Module Specification

1. Factual information			
Module title	**TM352 : Web, mobile and cloud technologies**	**Level**	3
Module tutor	TBA	**Credit value**	30
Module type	Taught	**Notional learning hours**	8

2. Rationale for the module and its links with other modules
Cloud computing and mobile technologies offer new possibilities for the production and distribution of IT applications and services. Rapid, elastic and scalable provisioning of IT resources allows organisations to be more innovative, agile and cost effective. In our personal lives, cloud and mobile technologies allow us to store, access and share information online. Storing and processing information with no clear physical location or legal authority raises important concerns around governance and security. In this module students will learn about the technical and social aspects of cloud computing and mobile technologies, and they will gain hands-on experience of these technologies.

3. Aims of the module
The aims of this module are to:

- Provide knowledge to students about foundations of the internet and the mechanisms of web services and applications provisioning.
- Teach students about the cloud model and the associated resources of a cloud infrastructure.
- Impart knowledge to students about the business case for cloud and the different ways to distributing the cloud infrastructure.
- Create awareness in students concerning the various challenges involved in mobile application development and the combined use of mobile technology and cloud technology.
- Enable students to develop and deploy web services to an application server and perform exploration of toolkits for developing mobile applications.

4. Pre-requisite modules or specified entry requirements
This module will require students to be competent and experienced (Java) programmers. A prior study requirement will be M251 (Object-oriented programming using Java). Familiarity with some concepts found in TT284 (Web technologies) will be beneficial, therefore this module will also be a prior study requirement. For the CwB Pathway, M251 and M269 (Algorithms, Data Structures and Computability), in place of TT284, can serve as pre-requisite.

5. Intended learning outcomes	
A. Knowledge and understanding	**Learning and teaching strategy**
Knowledge and understanding of: A1. The different approaches to providing network applications and services including the architectures and protocols involved. A2. The security and legal issues related to the adoption and use of cloud services, data and applications. A3. The risks and benefits of adopting cloud and mobile technology for a range of business models.	• 25% face-to-face tutorial sessions • TMA work • Module on-line learning resources and support material

B. Cognitive skills	**Learning and teaching strategy**
Upon completing this module, students will be able to: B1. Analyse and critique an organisation's approach to IT infrastructure and delivery of applications and services. B2. Design an effective approach to IT infrastructure for an organisation utilising cloud technology appropriately. B3. Create prototypes of cloud services and mobile applications.	• 25% face-to-face tutorial sessions • TMA work • Module on-line learning resources and support material

C. Practical and professional skills	**Learning and teaching strategy**
Upon completing this module, students will be able to: C1. Implement IT solutions to address legal, ethical and security issues related to cloud based resources and access to data, applications and services. C2. Deploy, demonstrate and utilise a cloud infrastructure C3. Create a mobile application and adapt this to utilise cloud based resources.	• 25% face-to-face tutorial sessions • TMA work • Module on-line learning resources and support material

D Key transferable skills	Learning and teaching strategy

Upon completing this module, students will be able to:
  D1. Research and analyse an organisation's IT infrastructure and identify opportunities for cloud technology adoption.
  D2. Plan and produce a structured technical report detailing an approach for an organisation which is adopting cloud and mobile technologies.
  D3. Produce a presentation to convey the means, risks and benefits for an organisation to adopt cloud and mobile technologies.
	• 25% face-to-face tutorial sessions
	• TMA work
	• Module on-line learning resources and support material

6. Indicative content.

The module is organised into three blocks:
•   Web Foundations
•   The Cloud
•   Mobile Applications.

The principles behind cloud technology and its utilisation in different contexts are the main focus of the module with Web Foundations providing an appropriate grounding in the enabling technology and Mobile Applications demonstrating how to further capitalise on cloud infrastructure in developing flexible mobile applications.

Trust and security are important themes running through the module, alongside the social, political, technical and legal issues which these recent developments in IT raise. Case studies draw together key features from each part, setting the scene for a project where you will use your new skills to specify, prototype and demonstrate cloud and mobile solutions for an organisation.

Block 1 – Web Foundations

This first block sets the scene for the module by exploring how networks, and especially the internet, support access to networked services and applications. The block first provides a brief overview of the underlying standards and protocols of the web (HTTP, XML, CSS, etc.), including secure protocols (HTTPS, TLS, SSL, SSH) and then reviews the development of modern distributed architectures and different approaches (REST, SOAP) that are used to access web services and how these relate to cloud approaches. The block also includes a range of practical activities using NetBeans to develop and deploy web services to an application server (Glassfish) as well as testing and consuming services.

Block 2 – The Cloud

The second block introduces the cloud model and the types of resources (processing power, databases, general storage and networking) that can be provided by a typical cloud infrastructure. Different levels of cloud model are investigated, such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS), and contrasted with the web services model.

The block briefly reviews consumer cloud offerings, such as Dropbox and Google Drive for storing assets, before moving on to more

6. Indicative content.

sophisticated commercial offerings of cloud infrastructure, such as OpenStack and Amazon Web Services (AWS). Virtualisation and the use of hypervisors are outlined with a focus on the common facilities of the dominant mainstream platforms, including monitoring resource usage, load balancing and automatic scaling of resources to meet demand.

As well as technical aspects, the block considers the business case for cloud in different contexts (start-up, corporate, projects, collaborations) and different approaches to distributing cloud infrastructure (private, public and collaborative) as well as considering security and legal implications for each approach.

A range of cloud operations are demonstrated and included in a set of practical activities to provide hands-on experiences. These activities include:
- using a cloud dashboard to create resource constraint descriptions in which to run virtual machines and other components
- creating security rules to control access to cloud resources
- launching, accessing, monitoring and destroying cloud resources
- scripting and testing an auto-scaling scenario so that an application which comes under a high load is automatically replicated with the load shared between the existing and new resources
- use of a programmatic REST API to perform cloud operations.

Block 3 – Mobile Applications

Finally, this block explores the current state of the mobile market and the prospects for mobile technology as well as its combined use with cloud technology. The block commences by investigating a range of challenges facing developers of mobile apps, including dealing with the multiplicity of:
- users' devices (tablets, mobile phones etc.)
- framework technologies (Java, Microsoft, Android, iOS)
- communication technologies (Web services, HTTP, and TCP sockets).

The block examines a range of considerations in developing a mobile application including deployment and upgrading, user interface design, performance and memory management as well as connectivity, back-end storage and security. The block also includes a case study element, exploration of toolkits for developing applications and the practical development of a mobile application which is subsequently extended to exploit cloud facilities.

Block 1: Web foundations

Part 1 An Introduction to the Web and Web Services
Part 2 Mechanisms of Web Services
Part 3 Using NetBeans to create simple Web Services
Part 4 RESTful Web Services
Part 5 Security and HTML5

6. Indicative content.

Block 2: The Cloud
Part 1 What is the Cloud?
Part 2 Risks of the Cloud
Part 3 Designing for the Cloud
Part 4 Implementations of the cloud (private, public & hybrid)
Part 5 The OpenStack Framework
Block 3: Mobile Applications
Part 1 The mobile market
Part 2 Native and generic tools for app development

Pedagogic use of media tools
The module is proposing to use:
1. OpenStack; an open source specification for Cloud services and APIs for which several implementations exist. The preferred incarnation of this will be DevStack which is simple to install on a Linux machine. This software could be distributed as a VM to students. However, using a VM which hosts DevStack, which itself will be used to launch one or more guest VMs as Cloud resources, will generally prove too demanding for the average student's machine. TM352 will offer an AOU hosted Cloud facility for each student. This has additional advantages:
• Students who fail for one reason or another to install and run the software can simply use their AOU facility instead.
• Tutors can be given access to the server accounts to examine student work and provide support as well as for marking assessed practical work.
2. Java APIs for OpenStack. There are several of these including OpenStack4j and Daesin. Daesin is an abstracted API, independent of any specific cloud implementation and likely to be more stable.
3. A Interactive Development Environment (IDE) for Java. For this role 'NetBeans' has been selected. Students can choose to use an IDE of their own choice if they prefer.

7. Assessment strategy, assessment methods and their relative weightings

TMA Work: 20% (including practical project work)
MTA: 30%
Exam: 50%

8. Mapping of assessment tasks to learning outcomes

Assessment tasks	Learning Outcomes											
	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3
TMA	X	X	X	X	X	X	X	X	X	X	X	X
MTA	X	X		X	X		X	X		X		
Final	X	X	X	X	X		X	X		X		

9. Teaching staff associated with the module

Tutor's name and contact details	Contact hours
Dr. Moneef Jazzar (GCC).	

10. Key reading list

Author	Year	Title	Publisher	Location
Adopted from OU, UK.				

11. Other indicative text (e.g. websites)

https://lms.arabou.edu.kw