CS 598: Cloud Computing Capstone

Course Description

This course will allow you to apply the algorithms and techniques for cloud computing that you learned in Cloud Computing Concepts and Cloud Computing Applications to solve novel and challenging cloud computing research problems.

Note: You should complete Cloud Computing Applications **AND** one of the following courses before beginning this course:

- Cloud Computing Concepts
- Cloud Networking
- IoT

This course can be quite challenging. We assume you have taken the required classes above and are familiar with the current state of the art. You enter this course with mastery of all those topics, ready to push the boundaries of technology and science (aka, research)**.** If any of these conditions are not valid for you, this capstone may not be for you (and you will likely struggle).

This course is composed of two (2) graded components:

- The course's first component is reading four (4) conference papers and presenting them to your classmates. For each paper, you choose a recent conference paper from a selection of top-ranking computer systems conferences, read it carefully, understand it, and then prepare a video presentation. This component is peer-reviewed and worth 40% of the course grade.

    a. You are expected to peer review at least three (3) other paper presentations. Reviewing more papers is recommended (we recommend 6). As this course is about research, the more you read about recent papers, the more you will understand and internalize how a research paper is written.

- The second component of the course involves performing a group-based research project. Here, you propose a novel and impactful research idea, conduct a literature survey, form a hypothesis, design a system, implement your proposed system, run experiments to prove (or disprove) your hypothesis on your system to validate it, measure your system's performance, and finally write a paper presenting all the above. The goal is to develop a paper of such high quality that it can be submitted to a conference or workshop and accepted for publication.
    - The research project will be **staff-graded** and require **five (5)** written milestones and a virtual symposium **presentation**. The goal is to culminate your work in a publishable paper and hopefully submit it to a conference or workshop for peer review and publication.
        - The research project will be performed as a team. **Each team should include four (4) students.**
        - To ensure the whole team pulls their fair share, 20% of the grade for each milestone comes from your teammates' review.
    - The course staff will oversee and guide you through this journey with direct feedback and suggestions.
        - On the first week, office hours are open to all students from 6:30 to 7:30 PM CST, and we strongly suggest you attend and discuss your ideas.
        - Once teams are formed (week 2), teams will pick a bi-weekly online meeting slot to discuss their ideas and project progress with the instructors. The time slots are 30 minutes each, from 6:30 to 7:30 PM CST, Mondays through Thursdays. At least some team members are expected to attend the bi-weekly meetings, and regular attendance will be considered in the milestone grading. The constant engagement and progress typically improve the quality of your research project.
        - The course staff will grade each milestone. This grade accounts for 80% of the grade for each particular milestone, with the other 20% coming from teammate review. The course staff use these milestones to offer feedback and guidance.
        - The course staff will review and provide feedback and grades for each milestone within 1~2 weeks.
    - The publication of your paper at a conference is outside the scope of this course; however, we hope that by the end of the semester, you will have a potentially publishable paper that you can submit to conferences.
        - The **CCGRID**, Middleware, and OSDI/USENIX conference timelines typically match our schedule, with a submission deadline in the final two

weeks of the semester. Therefore, it is a good idea to focus on their themes and styles from the beginning of the semester to have a clear target.

- Other good conferences to target include ACM SoCC, IEEE Cloud, IEEE ICWS, and IEEE IC2E, as well as systems conferences such as ASPLOS, DSN, and ISSRE.

Ethics and Intellectual Property:

- We conduct research according to the ethics of research and publication (reference 1, reference 2)
- Your work needs to be original. We have a strict policy regarding originality and take plagiarism ***VERY*** seriously. The campus regulations on academic integrity found in the Student Code of Conduct are also quite explicit about this issue.
- The code of ethics above requires that the author list include anyone who has contributed substantially to the research, including drafting or revising the article and approving the final version. The course staff helping and guiding your research fits this description. Therefore, any final published paper in a conference or workshop should include them as co-authors (typically as the last one or two authors).
- The intellectual property of any ideas and systems generated during the semester belongs to the University of Illinois.

Course Expectation

This course is designed to be studied independently, with frequent milestone checks with the course instructors. There will be bi-weekly office hour check-ins for each team, and we strongly suggest the students use the opportunity to get frequent feedback on their research projects.

Textbook

This course does not require textbooks. It is completely based on research papers from recent top-notch conferences.

Course Schedule

Week	**Paper Presentation** Presentations due on Sunday night, **peer reviews due 3**	**Capstone Research Project** All the due dates are at the end of the week (usually Sunday night), except the **final paper** (which is on the last day of instruction, according to the academic calendar)

	days after (Wednesday night)	
0 Course soft Launch		• Course soft launch (the week before the official first day of instruction) • Start looking for teammates on Campuswire and form teams

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Official start of semester
	Choose paper 1	• Start or continue looking for teammates on Campuswire ASAP and form teams
		• Brainstorm on the project among teammates
		• There will be office hours open to all students Monday to Thursday, 6:30-7:30 PM CST
		  ○ Consult with course staff on project ideas during these office hours
		• If you have formed a team, submit team information to the TA and pick a biweekly instructor check-in timeslot
		  a. One submission per team is enough

2		Biweekly check-ins start this week. • Brainstorm on the project among teammates • Start a draft document • Consult with course staff on project ideas during your check-ins

3	Present paper 1	• 10th day add/drop deadline is typically towards the end of week 2 or early in week 3, so some team compositions may change and finalize this week.
		  ○ Use Campuswire and reach out to the TA if you need help with changing teams or finding a team.
		  ○ **Deadline to submit team information to the TA** is two days after the 10th day add/drop deadline
		  ▪ Students without teams will be randomly assigned by the TA after this deadline.
		  ○ *The course staff reserves the right to adjust some team compositions as needed*
		• Consult with course staff on project ideas
		• Finalize your work on milestone 1
		• **Milestone 1: Team Project Proposal [10% of the research project grade]**
		• Should include:
		  ○ Project Idea
		  ○ Justification
		  ▪ Intellectual Merit, Novelty, and impact
		  ○ Your preliminary plan
		  ▪ What system do you want to implement?
		  ▪ What experiments do you think you'd need
		  ○ Preliminary literature survey (minimum of 7 references)
		• 2-3 pages

4	Peer review of paper 1 presentation Choose paper 2	Work on milestone 2
5	Present paper 2	Continue working on milestone 2
6	Peer review of paper 2 presentation Choose paper 3	• Continue and finalize your work on milestone 2 • **Milestone 2: Expanded Literature Survey [20% of the research project grade]** • Should include: a. Project idea (you can pivot from milestone 1 if needed) b. Expanded literature survey (minimum of 15 references) c. Experiment setup description i. What system do you intend to build? ii. What hypothesis do you want to test? iii. What measurements do you intend to collect? Why & What for? iv. What will a successful outcome look like? d. Any preliminary experimental results or proof of concept at this stage is a plus but not required. • 5 pages
7		Work on Milestone 3
8	Present paper 3	Continue working on milestone 3
9	Peer review of paper 3 presentation Choose paper 4	• Continue and finalize your work on milestone 3 • **Milestone 3: First set of experimental results completed [20% of the research project grade]** • Should include: a. Everything in the previous paper, plus b. Even more expansion of the literature survey (minimum of 20 references) c. Report on the systems that you have built, experiments that you have run, and metrics you have collected d. Explain if your results are positive or negative e. Where to go from here? i. Do you intend to pivot? With everything you have learned, do you want to change anything? If so, how? (include answers to the same set of experiment setup in milestone 2) ii. If you are successful so far, how do you intend to expand your system or the experiments validating your system or hypothesis? • 7 pages
10		work on milestone 4

11	Present paper 4	Continue working on milestone 4 Start working on your virtual symposium presentation

12	Peer review of paper 4 presentation	• Continue and finalize your work on milestone 4
		• **Milestone 4: Final Experimental Data [20% of research project grade]**
		• Hopefully, by now your results have been successful, and you can report an extended set of experimental results for a sizable implementation in this milestone
		• Last chance to identify any pivots in your research
		  a. Like the previous milestone, if you intend to do any last-minute pivot, you should explain and justify it, and explain what the successful outcome will look like
		  b. Sometimes pivots happen because you have found new relevant papers that you had missed before. If so, you should work out a new literature survey / related works section.
		• 8-9 pages
		
		While you continue your research work, start a presentation draft for next week

13		Continue your research work • If you had previously identified a need for another pivot in milestone 4, or now from the symposium peer feedback, now is the time to act. • Continue working on your implementation, experiments, and data collection. • See if you can come up with some theoretical modeling or simulation backing / validating your experimental results. Having such a section can greatly help your paper get accepted into a conference. This should be about half a page to at most a page. a. But theoretical modeling can only help you so much, the main factor in getting your paper published is the quality of your system implementation, the experiments, and their results. Virtual Symposium: • Prepare a presentation of your research project **[15% of research project grade]** • Peer review each other's research 3~6 peer reviews, due 3 days after the presentation submission
14	*FALL BREAK*	*FALL BREAK*
15		Work on Milestone 5, the final paper • Incorporate feedback from virtual symposium if you find them useful. a. Hopefully the peer review feedback may identify any shortcomings or open areas to expand your research.

		• Continue expanding experiments • Spend quality time on the charts and graphs showing the results in your final paper.
16		• Finalize your work on milestone 5 • **Final paper [15% of research project grade]** a. Assuming your experiments were successful in milestone 4, you should finalize your paper by adding an analysis of the results section. b. If you had identified a need for another pivot in milestone 4 or after the virtual symposium, any new pivot experimental results or expanded experiments should be here, plus analysis c. Go back and really polish the abstract, introduction, and conclusions sections. These sections are absolutely necessary for a successful conference submission d. A good future works section is a must have at this point. • Make sure your paper is in IEEE transactions format • 10 pages a. The final page count depends on which conference you are targeting. Most ask for 10 pages, but some are 8 (or 12). b. A good set of goals to aim for is 3-4 pages to describe your novel system and another 3-4 pages for experimental results. Abstract and Introduction should be less than a page to about a page. The related works can be 1-2 pages. The analysis/modeling, future works, and conclusions together should be about one page.

Assignment Deadlines

The deadlines are typically on Sunday nights, but a few are different. You can check the deadlines on Coursera.

Peer review feedback is due 3 days after the submission deadline, which is typically on Wednesday nights.

Grading Distribution and Scale

Your final grade will be calculated based on the activities in the table below. Your official final course grade will be listed in Enterprise. The course grade displayed in Coursera may not match your official final course grade.

Assignment	Percentage
Research Project	60%

Paper review and presentation	40% (5% for each paper presentation and 5% for peer reviews, 1 point for each)
Total	100%

Letter grades are calculated based on the table below (obtained from here):

NUMERICAL GRADE		LETTER GRADE
98.00 – 100.00	→	A+
92.00 – 97.99	→	A
90.00 – 91.99	→	A-
88.00 – 89.99	→	B+
82.00 – 87.99	→	B
80.00 – 81.99	→	B-
78.00 – 79.99	→	C+
72.00 – 77.99	→	C
70.00 - 71.99	→	C-
68.00 – 69.99	→	D+
62.00 – 67.99	→	D
60.00 - 61.99	→	D-
below 60	→	F

Student Code and Policies

A student at the University of Illinois at the Urbana-Champaign campus is a member of a University community of which all members have at least the rights and responsibilities common to all citizens, free from institutional censorship; affiliation with the University as a student does not diminish the rights or responsibilities held by a student or any other community member as a citizen of larger communities of the state, the nation, and the world. See the University of Illinois Student Code for more information.

Academic Integrity

All students are expected to abide by the campus regulations on academic integrity found in the Student Code of Conduct. These standards will be enforced and infractions of these rules will not be tolerated in this course. Sharing, copying, or providing any part of a homework solution or code is an infraction of the University's rules on academic integrity. We will actively look for violations of this policy in homework and project submissions. Any violation will be punished as severely as possible with sanctions and penalties typically ranging from a failing grade on this assignment to a failing grade in the course, including a letter of the offending infraction kept in the student's permanent university record.

Again, a good rule of thumb is to k*eep every typed word and piece of code your own*. If you think you are operating in a gray area, you probably are. If you would like clarification on specifics, please get in touch with the course staff.

Disability Accommodations

Students with learning, physical, or other disabilities requiring assistance should contact the instructor as soon as possible. If you're unsure if this applies to you or think it may, please contact the instructor and Disability Resources and Educational Services (DRES) as soon as possible. You can contact DRES at 1207 S. Oak Street, Champaign, via phone at (217) 333-1970, or via email at disability@illinois.edu.