

# (2022-2nd)Course Syllabus

Course Title	Cloud Computing	CRN (Course Reference Number)	EE7101
Subtitle	-	Credit hour (Lecture hours - Lab hours - Credit hours)	3-0-3
Course Format	Lecture <input checked="" type="checkbox"/> Discussion <input type="checkbox"/> Labotory <input type="checkbox"/> Practicum <input type="checkbox"/> Blended <input type="checkbox"/> Online <input type="checkbox"/> (Add)		
Course Description	This course is an advanced graduate course in cloud computing. It is both a paper-based, and discussion-oriented course. It takes a vertically oriented view of cloud computing, covering the full stack from data center architecture through application frameworks. The course highlights the key challenges and approaches at each level of designing and building a cloud computing infrastructure.		

## P1. Course Information

Instructor	Youngtae Noh	Office	
Office Hours	TBD	Office Telephone	
		E-mail	ytnoh@kentech.ac.kr
Discipline	Energy AI	Prerequisite	NONE
Target Audience	Graduate Students		
Course Reading & Resources			
Required Materials	Readings will be drawn from the top tier research papers and technical white papers.		
Other Recommended Materials (optional)	- Cloud Computing: Concepts, Technology & Architecture. (Thomas Erl Ricardo Puttini Zaigham Mahmood) - Cloud Computing Bible (Barrie Sosinsky)		
Course Access	This is an offline course. However, it may be changed to an on-line course if the situation due to COVID-19 does not allow off-line meeting.		
Technical & Academic Support	If you need any technical/academic assistance at any time during the course, please contact your instructor and/or course TA - Instructor: Prof. Youngtae Noh - Course Teaching Assistant: TBD		



## P2. Course Objectives

<b>Course Learning Objectives</b>	Through this course you will: - Understand the cloud computing and grasp large-scale system build-up. - Understand the cloud service models, cloud deployment models, and cloud infrastructure. - Understand the data center architecture, file storage, data base, virtualization, scheduling and elasticity.
<b>Course Learning Activities</b>	To meet the objectives, you will: - Read required reading materials (from recommended research papers or textbook) every week - Every student must present a research artical related to cloud computing. Other student (the audience) can earn bonus points on contributing to the in-class discussions on the presentation.

## P3. Topic Outline / Schedule

**Important note :**Refer to the course calendar for specific dates and times. Activity and assignment details will be explained in detail within each week's corresponding learning module. If you have any questions, please contact your instructor.

MODULE01 Week (01~03)	Cloud Computing Basics		
	Week01	Overview & kick-off	Introduction to Cloud Computing
			1. READ: Armbrust, et al, "A view of cloud computing", CACM, April 2010, pgs 50-58. 2. POST: Lecture Note 01 ~ 02
	Week02	Overview & kick-off	Understanding the cloud computing stacks. (Saas, Paas, laas)
			1. READ: Li, et al, "CloudCmp: Comparing Public Cloud Providers", Internet Measurement Conf., November 2010. 2. POST: Lecture Note 03  1. READ: Nurmi, et al, "The Eucalyptus Open-source Cloud-computing System", IEEE International Symposium on Cluster Computing and the Grid, May 2009. 2. POST: Lecture Note 04
	Week03	Overview & kick-off	Understanding the cloud computing stacks. (Saas, Paas, laas)
1. READ: Kepes, Ben, "Understanding the cloud computing stack: Saas, Paas, laas", RackSpace. 2. POST: Lecture Note 05 ~ 06			
MODULE02 Week (04~05)	Data Center Architecture		
	Week04	Data Centers	- Characterization of network traffic in data centers. - Fault tolerant data center.
			1. READ: Benson, et al, "Network traffic characterizations of data centers in the wild", SIGCOMM, 2010, Pages 267-280. 2. POST: Lecture Note 06  1. READ: Mysore, et al, "PortLand: a scalable fault-tolerant layer 2 data center network fabric", SIGCOM, October 2009, Pages 39-50. 2. POST: Lecture Note 07
MODULE02	Week05	Data Centers	Data center fabric
			1. READ: Andreyev, Alexey, "Introducing data center fabric, the



Week (04~05)			next-generation Facebook data center network", code.facebook.com, 11/14/2014. 2. POST: Lecture Note 08
MODULE03 Week (06~07)	Layer 2 Concerns and SDNs		
	Week06	Multipath TCP and DCTCP	- Improving datacente's performance with multipath TCP. - Improving datacente's performance with DCTCP.
			1. READ: Raiciu, et al, "Improving datacenter performance and robustness with multipath TCP", SICOMM, August 2011, Pages 266-277. 2. POST: Lecture Note 12  1. READ: Alizadeh, et al, "Data Center TCP (DCTCP)", SIGCOM, October 2010, Pages 63-74. 2. POST: Lecture Note 13
	Week07	Software Defined Networks (SDN)	- Introduction to SDN. - Enterprise aspects of the SDN.
1. READ: Feamster, et al, "The road to SDN", ACMQueue, December 2013. 2. POST: Lecture Note 14  1. READ: Casado, et al, "Ethane: taking control of the enterprise", SIGCOMM, October 2007, Pages 1-12. 2. POST: Lecture Note 15			
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	Week08	Midterm Exam	
MODULE04 Week (09~10)	File Storage		
	Week09	Haystack and GPFS	- Storage system optimized for Facebook’s Photos application - Shared data disk file system
			1. READ: Beaver, et al, "Finding a needle in the Haystack: Facebook's photo storage", OSDI, 2010. 2. POST: Lecture Note 14  1. READ: Schmuck and Haskin, "GPFS: A Shared-Disk File System for Large Computing Clusters", FAST, 2002, Pages 231-244. 2. POST: Lecture Note 15
	Week10	The Google and Hadoop File System	- The Google File System. - The Hadoop File System
1. READ: Ghemawat, et al, "The Google File System", SOSP, 2003. 2. POST: Lecture Note 16  1. READ: Shvachko, et al, "The Hadoop File System", MSST, 2010, Pages 1-10. 2. POST: Lecture Note 17			
MODULE05	Programming Frameworks		
		MapReduce, Dryad, and	- MapReduce - Dryad - Resilient Distributed Datasets
	1. READ: Dean, et al, “MapReduce: Simplified Data Processing on Large Clusters”, 2004. 2. POST: Lecture Note 18		



Week (11)	Week11	Resilient Distributed Datasets.	1. READ: Irsard, et al, "Dryad: distributed data-parallel programs from sequential building blocks", ACM SIGOPS. 2. POST: Lecture Note 19  1. READ: Zaharia, et al, "Resilient Distributed Datasets: A Fault-Tolerant Abstraction for In-Memory Cluster Computing", USENIX 2012. 2. POST: Lecture Note 20
MODULE06 Week (12)	NoSQL		
	Week12	Data center database	- An overview of database architecture - Big Table  1. READ: Mongo DB Architecture Guide. 2. POST: Lecture Note 21  1. READ: Chang, et al, "Bigtable: A Distributed Storage System for Structured Data", OSDI, 2006. 2. POST: Lecture Note 22
MODULE07 Week (13)	Virtualization		
	Week13	Virtualization Basics	- Introduction to virtualization - Virtual machines and Linus container  1. READ: Barham, et al, "Xen and the art of virtualization", SOSP, 2003, Pages 164-177. 2. POST: Lecture Note 23  1. READ: Felter, et al, "An Updated Performance Comparison of Virtual Machines and Linux Containers", IBM, RC25482, 2014. 2. POST: Lecture Note 24
MODULE08 Week (14)	Scheduling and Elasticity		
	Week14	Important topics on scheduling and elasticity.	- Apache Hadoop - Long tail avoidance - Dynamic scaling  1. READ: Vavilapalli, et al, "Apache Hadoop:yet another resource negotiator", SOCC, 2013. 2. POST: Lecture Note 25  1. READ: Xu, et al, "Bobtail: Avoiding Long Tails In The Cloud", NSDI, 2013. 2. POST: Lecture Note 26  1. READ: Vaquero, et al, "Dynamically scaling applications in the cloud:", SIGCOMM, January 2011, Pages 45-52. 2. POST: Lecture Note 27
MODULE09 Week (15)	Cloud Stacks and Frameworks		
	Week15	Important cloud frameworks	- Open-Source Cloud-computing System - Machine learning and data mining in the cloud  1. READ: Nurmi, et al, "The Eucalyptus Open-Source Cloud-computing System", CCGRID, 2009. 2. POST: Lecture Note 28  1. READ: Low, et al, "Distributed GraphLab: a framework for machine learning and data mining in the cloud", VLDB, 2012, Pages 716-727 2. POST: Lecture Note 28



-	Week16	Final Exam	- Final Exam
			Final Report submission.

### P4. Grading Policy

Graded Course Activities

Activity	Percentage
Participation	10
Presentation	30
Mid-term Exam	30
Final Exam	30
Total	100%

