



CPSC 5207EL 06 SP2025 - Topics in Computer Science: Introduction to Cloud Computing Technologies

Instructor Name:	Dr. Khalil A. Abuosba
Email:	kabuosba@laurentian.ca
Office Hours:	2:30 pm – 3:45 pm.
Office Location:	F217A
Cellphone No.:	647-962-7942

Course Description:	<p>This course is designed to provide the basic concepts of cloud computing; it provides an introduction into the technologies behind cloud computing. A combination of lectures and hands-on programming assignments expose the student to the leading cloud computing paradigms and programming platforms (e.g., EC2, Azure, App Engine). The course addresses a variety of concepts in the areas of service composition and orchestration. In addition, lectures provide an overview of the underlying technological concepts that make cloud computing possible (e.g., virtualization, scalability, fault tolerance, and security). (lec 3) cr 3.</p> <p>Topics shall include virtualization standards, QoS technologies, security considerations, integration and automation considerations, and virtualization deployment models. Full explanation of the processes, methodologies, and tools needed for DevOps support. Topics covered include Linux Fundamentals, Container Orchestration with Docker and Kubernetes, Networking Fundamentals, Cloud Computing using OpenStack, Network Function Virtualization as well as special topics related to emerging applications and research.</p>
Method of Course Delivery:	In-person.
Classroom Location and Time:	Arts Building, A-226 Lecture Fridays, 4:00 p.m. - 6:50 p.m.



Number of Course Credits:	3
Course Dates:	January 5, 2025 through April 30, 2025
Course Year:	2024/2025
Course Semester:	Spring
Prerequisite:	
Textbooks, Manuscripts, and Required Readings:	Resources are specified on the D2L/Brightspace course shell.
Student Learning Outcomes:	<p>By the end of this course the student should be able to</p> <ul style="list-style-type: none">- explain the main concepts of the cloud computing discipline.- explain how cloud computing is integrated with the Internet.- identify cloud computing infrastructure requirements.- understand the Cloud Federation Reference Model.- Identify TCP/IP protocols required in cloud computing.- identify cost-effective and efficient methods for managing resources deployed in the infrastructure.- explain how network functions would be deployed.- explain how to virtualize storage.- utilize and examine capabilities offered by different cloud computing platforms.- identify advanced capabilities offered by cloud computing in the areas of Big Data and Machine learning disciplines.- explain how to utilize cloud computing in delivering distributed systems including microservices.- identify how to manage virtual machines and containers.- identify how to orchestrate cloud services. <p>Specific Course Learning Outcomes</p> <ul style="list-style-type: none">- Upon completion of the course, the students will be able to:- identify the computational requirements for cloud computing.- identify tools utilized for virtualization.- identify tools utilized for service orchestration.- identify tools utilized for service scaling.



	<ul style="list-style-type: none"> - identify tools utilized for QoS and SLA. - evaluate cloud computing platforms. - use and evaluate container technologies. - use and evaluate virtual machine technologies. - use and evaluate containers and virtual machine management technologies. - design scalable microservices solutions. - identify cloud computing deployment models. - identify how to deliver secure solutions of full virtualization technologies. - identify virtualization requirements for Content Delivery Networks (CDNs). 			
Evaluation:	<ul style="list-style-type: none"> - 26% Four Assignments. - 10% online quizzes/Minimal Knowledge. - 15% Test 1. - 14% Test 2. - 35% Term Project of three phases. 			
Schedule of Course Assignments and Activities	Assessment	Type	Weight	Due Date
	Ten Weekly Quiz	Online Quiz	10%	7 Days from posting date
	Test 1	D2L-based/In-class	15%	June 6
	Test 2		14%	July 11
	Assignment 1: Virtualization and Container Orchestration	Individual	7%	June 1
	Assignment 2: Service Composition and Serverless Computing	Individual	7%	June 15
	Assignment 3: Big Data and Data Warehouses	Individual	6%	June 30
	Assignment 4: A. I Applications	Individual	6%	July 14
	Project Phase 1 Project Proposal	Group	8%	May 29
	Project Phase 2 Status Report	Group	0%	June 21
	Project Phase 3 Research Paper	Group	8%	July 21
	Project Phase 3 Presentation	Group	9%	July 18
	Project Phase 3 Documentation Report	Group	10%	July 21



Weekly Schedule:

Class	Topic	Readings	Deliverables
		<i>Additional Reading resources are specified in the Brightspace course shell.</i>	
W1 MAY 9	Basic Concepts of The Internet, Cloud Computing, Data Centers, and IoT.	Brightspace Resources	
W2 MAY 16	<ul style="list-style-type: none"> - Virtualization and Containerization. - The Google Cloud Platform. - Data Centers and Internet Exchanges. 	Architecture of Virtual Machines by R. P. Goldberg.	Quiz1
W3 MAY 23	<ul style="list-style-type: none"> - Service-Oriented Architectures (SOA). - Cloud Service Composition and Orchestration. - Container Orchestrators, Engines, and runtimes. - The AWS Platform Services. - The Google Cloud Platform Services. 	Cloud-Native Computing: A Survey from the Perspective of Services Cost-Performance Evaluation of General Compute Instances: AWS, Azure, GCP, and OCI	Quiz 2
W4 MAY 30	<ul style="list-style-type: none"> - Introduction to Serverless Computing. - APIs Management and Design Patterns. - The Azure Platform Services. - The Oracle Cloud Platform Services. 	SAND: Towards High-Performance Serverless Computing	Assignment 1 Quiz 3
W5 JUNE 6	<ul style="list-style-type: none"> - Scaling Services and Kubernetes. - Cloud Computing Security Access Control Policies. 	Large-scale cluster management at Google with Borg	Quiz 4 Assignment 2
Test 1			
W6 JUNE 13	<ul style="list-style-type: none"> - High Performance Computing Technologies. - Visualization Tools. - Accelerators (GPUs, NPUs, and TPUs). 	The Google File System	Quiz 5
W7 JUNE 20	Clustering, and Data warehouses. Batch Big Data Processing.	The Chubby Lock Service for Loosely-Coupled Distributed Systems MapReduce: Simplified Data Processing on Large Clusters	Quiz 6
W8 JUNE 27	Realtime Big Data Processing and Analysis. Big Data Storage Technologies.	Scuba: Diving into Data at Facebook A survey on NoSQL stores Big Data Architecture for Large Organizations	Quiz 7 Assignment 3
W9 JULY 4	Generative AI, NLP, and LLMs Cloud Solutions.	A Comprehensive Overview of Large Language Models Cost-Efficient LLM Serving in the Cloud: VM	Quiz 8



		Selection with KV Cache Offloading	
W10 July 11	<ul style="list-style-type: none"> - Metrics and Tools for Service Monitoring. - Augmented Reality in Cloud Computing. 	Look-Ahead Task Offloading for Multi-User Mobile Augmented Reality in Edge-Cloud Computing Building Scalable AI-Powered Applications with Cloud Databases: Architectures, Best Practices and Performance Considerations A Cloud-Edge Continuum Experimental Methodology applied to a 5G Core Study	Quiz 9
Test 2: Scaling Services, Big Data Processing, and Data Warehousing			
W11 July 18	Cloud Data Analysis Tools. Graph Analytics	Graph Databases Comparison: AllegroGraph, ArangoDB, InfiniteGraph, Neo4J, and OrientDB	Assignment 4 Quiz 10
W12 July 25	Project Presentations		

Integrated Learning Opportunities:	<ul style="list-style-type: none"> - Online Demonstrations. - Research Production Opportunities. - Problem Solving Approaches.
Library:	Librarians at Laurentian University offer workshops that help students to develop the ability to find, evaluate, create use and present information. Information literacy is a degree level expectation for all our students. For more information visit the Library website at https://laurentian.ca/library
Important Dates at Laurentian University:	Please check important dates at: https://laurentian.ca/important-dates
Accessibility and Accommodation:	Students who require accommodation are encouraged to register with the Accessibility Services Office as soon as they begin their program. Laurentian University encourages students to access all resources available through the Office for consistent support and access to their programs. More information can be found online at https://laurentian.ca/accessibility-services



Grading:	For information on Laurentian University's official grading scheme please see: https://laurentian.ca/transcripts																																																							
Laurentian University Grading Scheme: (for courses completed after August 2014)	<table><tr><td>90% - 100%</td><td>A+</td><td>=</td><td>10</td><td>Exceptional</td></tr><tr><td>85% - 89%</td><td>A</td><td>=</td><td>9</td><td>Outstanding</td></tr><tr><td>80% - 84%</td><td>A -</td><td>=</td><td>8</td><td>Excellent</td></tr><tr><td>75% - 79%</td><td>B+</td><td>=</td><td>7</td><td>Very Good</td></tr><tr><td>70% - 74%</td><td>B</td><td>=</td><td>6</td><td>Good</td></tr><tr><td>65% - 69%</td><td>C+</td><td>=</td><td>5</td><td>Satisfactory</td></tr><tr><td>60% - 64%</td><td>C</td><td>=</td><td>4</td><td>Adequate</td></tr><tr><td>55% - 59%</td><td>D+</td><td>=</td><td>3</td><td>Passable</td></tr><tr><td>50% - 54%</td><td>D</td><td>=</td><td>2</td><td>Marginal</td></tr><tr><td>40% - 49%</td><td>E</td><td>=</td><td>1</td><td>Failure</td></tr><tr><td>0% - 39%</td><td>F</td><td>=</td><td>0</td><td>Failure</td></tr></table>	90% - 100%	A+	=	10	Exceptional	85% - 89%	A	=	9	Outstanding	80% - 84%	A -	=	8	Excellent	75% - 79%	B+	=	7	Very Good	70% - 74%	B	=	6	Good	65% - 69%	C+	=	5	Satisfactory	60% - 64%	C	=	4	Adequate	55% - 59%	D+	=	3	Passable	50% - 54%	D	=	2	Marginal	40% - 49%	E	=	1	Failure	0% - 39%	F	=	0	Failure
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Course Copyright:	The student must obtain the instructor's written permission if the student wishes to: tape-record the sessions, take photographs, video-record, or reproduce any materials provided by the instructor. All such reproductions are infringement of copyright and therefore prohibited., Please refer to the Laurentian University website for information on copyright: https://laurentian.ca/copyright																																																							
University Policy on Academic Integrity:	Please see Academic Integrity for Students at Laurentian University: https://intranet.laurentian.ca/policies/2017.09.19%20-%20Policy%20and%20Procedures%20on%20Academic%20Integrity%20-%20EN.pdf																																																							
Academic Support:	Academic Support: Academic Support: The Centre for Academic Excellence, located on the second floor of the J.N. Desmarais Library Building offers academic support to help you reach your fullest potential. Academic advising, writing assistance, learning skills workshops are a few of the services offered. Contact them via email: academicadvising@laurentian.ca ; by telephone: (705)-675-1151 ext 3300																																																							
Late Assignments:	It is expected that assignments are submitted by the due date through the dropboxes of the D2L. Unless extensions are granted, there deductions of 2% per day applied to late assignments.																																																							
Attendance:	Attendance is required.																																																							

