10)		
	UFCF6T-30-M Global Enterprise Management								A (100)		
	UFCF6U-30-M Network Operating Systems	A (50)				B (25)			B (25)		
	UFCF6V-30-M Securing Networks	A (50)				B (25)			B (25)		
	UFCFSB-60-M Dissertation						A (20)			A (80)	

*Assessment should be shown in terms of either **Written Exams**, **Practical exams**, or **Coursework** as indicated by the colour coding above.

Part 7: Student Learning

Teaching, learning and assessment strategies to enable learning outcomes to be achieved and demonstrated

Teaching in the MSc Network Systems programme is a mix of *scheduled, independent and placement learning*.

Scheduled learning includes lectures, seminars, tutorials, project supervision, demonstration, practical classes and workshops

Independent learning includes hours engaged with essential reading, case study preparation, assignment preparation and completion etc.

Description of Distinctive Features and Support

In addition to achieving a Masters degree, this program develops the student to undertake industry-accredited certification. The certification is offered by Juniper as part of their Juniper Networks Certification Program (JNCP), which is widely recognised within the networking industry. Successful completion of the programme modules will prepare the students to undertake JNCP certification at the Professional level (2nd highest level out of 4) in the Enterprise

Part 7: Student Learning

track or the Security track. Students will also benefit from the use of training materials, hardware and software resources and practice materials provided through the Juniper Academic Alliance programme (UWE is a member of this Academic Alliance).

Our curriculum, though more academic in nature, is aligned with the training required to undertake the mentioned certifications. Taking and passing the certification is not a requirement of the programme but, having equipped the students to pass, staff on the programme will be in a position to direct students to test centres.

In addition, a distinctive and highly beneficial feature of the programme is the availability of placement opportunities at Juniper or one of its several channel partners. This will be a 12-week placement at one of the US, EU or Asian Juniper Networks/channel partners sites. On the job training will take place, but in addition the student will have the opportunity to attend internal structured training events and activities on professional, technical and personal skills that are relevant both to the job in hand and also future career opportunities. It must be noted that this placement is not a requirement for completing the programme and achieving its learning outcomes.

The students will have access to the *Junos SDK* at UWE labs. The Junos SDK is a software development kit for developing control, processing or security applications for Juniper devices. UWE is the only university in the UK to be given access to this state of the art resource for student learning.

The students will also have access to *Junosphere*, which is a virtual Junos environment that enables the creation and operation networking elements using the Juniper Networks' Junos operating system. Offered in the form of software-based services, Junosphere enables educational institutions to easily experiment, model, and educate by leveraging the flexibility, cost efficiency, and simplicity of a cloud-based delivery model. This the students enrolled in this programme will be able to model, test and experiment with networking features, topologies and services with no risk to physical hardware or network infrastructure and without the expense of hardware and maintenance costs.

Class-based Activities Classes use a range of activities. The particular mode of delivery of a module is determined by its Module Leader, and typically involves a combination of one or more lectures, practical sessions, group activities and group project work. Modules on the programme that require laboratory classes are commonly delivered by means of a combination of lecture and practicals/tutorials.

Academic Support Academic advice and support is the responsibility of the staff delivering the module in question. Staff can be contacted outside of normal timetabled hours, either by appointment or during published "surgery" hours, in order to offer advice and guidance on matters relating to the material being taught and on its assessment.

On-line Academic Support Extensive on-line support for this programme is provided through the University portal (myUWE). This provides access to the University's e-library, which allows students to read academic journals and study-skills material. Of particular interest to students of this programme is access to the ACM, IEEE and British Standards Online databases. The portal also gives entry to UWE's Virtual Learning Environment (Blackboard) which is used by academics to make available general information about the module delivery, handbooks, lecture notes and other materials. In addition, the portal publishes individual student timetables, marks and other aspects of the operation of the programme and University life.

Pastoral Support Pastoral care is provided through the University-wide Student Advisers, a team of staff who provide comprehensive, full-time student support service on a drop-in basis or

Part 7: Student Learning

by appointment. Advisers are trained to provide advice on matters commonly of concern, including regulatory and other matters; the Adviser will, when necessary, advise the student to seek advice to from other professional services including the University's Student Services Department or from members of academic staff.

Independent Study

Many modules require students to carry out independent study, such as research for projects and coursework assignments, and a full range of facilities are available at all sites to help students with these. The philosophy is accordingly to offer students both guided support and opportunities for independent study. Guided support, mainly in the form of timetabled sessions, takes the form of lectures, tutorials, seminars and practical laboratory sessions. Students are expected to attend all sessions on their timetable, and this is especially important because of the high content of practical work in the programme.

The development of independent study will also be assisted by the nature of the support offered in individual modules. Typically, module leaders will provide a plan for the module indicating the activities to be carried out and the forms of learning to be undertaken during the delivery of the module, with a view to encouraging students to plan ahead and to take responsibility for managing their time and resources.

Computing Facilities The Faculty offers a specialised computing facility along side the general University provisions. There are multiple computing laboratories of 20 plus seats all running Linux based systems required for this program. The specialist laboratories will be augmented with software resources and hardware equipment necessary for the delivery of the modules. One of the most popular areas within the Faculty is the Open Access laboratory. This area is never timetabled and gives students the opportunity to access machines at all times during opening hours. This is a mixed environment consisting of PCs and Unix workstations.

Part 8: Reference Points and Benchmarks

This programme falls squarely within the subject domain described by the QAA Subject Benchmark Statement for Computing 2011. The benchmark description of computing as (pg. 4):

“ideas of abstraction and design, applied in the context of the domain knowledge associated with particular applications and linked to problem solving”

describes this programme. The specification of major technologies in the benchmark (pg. 5):

“pervasive computing, including networks, the internet, mobile computing systems and social networking systems; the interface with telecommunications and the exploitation of modern communication systems”

encompasses the technologies covered in the programme. In terms of the sub-disciplines described by the benchmark (pg. 5), this programme is consistent with the stated characteristic of a degree in a computing subject in which the ethos is underpinned by:

“the established disciplines of computer science, software engineering, computer communications and networks, and information technology, as well as variants of these”
and

“computer engineering (which includes the design and development of computers, devices and associated technologies to serve a range of purposes within diverse

Part 8: Reference Points and Benchmarks

environments) as well as embedded and real time systems whose operation may have safety or security implications”

The nature of the program is consistent with the *generalist master's* definition of the benchmark:

For the generalist degree it is normally important that:

- *in their conception there is a focus on employment needs*
- *skills from first degrees, which may include computing elements, are required and built upon*
- *graduates will be able to demonstrate the relevance of broad knowledge and skills to bring about change and, where appropriate, to develop cross-disciplinary insights, dependencies and links.*

Furthermore, the programme accommodates the fundamental requirements of a Masters degree in Computing specified by the benchmark, summarised in the following table.

Fundamental Requirements of a Masters Programme in Computing	MSc Network Systems
the topic and learning outcomes are identified and defined clearly, and their relationship to the subject of computing and its applications is carefully captured in the title of the award	Evidenced by this document, supporting appendices and module specifications
programmes are carefully designed to accommodate students who enter with the required entrance qualifications, typically at honours degree level or equivalent	Evidenced by entry requirements and pre-requisites in the module specifications
the relevant theoretical underpinnings are identified and should result in emphasis on those fundamental aspects of a subject which do not change in the context of rapid technological development	Evidenced by the module specifications
the curriculum demonstrates an integration between theory and practice as well as the planned development of a set of attitudes and an appreciation of a range of applications and their impact on users	Evidenced by the module specifications
there is an appropriate integration between a set of classes that demonstrates cohesion in content and a planned approach to the topic of the programme	Evidenced by this document, supporting appendices, Market Impact and Approval, and module specifications
the majority of the material and its assessment is at master's level and is positioned at the forefront of developments	Evidenced by the module specifications
a major component is a substantial individual activity that requires an awareness of material from across the individual modules and which provides opportunities for students to demonstrate a range of master's level abilities and achievements	Evidenced by the coursework, reading strategy and practical based learning described in the module specifications
all master's degree programmes will meet the outcomes of the qualification descriptor identified in <i>The framework for higher education qualifications in England, Wales and Northern Ireland (2008)</i> or <i>The framework for qualifications of higher education institutions in Scotland (2001)</i>	Evidenced by this document and the contextual document
where credit is used, national guidance identifies a typical minimum of 180 credits for a master's degree, of which at least 150 will be at master's level.	Evidenced by this document and the module specifications
A typical minimum of 480 credits (600 in Scotland) is identified for an integrated master's degree, with at least 120 at master's level.	N/A
All institutions will wish to provide courses that address the needs of employers and/or catch the imagination of students.	Evidenced by the innovative curriculum, collaboration with Juniper Networks and supporting arguments and evidence in the Market Impact and Approval document

The Threshold Standard

Part 8: Reference Points and Benchmarks

The programme addresses all the concerns of the threshold standard specified in the benchmark for a master's degree in computing:

The students' success in this program will be based on assessment of their overall understanding of the enterprise level network systems. Students are expected to achieve in depth grasp of advanced networking, network operating systems, network security and global enterprise management areas. Their grasp of the subject matter will be thoroughly assessed through the assessment procedures listed in this document and described in detail in the respective module specifications.

Furthermore, the students are expected to demonstrate a comprehensive understanding of the essential principles and practices of the domain of enterprise level networking. The demonstration of this awareness has to be supported by a critical awareness of the design, configuration and operation of enterprise level networks through demonstration of their ability to apply the acquired knowledge in practical scenarios. The specifically focused lectures and practical sessions are targeted to impart this higher-level domain knowledge, which will be systematically assessed via the assessment strategies of these modules.

The work produced by the students in this programme is expected to be informed by the latest research and professional practice in the domain of enterprise networking. The programme makes available latest industry based training and theoretical material, software facilities and networking hardware to impart a solid understanding of latest domain concepts and practices.

A major component of the UFCF6T-30-M module develops the students' understanding of the professional, legal, social and ethical framework within which they would have to operate as enterprise networking professionals.

The dissertation module UFCFSB-60-M, through placement and dissertation, develops the ability of the students to apply the principles and practices of the enterprise level network systems in tackling a significant domain related activity.

The QAA Framework for Higher Education Qualifications in England, Wales and Northern Ireland has been used to ensure that the level of learning required by this programme is appropriate. The QAA Framework describes the attributes and skills expected Masters level. It is our view that the learning outcomes of this programme are fully consistent with the qualification descriptor in the Framework, and hence that successful students will be able to demonstrate that they meet the expectations of the Framework. In addition, the BCS Accreditation guidelines have been considered throughout to ensure that an application for accreditation by this professional body will be favourably received.

Juniper Networks managers, trainers, Head of Corporate Affairs and Public Policy and Senior Manager of Juniper Academic Alliance have been involved throughout the development of the programme and will continue to be involved as the programme is delivered. We are therefore confident not only that the programme offers a curriculum that is relevant to current industry needs but that it will continue to do so.

This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of individual modules can be found in module specifications, available on the University's website.