

H9CPP: Cloud Platform Programming

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| Module Code: | H9CPP |
| Long Title | Cloud Platform Programming APPROVED |
| Title | Cloud Platform Programming |
| Module Level: | LEVEL 9 |
| EQF Level: | 7 |
| EHEA Level: | Second Cycle |
| Credits: | 10 |
| Module Coordinator: | Horacio Gonzalez-Velez |
| Module Author: | Adriana Chis |
| Departments: | School of Computing |
| Specifications of the qualifications and experience required of staff | MSc and/or PhD degree in computer science or cognate discipline. Experience lecturing in the field. May have industry experience also. |
| Learning Outcomes | |
| <i>On successful completion of this module the learner will be able to:</i> | |
| # | Learning Outcome Description |
| LO1 | Demonstrate in-depth knowledge of core cloud-based services. |
| LO2 | Critically analyse advantages and disadvantages of different cloud-based architectures and technologies/services. |
| LO3 | Formulate and produce new code libraries that implement advanced programming constructs in order to create secure, dynamic, configurable, robust, scalable cloud-based applications. |
| LO4 | Construct and present a complex dynamic cloud-based application through selecting relevant cloud related architectural patterns and services taking into account the evaluation and assessment of application design, development, and testing methodologies. |
| LO5 | Identify and ethically apply best practices for continuous integration, delivery and deployment of cloud-based applications. |
| Dependencies | |
| Module Recommendations | |
| No recommendations listed | |
| Co-requisite Modules | |
| No Co-requisite modules listed | |
| Entry requirements | |

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| Module Content & Assessment | | | |
|---|-----------------|---------------------------|-----------|
| Indicative Content | | | |
| Introduction to Cloud Concepts Review of different architectures for distributed computing (e.g. client-server, multitier architecture); review of versioning control. Cloud Delivery Models. Cloud Core Services (e.g. computation, storage, databases). Elastic Load Balancing. Auto-Scaling. | | | |
| Introduction to Developing/Programming on Cloud Systems Development Lifecycle. Working with a Cloud SDK. Errors and Exceptions. Application and Infrastructure monitoring. | | | |
| Deployment Continuous Integration and Continuous Deployment. Deployment and Testing Strategies. | | | |
| Introduction to Identity and Access Management Overview of IAM. Authentication with IAM. Authorization with IAM | | | |
| Object Storage Services Introduction to Cloud Storage Services. Protecting Data and Managing Access to Cloud Resources. | | | |
| NoSQL Services Introduction to NoSQL. Partitions and Data Distribution. Read/Write Throughput. Streams and Global Tables. | | | |
| Caching for Scalability Caching Overview. Caching Strategies. Explore different caching services (e.g. CloudFront, ElastiCache). | | | |
| Containers Introduction to Containers. Containers vs. Hardware Virtualization. Microservices – Use Case for Containers. | | | |
| Application Integration/Messaging Services Introduction to Message Queues. Investigate different message queues services (e.g. Amazon SQS, Amazon SNS). | | | |
| Serverless Computing Introduction to Serverless Computing, Deployment of Serverless Applications. Functions as a Service (FaaS) platform. Execution Models for Invoking FaaS. Overview of Deploying FaaS Functions. Case Study: an implementation of a FaaS platform (e.g. AWS Lambda: Overview of AWS Lambda, Execution Models for Invoking Lambda Functions, AWS Lambda Permissions, Authoring and Configuring Lambda Functions, Deploying Lambda Functions). | | | |
| Cloud-based RESTful API Application Programming Interfaces. Creating a RESTful API. Testing a RESTful API. Deploying a RESTful API. Invoking a RESTful API. Monitoring a RESTful API. | | | |
| Orchestration/Workflow Coordination in Distributed Applications Workflow Coordination in Distributed Applications | | | |
| Assessment Breakdown | | | % |
| Coursework | | | 60.00% |
| End of Module Assessment | | | 40.00% |
| Assessments | | | |
| Full Time | | | |
| Coursework | | | |
| Assessment Type: | Project | % of total: | 60 |
| Assessment Date: | n/a | Outcome addressed: | 1,2,3,4,5 |
| Non-Marked: | No | | |
| Assessment Description: Develop a complex dynamic cloud-based application through selecting relevant cloud related architectural patterns and cloud-based services. | | | |
| End of Module Assessment | | | |
| Assessment Type: | Terminal Exam | % of total: | 40 |
| Assessment Date: | End-of-Semester | Outcome addressed: | 1,2 |
| Non-Marked: | No | | |
| Assessment Description: The exam will assess learners' knowledge and understanding of cloud technologies. | | | |
| No Workplace Assessment | | | |
| Reassessment Requirement | | | |
| Coursework Only <i>This module is reassessed solely on the basis of re-submitted coursework. There is no repeat written examination.</i> | | | |
| Reassessment Description This module is reassessed solely on the basis of re-submitted coursework which evaluates all the learning outcomes. | | | |

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| Module Workload | | | | |
|--------------------------------------|----------------------|-------|--------------|---------------------------------|
| Module Target Workload Hours 0 Hours | | | | |
| Workload: Full Time | | | | |
| Workload Type | Workload Description | Hours | Frequency | Average Weekly Learner Workload |
| Lecture | No Description | 36 | Per Semester | 3.00 |
| Practical | No Description | 24 | Per Semester | 2.00 |
| Independent Learning Time | No Description | 190 | Per Semester | 15.83 |
| Total Weekly Contact Hours | | | | 5.00 |

| Module Resources | |
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| <i>Recommended Book Resources</i> | |
| Ian Foster, Dennis B. Gannon. (2017), Cloud Computing for Science and Engineering, MIT Press, p.392, [ISBN: 9780262037242]. | |
| <i>Supplementary Book Resources</i> | |
| Sean Keery, Clive Harber, Marcus Young. (2019), Implementing Cloud Design Patterns for AWS, Second Edition. Packt Publishing, [ISBN: 9781789136203]. | |
| <i>Recommended Article/Paper Resources</i> | |
| <p>E. Jonas, J. Schleier-Smith, V. Sreekanti, C.C. Tsai, A. Khandelwal, Q. Pu, V. Shankar, J. M. Carreira, K. Krauth, N. Yadwadkar, J.E. Gonzalez, R. A. Popa, I. Stoica and D. A. Patterson. (2019), Cloud Programming Simplified: A Berkeley View on Serverless Computing, EECS Department, University of California, Berkeley. Technical Report No. UCB/EECS-2019-3, https://www2.eecs.berkeley.edu/Pubs/Tech Rpts/2019/EECS-2019-3.html</p> <p>R. Buyya et al.. A Manifesto for Future Generation Cloud Computing: Research Directions for the Next Decade, ACM Computing Surveys, 51 (5), p.105:1, https://doi.org/10.1145/3241737</p> <p>I. Baldini et al.. (2017), Serverless Computing: Current Trends and Open Problems, In: Chaudhary S., Somani G., Buyya R. (eds) Research Advances in Cloud Computing. Springer, Singapore, https://doi.org/10.1007/978-981-10-5026-8_1</p> | |
| <i>Other Resources</i> | |
| <p>[Website], AWS. AWS Lambda, [Accessed September 1st 2019], https://aws.amazon.com/lambda</p> <p>[Website], IBM. IBM Cloud Functions, [Accessed September 1st 2019], https://cloud.ibm.com/functions</p> <p>[Website], Apache OpenWhisk, [Accessed September 1st 2019], https://openwhisk.apache.org</p> <p>[Website], Google. Google Cloud Functions, [Accessed September 1st 2019], https://cloud.google.com/functions</p> | |
| Discussion Note: | Approved to allow for publication of parent programme on NCI website. |