

# FLORIDA ATLANTIC UNIVERSITY™

## Graduate Programs—NEW COURSE PROPOSAL<sup>1</sup>

UGPC APPROVAL \_\_\_\_\_  
 UFS APPROVAL \_\_\_\_\_  
 SCNS SUBMITTAL \_\_\_\_\_  
 CONFIRMED \_\_\_\_\_  
 BANNER POSTED \_\_\_\_\_  
 CATALOG \_\_\_\_\_

DEPARTMENT: DEPT. OF COMPUTER & ELECTRICAL  
ENGINEERING AND COMPUTER SCIENCE

COLLEGE: COLLEGE OF ENGINEERING AND COMPUTER SCIENCE

RECOMMENDED COURSE IDENTIFICATION (TO OBTAIN A COURSE NUMBER, CONTACT [ERUDOLPH@FAU.EDU](mailto:ERUDOLPH@FAU.EDU))

PREFIX    COT    COURSE NUMBER    5612    LAB CODE (L or C)     
 COMPLETE COURSE TITLE: CLOUD COMPUTING

### EFFECTIVE DATE

(first term course will be offered)

FALL 2011\_/ FALL 2016

CREDITS<sup>2</sup>  
3

TEXTBOOK INFORMATION  
CLASS NOTES

GRADING (SELECT ONLY ONE GRADING OPTION): REGULAR    X    SATISFACTORY/UNSATISFACTORY   

#### COURSE DESCRIPTION, NO MORE THAN THREE LINES:

Cloud computing is concerned with the use and architecture of this model of computation. We study the services provided by clouds, their internal structure, and their possibilities and limitations.

#### PREREQUISITES\*

Basic knowledge of UML and COP4610 Computer Operating Systems, or permission of instructor

#### COREQUISITES\*

NONE

#### REGISTRATION CONTROLS (MAJOR, COLLEGE, LEVEL)\*

Open to graduate students and advanced undergrads

\* PREREQUISITES, COREQUISITES AND REGISTRATION CONTROLS WILL BE ENFORCED FOR ALL COURSE SECTIONS.

#### MINIMUM QUALIFICATIONS NEEDED TO TEACH THIS COURSE:

MEMBER OF THE GRADUATE FACULTY OF FAU AND HAS A TERMINAL DEGREE IN THE SUBJECT AREA (OR A CLOSELY RELATED FIELD).

Faculty contact, email and complete phone number:

Dr. Eduardo B. Fernandez,  
[fernande@fau.edu](mailto:fernande@fau.edu)  
561-297-3466 561-843-4352 (cell.)

Please consult and list departments that might be affected by the new course and attach comments.<sup>3</sup>

None

#### Approved by:

Department Chair: *Maryann Eustel*  
 College Curriculum Chair: *[Signature]*  
 College Dean: *[Signature]*  
 UGPC Chair: *[Signature]* Wm. McDaniel  
 Graduate College Dean: *[Signature]*  
 UFS President: \_\_\_\_\_  
 Provost: \_\_\_\_\_

#### Date:

03/02/2106  
3/17/16  
3/17/2016  
4-6-2016  
4-6-16

1. Syllabus must be attached; see guidelines for requirements: [www.fau.edu/provost/files/course\\_syllabus.2011.pdf](http://www.fau.edu/provost/files/course_syllabus.2011.pdf)

2. Review Provost Memorandum: Definition of a Credit Hour [www.fau.edu/provost/files/Definition\\_Credit\\_Hour\\_Memo\\_2012.pdf](http://www.fau.edu/provost/files/Definition_Credit_Hour_Memo_2012.pdf)

3. Consent from affected departments (attach if necessary)

Email this form and syllabus to [UGPC@fau.edu](mailto:UGPC@fau.edu) one week before the University Graduate Programs Committee meeting.

**Department of Computer & Electrical Engineering  
and Computer Science  
Florida Atlantic University  
Course Syllabus**

<b>1. Course title/number, number of credit hours</b>	
Cloud Computing/COT5612	# of credit hours 3
<b>2. Course prerequisites, corequisites, and where the course fits in the program of study</b>	
Basic knowledge of UML and COP4610 Computer Operating Systems, or permission of instructor	
<b>3. Course logistics</b>	
<p><i>Term:</i> Fall 2016  This is a classroom lecture course  <i>Class location and time</i>  TBA  This course has some design content (project).</p>	
<b>4. Instructor contact information</b>	
<i>Instructor's name</i>	Dr. Eduardo B. Fernandez
<i>Office address</i>	EE417
<i>Office Hours</i>	TBA
<i>Contact telephone number</i>	561-297-3466
<i>Email address</i>	fernande@fau.edu
<b>5. TA contact information</b>	
<i>TA's name</i>	TBA
<i>Office address</i>	
<i>Office Hours</i>	
<i>Contact telephone number</i>	
<i>Email address</i>	
<b>6. Course description</b>	
<p>Cloud computing is concerned with the use and architecture of this model of computation. We study the services provided by clouds, their internal structure, and their possibilities and limitations. We use UML as a language to describe architectures and patterns to help the design of software applications using clouds and to describe cloud architectures.</p>	
<b>7. Course objectives/student learning outcomes/program outcomes</b>	
<i>Course objectives</i>	<p>Describe the possibilities and limitations of cloud computing from the point of view of users and designers</p> <p>Be able to understand what components and tools are used to deal with clouds</p>



**Department of Computer & Electrical Engineering  
and Computer Science  
Florida Atlantic University  
Course Syllabus**

	<p>Analyze examples of real cloud architectures with respect to their structure and function.</p> <p>Analyze and apply UML models and patterns to describe and design cloud systems.</p> <p>Be able to log into real clouds, open accounts, and select services from them.</p> <p>Estimate the security and reliability levels of systems running different types of applications and in different environments. Define requirements and defenses to provide appropriate security and reliability levels.</p> <p>Given a set of application requirements, students should be able to select the most convenient cloud product from a set of commercial offerings, and write appropriate service contracts.</p>
<b>8. Course evaluation method</b>	
Take-home final exam (55%). Assignments (3). (45%).	
<b>9. Course grading scale</b>	
Relative grading, no ranges or curves	
<b>10. Policy on makeup tests, late work, and incompletes</b>	
<p>Makeup tests are possible, and are given only if there is solid evidence of medical or otherwise family/personal emergency issues that prevent the student from participating in the exam. Makeup exams will be handled case by case.</p> <p>Late work is not acceptable.</p> <p>A grade of incomplete will be assigned only in the case of solid evidence of medical or otherwise serious emergency situation.</p>	
<b>11. Special course requirements</b>	
None	
<b>12. Classroom etiquette policy</b>	
University policy requires that in order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular phones and laptops, are to be disabled in class sessions.	
<b>13. Disability policy statement</b>	
In compliance with the Americans with Disabilities Act (ADA), students who require special accommodations due to a disability to properly execute coursework must register with the Office for Students Accessibility Services (SAS) located in Boca Raton campus, SU 133 (561) 297-3880 and follow all SAS procedures.	

**Department of Computer & Electrical Engineering  
and Computer Science  
Florida Atlantic University  
Course Syllabus**

<b>14. Honor code policy</b>
Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and place high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. See University Regulation 4.001 at <a href="http://www.fau.edu/regulations/chapter4/4.001_Code_of_Academic_Integrity.pdf">www.fau.edu/regulations/chapter4/4.001_Code_of_Academic_Integrity.pdf</a>
<b>15. Required texts/reading</b>
Class notes/slides placed on Blackboard (bb9.fau.edu) 450 slides  Notes on UML.
<b>16. Supplementary/recommended readings</b>
Selection of papers (see references list)
<b>17. Course topical outline, including dates for exams/quizzes, papers, completion of reading</b>
Week 1 : Motivation and objectives, Objectives of cloud computing. Advantages and problems. Applications appropriate for clouds. Typical services.
Week 2: Service levels. Infrastructure as a Service, Middleware (Platform) as a Service. Software as a Service. Advantages and problems of each type of service. SOA and its relationship to cloud computing. Application as a Service.
Week 3: Infrastructure as a Service. Virtualization approaches. Desktop and server virtualization. Examples: Amazon EC2, Eucalyptus. <b>Assignment 1</b> . Reference architectures.
Week 4: Platform as a Service. Platform approaches. Agnostic middleware. Example: Microsoft Azure.
Week 5: Software as a Service. Example: Google Apps. Applications using multiple clouds.
Week 6: Service-oriented architectures. Web services and their standards. Service contracts
Week 7: Security. Attacks and their defenses. Misuse patterns.
Week 8: Security. Finding threats, secure architectures. <b>Assignment 2</b>
Week 9: Reliability. Providing reliability, availability, and fault tolerance in cloud systems
Week 10: Identity management. Importance and examples Governance. Policies and management.
Week 11: Wireless clouds. Effect on security and functionality
Week 12: The Internet of Things. Fog computing. <b>Assignment 3</b>
Week 13: Clouds and cyber-physical systems
Week 14: Multiclouds, brokers, cloud ecosystems
Week 15: Summary <b>Final exam</b>
The assignments are hands-on in commercial clouds, in Amazon EC-2 and Microsoft Azure

**Department of Computer & Electrical Engineering  
and Computer Science  
Florida Atlantic University  
Course Syllabus**

## References

- Amazon Web Services LLC, "Amazon Elastic Compute Cloud (Amazon EC2)", <http://aws.amazon.com/ec2>
- M. Armbrust et al, "Above the Clouds: A Berkeley View of Cloud Computing", Technical Report No. UCB/EECS-2009-28, <http://www.eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-28.html>
- W. Dawoud, I. Takouna, and C. Meinel, "Infrastructure as a Service Security: Challenges and Solutions", the 7th International Conference on Informatics and Systems, 2010
- Mahesh H. Dodani, "Cloud Architecture", Journal of Object Technology, [Volume 8, no. 7 \(November 2009\)](https://doi.org/10.5381/jot.2009.8.7.c3), pp. 35-44, [doi:10.5381/jot.2009.8.7.c3](https://doi.org/10.5381/jot.2009.8.7.c3).
- E.B. Fernandez, Raul Monge, and Keiko Hashizume, "Two patterns for cloud computing: Secure Virtual Machine Image Repository and Cloud Policy Management Point" *20th Conf. on Pattern Languages of Programs (PLoP 2013)*
- E. B. Fernandez, Nobukazu Yoshioka, and Hironori Washizaki, "Patterns for cloud firewalls", *Procs. of AsianPLoP (Pattern Languages of Programs) 2014*, Tokyo, Japan, March 2014.
- D.A.B.Fernandes, et al., "Security issues in cloud environment", *Int. J. of Information Security*, 2014.
- E.B. Fernandez, Raul Monge, and Keiko Hashizume, "Building a security reference architecture for cloud systems", *Requirements Engineering*, 2015.
- G. Hutch, "Getting the most out of Virtualization", The Architecture Journal, <http://msdn.microsoft.com/en-us/architecture/ff803574.aspx>
- Y. Luo, "Network I/O virtualization for cloud computing", IEEE IT Pro, Sept./Oct. 2010, 36-41
- Microsoft Power and Utilities, *Smart Energy Reference Architecture*, Oct. 2009, <http://www.Microsoft.com/Utilities>
- D. Nurmi, et al., "The Eucalyptus Open-source Cloud-computing system", 9<sup>th</sup> IEEE/ACM Int. Symposium on Cluster Computing and the grid, 2009, 124-131.
- NIST <http://www.nist.gov/itl/cloud/>
- W. Theilman et al., "A Reference Architecture for multi-level SLA management", *Journal of Internet Eng.*, vol. 4, No 1, Dec. 2010, 290-298.
- VMware, <http://www.vmware.com>
- Wikipedia, "Cloud computing", [http://en.wikipedia.org/wiki/Cloud\\_computing](http://en.wikipedia.org/wiki/Cloud_computing)
- Q. Zhang, L. Cheng, R. Boutaba, "Cloud computing: state-of-the-art and research challenges", *J. Internet Serv. Appl.*, vol. 1, 2010, 7-18.