



## Teaching Guide

| Teaching Guide           |  |        |   |         |
|--------------------------|--|--------|---|---------|
| Identifying Data         |  |        | 2020/21   |         |
| Subject (*)              | Computing as a Service   | Code   | 614502004   |         |
| Study programme          | Mestrado Universitario en Enxeñaría Informática (plan 2012)  |        |   |         |
| Descriptors              |  |        |   |         |
| Cycle                    | Period   | Year   | Type  | Credits |
| Official Master's Degree | 1st four-month period  | First  | Obligatory  | 6       |
| Language                 | SpanishGalician  |        |   |         |
| Teaching method          | Hybrid   |        |   |         |
| Prerequisites            |  |        |   |         |
| Department               | Ciencias da Computación e Tecnoloxías da InformaciónComputaciónEnxeñaría de ComputadoresMatemáticas  |        |   |         |
| Coordinador              | López Taboada, Guillermo   | E-mail | guillermo.lopez.taboada@udc.es  |         |
| Lecturers                | Carneiro Diaz, Victor Manuel<br>Fernández Lozano, Carlos<br>Ferreiro Ferreiro, Ana María<br>López Taboada, Guillermo   | E-mail | victor.carneiro@udc.es<br>carlos.fernandez@udc.es<br>ana.fferreiro@udc.es<br>guillermo.lopez.taboada@udc.es |         |
| Web                      | moodle.udc.es  |        |   |         |
| General description      | <p>The main objective of this subject is to introduce the student to a new paradigm of distributed computing, Cloud Computing (Cloud Computing), and provide an overview of its possibilities for use in the business world. Cloud Computing systems allow an organization's computing resources to be outsourced to a third-party provider, allowing fast, transparent, secure and cheap provisioning and release of these resources through the Internet. This flexibility in computer management, together with the pay-per-use model available in public clouds, allow companies to rapidly deploy computer applications on systems that adapt their resources efficiently based on the natural life cycle of the business, with the consequent cost savings and productivity improvements. However, its use also represents an important challenge for companies, which must know the advantages and disadvantages of this technology before deciding to opt for its adoption, since this implies significant changes that affect their business model.</p> <p>On the other hand, the virtualization-based technologies used in public clouds can also be applied in the private computing centers of companies to achieve more efficient management, adding many of the features that public clouds provide while the Sensitive information remains under the control of the organization.</p> <p>Through the activities planned in this subject, the student will know the basic concepts and problems associated with Cloud Computing from a business point of view, they will be provided with information on success stories in their use in business environments and, to get a good understanding of technology , will carry out practices on public Clouds, deploying and using virtualized infrastructures and platforms and executing distributed applications developed applying a new programming model: the Map / Reduce model, a model that is supported by the main Cloud service providers.</p> |        |   |         |



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| <b>Contingency plan</b> | <p>1. Modifications to the contents</p> <ul style="list-style-type: none"> <li>- No changes will be made.</li> </ul> <p>2. Methodologies *Teaching methodologies that are maintained</p> <ul style="list-style-type: none"> <li>- All.</li> </ul> <p>3. Mechanisms for personalized attention to students</p> <ul style="list-style-type: none"> <li>- Email: Daily. Of use to make consultations, request virtual meetings to resolve doubts and follow up on supervised work.</li> <li>- Moodle: According to the needs of the students. They have "thematic forums associated with the modules" of the subject, to formulate the necessary queries. There are also "specific activity forums" to develop the "Directed Discussions", through which the development of theoretical content of the subject is put into practice.</li> <li>? Teams: 1 weekly session in a large group for the advancement of the theoretical contents and the tutored works in the time slot assigned to the subject in the faculty class calendar. From 1 to 2 weekly sessions (or more as the students demand) in a small group (up to 6 people), for follow-up and support in carrying out the "supervised work". This dynamic allows for standardized monitoring adjusted to the learning needs of the students to carry out the work of the subject.</li> </ul> <p>4. Modifications in the evaluation</p> <ul style="list-style-type: none"> <li>- No changes will be made.</li> </ul> <p>5. Modifications to the bibliography or webgraphy</p> <ul style="list-style-type: none"> <li>- No changes will be made.</li> </ul> |
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| Study programme competences / results |  |
|---------------------------------------|--|
| Code                                  | Study programme competences / results  |
| A5                                    | Capacidade de comprender e saber aplicar o funcionamento e organización da internet, as tecnoloxías e protocolos de redes de nova xeración, os modelos de compoñentes, software intermediario e servizos.  |
| A9                                    | Capacidade para deseñar e avaliar sistemas operativos e servidores, e aplicacións e sistemas baseados en computación distribuída.  |
| A10                                   | Capacidade para comprender e poder aplicar coñecementos avanzados de computación de altas prestacións e métodos numéricos ou computacionais a problemas de enxeñaría.  |
| B1                                    | Capacidade de resolución de problemas.   |
| B5                                    | Habilidades de xestión da información.   |
| B9                                    | Capacidade para xerar novas ideas (creatividade).  |
| B10                                   | Capacidade para proxectar, calcular e deseñar produtos, procesos e instalacións en todos os ámbitos da enxeñaría informática   |
| B13                                   | Capacidade para o modelado matemático, cálculo e simulación en centros tecnolóxicos e de enxeñaría de empresa, particularmente en tarefas de investigación, desenvolvemento e innovación en todos os ámbitos relacionados coa Enxeñaría en Informática |
| B14                                   | Capacidade para a elaboración, planificación estratéxica, dirección, coordinación e xestión técnica e económica de proxectos en todos os ámbitos da Enxeñaría en Informática seguindo criterios de calidade e ambientais                               |
| B16                                   | Capacidade para a posta en marcha, dirección e xestión de procesos de fabricación de equipos informáticos, con garantía da seguridade para as persoas e bens, a calidade final dos produtos e a súa homologación                                       |
| B17                                   | Capacidade para a aplicación dos coñecementos adquiridos e de resolver problemas en contornas novas ou pouco coñecidos dentro de contextos máis amplos e multidisciplinares, sendo capaces de integrar estes coñecementos                              |
| B18                                   | Capacidade para comprender e aplicar a responsabilidade ética, a lexislación e a deontoloxía profesional da actividade da profesión de Enxeñeiro en Informática  |
| B19                                   | Capacidade para aplicar os principios da economía e da xestión de recursos humanos e proxectos, así como a lexislación, regulación e normalización da informática  |
| B21                                   | Posuír e comprender coñecementos que acheguen unha base ou oportunidade de ser orixinais no desenvolvemento e/ou aplicación de ideas, a miúdo nun contexto de investigación  |



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| B22 | Que os estudantes saiban aplicar os coñecementos adquiridos e a súa capacidade de resolución de problemas en contornas novas ou pouco coñecidos dentro de contextos máis amplos (ou multidisciplinares) relacionados coa súa área de estudo   |
| B23 | Que os estudantes sexan capaces de integrar coñecementos e enfrontarse á complexidade de formular xuízos a partir dunha información que, sendo incompleta ou limitada, inclúa reflexións sobre as responsabilidades sociais e éticas vinculadas á aplicación dos seus coñecementos e xuízos |
| B25 | Que os estudantes posúan as habilidades de aprendizaxe que lles permitan continuar estudando dun modo que haberá de ser en gran medida autodirixido ou autónomo   |
| C6  | Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.   |
| C7  | Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.  |
| C8  | Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade  |

| Learning outcomes   |                                       |                                    |            |
|---|---------------------------------------|------------------------------------|------------|
| Learning outcomes   | Study programme competences / results |                                    |            |
| Coñecer e utilizar os servizos que ofrecen clouds públicos como Amazon EC2, Google Apps ou Microsoft Azure para a configuración de infraestruturas virtuais e o implantamento de aplicacións. | AJ5                                   | BJ1<br>BJ10<br>BC1<br>BC2          | CJ6        |
| Coñecer os casos de uso máis habituais na integración de tecnoloxías Cloud en contornas empresariais.   | AJ5<br>AJ9                            | BJ1<br>BJ9<br>BJ14<br>BJ16<br>BJ17 | CJ6        |
| Coñecer as tecnoloxías, aspectos legais e problemáticas relacionados coa xestión da seguridade e a privacidade no uso de clouds públicos.   | AJ5<br>AJ9                            | BJ18<br>BJ19<br>BC3                |            |
| Coñecer e utilizar o modelo de programación Map/Reduce para desenvolver aplicacións distribuídas e desplegalas sobre infraestruturas de cloud públicas.                                       | AJ9<br>AJ10                           | BJ1<br>BJ13<br>BC1                 |            |
| Habilidade para a procura, selección e manexo de recursos (bibliografía, software, etc.) relacionados coa computación Cloud.  |                                       | BJ5<br>BC5                         | CJ7<br>CJ8 |

| Contents                   |   |
|----------------------------|---|
| Topic                      | Sub-topic   |
| 1. Introduction            | General concepts<br>Virtualization technologies<br>Service models: SaaS, PaaS, IaaS<br>Deployment models<br>Study cases<br>Challenges and opportunities |
| 2. Service Models          | Infraestructura como Servicio (IaaS)<br>Caso de uso: Amazon Web Services<br>Plataforma como Servicio (PaaS)<br>Caso de uso: Microsoft Azure             |
| 3. Application development | Map/Reduce programming model  |
| 4. Cloud in business       | Privacy and data protection.<br>Legal aspects.  |



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|-------------------------|---|
| 5. Open cloud platforms | Introduction to open cloud platforms<br>Compartmental study<br>Use case: OpenNebula |
|-------------------------|---|

| Planning                       |                                       |                                      |                               |             |
|--------------------------------|---------------------------------------|--------------------------------------|-------------------------------|-------------|
| Methodologies / tests          | Competencies / Results                | Teaching hours (in-person & virtual) | Student?s personal work hours | Total hours |
| Guest lecture / keynote speech | A5 A9 A10 B10 B14<br>B18 B19 C6 C7 C8 | 21                                   | 0                             | 21          |
| ICT practicals                 | A5 A10 B1 B13 B16<br>B17 B22          | 21                                   | 63                            | 84          |
| Supervised projects            | B5 B9 B21 B22 B23<br>B25 C6           | 0                                    | 30                            | 30          |
| Objective test                 | A10 B1 B17                            | 3                                    | 9                             | 12          |
| Personalized attention         |                                       | 3                                    | 0                             | 3           |

(\*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

| Methodologies                  |   |
|--------------------------------|---|
| Methodologies                  | Description   |
| Guest lecture / keynote speech | Taught by a professor. Classes include theoretical contents, as well as seminars. |
| ICT practicals                 | Problem solving and practical cases.  |
| Supervised projects            | Semi-autonomous work on larger practical cases, under the professors' guidance.   |
| Objective test                 | Exam  |

| Personalized attention                |   |
|---------------------------------------|---|
| Methodologies                         | Description   |
| ICT practicals<br>Supervised projects | <p>Personalized attention during the practices will serve to guide and check the work that students are doing according to the instructions provided to them, depending on the specific practice in question.</p> <p>In order to carry out the supervised work, the teachers will provide the necessary initial indications, bibliography for consultation and will monitor the progress that the student is making to offer the relevant guidelines in each case, so as to ensure the quality of the work according to the criteria. which are indicated.</p> <p>All the teachers of the subject will also propose a schedule of tutorials in which the students will be able to solve any doubt related to the development of the same. Students will be recommended to attend tutorials as a key part of learning support.</p> |

| Assessment                     |                                       |   |               |
|--------------------------------|---------------------------------------|---|---------------|
| Methodologies                  | Competencies / Results                | Description   | Qualification |
| Guest lecture / keynote speech | A5 A9 A10 B10 B14<br>B18 B19 C6 C7 C8 | Ao longo do cuadrimestre realizaranse varias probas obxectivas para avaliar os contidos teóricos tratados nas sesións maxistrals.   | 40            |
| ICT practicals                 | A5 A10 B1 B13 B16<br>B17 B22          | As prácticas da materia consistirán en diferentes actividades relacionadas co uso de clouds públicos (AWS e Azure), a programación de aplicacións Map/Reduce e a implantación de clous privados con OpenNebula. | 40            |
| Supervised projects            | B5 B9 B21 B22 B23<br>B25 C6           | Os traballos tutelados serán opcionais e sobre algún tema a convenir entre o alumno e o profesor.   | 20            |



|                |            |  |   |
|----------------|------------|--|---|
| Objective test | A10 B1 B17 | A proba obxectiva resérvase para aqueles alumnos que non poideran asistir ás sesións maxistras. O seu valor será o mesmo que o das probas realizadas nas sesións maxistras (40% da nota total da materia). | 0 |
|----------------|------------|--|---|

### Assessment comments

With the compulsory work that the student has to carry out (objective tests and compulsory practices) up to 80% of the total mark of the subject can be obtained. The remaining 20% can be achieved by performing optional supervised work.

For the second opportunity (July call) the same evaluation criteria will be applied. Students will have the opportunity to take an objective test on the contents covered in the master sessions and there will be a second date of delivery of the practices and supervised work.

Students with part-time enrollment will be able to follow the subject without problems, as the performance of the assessable practices does not require attendance and the assessment of the theoretical contents can be done with a single attendance to perform the objective test on the date indicated in the exam calendar.

#### FRAUD

In the event that any fraud is detected in the evaluable tests, the sanctioning measures provided for in the University regulations will be applied.

### Sources of information

|                      |  |
|----------------------|--|
| <b>Basic</b>         | John Rathon (2011, 2º ed). Cloud Computing Explained: Implementation Handbook for Enterprises. Recursive Press. Luís Joyanes Aguilar (2013). Computación en la Nube: Estrategías de Cloud Computing en las Empresas. Ed. Marcombo. Tom White (2011, 2º ed). Hadoop: The Definitive Guide. MapReduce for the Cloud. O'Reilly. Giovanni Toraldo (2012). OpenNebula 3 Cloud Computing. eBook. |
| <b>Complementary</b> | Mathew Portnoy (2012). Virtualization Essentials. Wiley. Mathew Portnoy (2012). Virtualization Essentials. Wiley.  |

### Recommendations

#### Subjects that it is recommended to have taken before

#### Subjects that are recommended to be taken simultaneously

#### Subjects that continue the syllabus

The strategic Planning of Information Systems/614502001  
 Quality, Information Security and Computing Audit/614502003  
 Design of Information Systems/614502007  
 Business Intelligence/614502009  
 Information Retrieval and the Semantic Web/614502010  
 Final Project/614502012

#### Other comments

(\* )The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.