

ECE 69500: Datacenter and Cloud Networks

Spring 2022

1 Course Information

Course Number and Title: ECE 69500, Datacenter and Cloud Networks.

CRN: 28957

Section: 037

Campus: West Lafayette

Instructional Modality: Face-to-Face

Lecture Time: Tue, Thu, 3:00–4:15pm in EE 236.

Course Credit Hours: 3

Prerequisites: ECE 46300 (Introduction to Computer Communication Networks) or ECE 50863 (Computer Network Systems) or Permission of the instructor

Course Web Page: <https://web.ics.purdue.edu/~vshriva/courses/ece69500sp22/index.html>

Course Brightspace Page: <https://purdue.brightspace.com/d2l/home/460765>

Course Piazza Page: <https://piazza.com/purdue/spring2022/ece69500dcn/home>

2 Instructor(s) Contact Information

Instructor

[Vishal Shrivastav](#)

Assistant Professor of Electrical and Computer Engineering at Purdue University

Office: EE 334B, 465 Northwestern Ave., West Lafayette, Indiana 47907–2035, USA

Email: vshriva@purdue.edu

Office Hours: Mon 3–4pm on Zoom

3 Course Description

The modern datacenter and the cloud has emerged as the dominant computing platform that powers most of world's consumer online services, financial, military, and scientific application domains. The goal of this course is to introduce students to the design, implementation, and management of modern datacenter and cloud networks, as well as provide them with a proper grounding for research in these areas. Each lecture will cover the presentation and discussion of one seminal paper from the field of datacenter and cloud networks. The course will also provide students with an experience in how to present a research paper, how to critically review a research paper, and how to work on a research project and write a research paper.

4 Prerequisites

ECE 46300 (Introduction to Computer Communication Networks) or ECE 50863 (Computer Network Systems) or Permission of the instructor.

5 Course Topics

1. Datacenter Architecture and Topology
2. Datacenter Routing and Load balancing
3. Datacenter Transport
4. Software-defined Networking
5. Programmable Data Plane
6. Multi-tenancy in the Cloud
7. RDMA inside Datacenter
8. Resource Disaggregation inside Datacenter
9. Optics inside Datacenter

6 Learning Resources, Technology, and Texts

Required Material: Research papers from the [syllabus](#).

Students will submit all assignments (paper reviews, project materials) on Brightspace. All grades will be posted on Brightspace. We will use Piazza as the discussion forum to post and discuss questions regarding the course.

7 Learning Outcomes

A student who successfully fulfills the course requirements will have demonstrated:

1. an understanding of the design, implementation, and management of datacenter and cloud networks and familiarity with the state-of-the-art technologies in these areas.
2. an ability to formulate and motivate research problems and ideas.
3. an ability to critique research papers, work on research projects, present research papers, and write a research paper.

8 Assignments and Exams

35% — Paper Reviews

Each student is expected to write a 2 to 3 page review of one paper from each of the 9 course topics from the syllabus, thus totaling 9 reviews. The first review will be worth 3% credit while the remaining 8 reviews will be worth 4% credit each. A paper review will typically include the paper summary, its strengths and weaknesses, and any suggestions for improvement. No collaboration is allowed for writing the paper reviews.

10% — Paper Presentations

Each student is expected to present one or more research papers from the syllabus to the class during the semester. For grading we will only consider the student's best presentation.

50% – Research Project

Each student will work on a semester-long research project in a group of at most 3 students. Students can either propose their own project or talk to the instructor for project ideas. Any research project with significant networking component will be acceptable. The final deliverables will include a 12-page paper and a 15-20 min presentation on the project. The overall grading will be broken into three milestones:

Milestone 1: Problem, Motivation, and Related Work [15%]

Milestone 2: Design and Evaluation Plan [15%]

Milestone 3: Final Paper and Presentation [20%]

5% – Attendance and Participation**9 Course Schedule**

Week	Dates	Topic
1	Jan 10 – Jan 14	Course Introduction Datacenter Architecture and Topology I
2	Jan 17 – Jan 21	Datacenter Architecture and Topology II Datacenter Architecture and Topology III
3	Jan 24 – Jan 28	Datacenter Routing and Load balancing I Datacenter Routing and Load balancing II
4	Jan 31 – Feb 4	Datacenter Routing and Load balancing III Datacenter Transport I
5	Feb 7 – Feb 11	Datacenter Transport II Datacenter Transport III
6	Feb 14 – Feb 18	Software-defined Networking I Software-defined Networking II
7	Feb 21 – Feb 25	Software-defined Networking III Programmable Data Plane I
8	Feb 28 – Mar 4	Programmable Data Plane II Programmable Data Plane III
9	Mar 7 – Mar 11	Multi-tenancy in the Cloud I Multi-tenancy in the Cloud II
10	Mar 14 – Mar 18	Spring Break
11	Mar 21 – Mar 25	Multi-tenancy in the Cloud III RDMA inside Datacenter I
12	Mar 28 – Apr 1	RDMA inside Datacenter II RDMA inside Datacenter III
13	Apr 4 – Apr 8	Resource Disaggregation I Resource Disaggregation II
14	Apr 11 – Apr 15	Resource Disaggregation III Optics inside Datacenter I
15	Apr 18 – Apr 22	Optics inside Datacenter II Optics inside Datacenter III
16	Apr 25 – Apr 29	Final Project Presentation

10 Grading Scale

The breakpoints for letter grades is shown below. Typically the final letter grade for a student will be based on their raw cumulative score at the end of the semester (normalized to 100 while accounting for the weight of each assignment and exam). However, the final raw score may be “curved up” to adjust for the difficulty level of assignments and exams, resulting in a potentially better final letter grade. For example, a raw score of 74 (B–) for a student may be curved up to 78 (B) to adjust for the difficulty level. The adjustment factor will be decided by the instructor at the end of the semester, and will be uniformly applied to each student’s final raw score. Raw scores will never be “curved down”.

Letter Grade	A+	A	A–	B+	B	B–	C+	C	C–	D+	D	D–	F
Score (out of 100)	95+	90+	85+	80+	75+	70+	65+	60+	55+	50+	45+	40+	≤40

11 Attendance Policy

This course follows Purdue’s academic regulations regarding attendance, which states that students are expected to be present for every meeting of the classes in which they are enrolled. Attendance may be taken at the beginning of a class and lateness may be noted. When conflicts or absences can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency absences when advance notification to the instructor is not possible, the student should contact the instructor as soon as possible by email. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor’s department because of circumstances beyond the student’s control, and in cases falling under excused absence regulations, the student or the student’s representative should contact or go to the [Office of the Dean of Students website](#) to complete appropriate forms for instructor notification. Under academic regulations, excused absences may be granted for cases of grief/bereavement, military service, jury duty, and parenting leave. For details, see the [Academic Regulations & Student Conduct section](#) of the University Catalog website. Guidance on class attendance related to COVID-19 are outlined in the [Protect Purdue Pledge for Fall 2021](#) on the [Protect Purdue website](#).

12 Academic Guidance in the Event a Student is Quarantined/Isolated

If a student must miss class at any point in time during the semester, they should reach out to the instructor via email so that they can communicate about how the student can maintain their academic progress. If the student finds themselves too sick to progress in the course, they should notify their advisor and instructor via email. They will make arrangements based on student’s particular situation. Note that, [Details for Students on Normal Operations for Fall 2021](#) announced on [Protect Purdue website](#) states, “individuals who test positive for COVID-19 are not guaranteed remote access to all course activities, materials, and assignments”.

13 Classroom Guidance Regarding Protect Purdue

Guidance on classroom protocols related to COVID-19 are outlined on the [Protect Purdue website](#). Any student who has substantial reason to believe that another person is threatening the safety of others by not complying with Protect Purdue protocols is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the [Office of the Student Rights and Responsibilities](#). See also [Purdue University Bill of Student Rights](#) and the Violent Behavior Policy under University Resources on Brightspace.

14 Academic Integrity

Students are free to collaborate with anyone or use any available material online for preparing their presentations and completing their research project. However, unless expressly allowed, students are expected to complete all paper reviews by themselves. A student is considered in violation of the academic honesty policy regardless of whether they are the one “copying” or the one “being copied from”. Punishments for academic dishonesty are severe, including receiving a failing grade in the course or being expelled from the university. By departmental rules, all instances of cheating will be reported to the Dean of Students. On the first instance of cheating, students involved will receive a 0 on the assignment; the second instance of cheating will result in a failing grade in the course.

Use of Copyrighted Materials: All course materials are subject to Purdue’s copyright policies. Students must not share, distribute, or post any material on an online website without checking with the instructor.

15 Nondiscrimination Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. More details are available on the course Brightspace table of contents, under “University Policies”.

16 Accessibility

Purdue University strives to make learning experiences as accessible as possible. If a student anticipates or experiences physical or academic barriers based on disability, they are welcome to let the instructor know so that they can discuss options. Students are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

17 Mental Health/Wellness Statement

If a student finds themselves beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, they should try [WellTrack](#). Students can sign in and find information and tools at their fingertips, available to them at any time.

If a student needs support and information about options and resources, they should contact or see the [Office of the Dean of Students](#). Call 765-494-1747. Hours of operation are Mon–Fri, 8am–5pm.

If a student finds themselves struggling to find a healthy balance between academics, social life, stress, etc., they should sign up for free one-on-one virtual or in-person sessions with a [Purdue Wellness Coach at RecWell](#). Student coaches can help students navigate through barriers and challenges toward their goals throughout the semester. Sign up is free and can be done on BoilerConnect.

If a student is struggling and needs mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If a student or someone they know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact [Counseling and Psychological Services \(CAPS\)](#) at 765-494-6995

during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

CAPS also offers resources specific to COVID-19 on its [website](#). Topics range from “Adjusting to the New Normal” to “How to Talk with Professors about Personal Matters.”

18 TaskHuman Service

TaskHuman offers private, real-time, on-demand, 1-on-1 video calls with wellness coaches covering over 800+ topics such as anxiety, mindfulness, reducing stress, clean eating, time management, in-home workouts, relationship tensions, financial issues, spiritual guidance and many more. Students can access these wellness coaches from around the world 24/7. The College of Engineering has an exclusive agreement with TaskHuman which gives students FREE and UNLIMITED access to these resources. Learn more at: <https://engineering.purdue.edu/ECE/TaskHuman>.

Download TaskHuman



Scan the QR Code to download the TaskHuman App or download the TaskHuman App directly from the App Store or Google Play Store. Create an account – Go to Setting and tap on “Check for Discounts”, Insert the code: **purdue63**. Don’t see a topic you want or have other questions? Contact Brooke Parks, Senior Lecturer in ECE, at brookeparks@purdue.edu

19 Basic Needs Security

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students Mon–Fri, 8am–5pm. Considering the significant disruptions caused by the current global crisis as it related to COVID-19, students may submit requests for emergency assistance from the [Critical Needs Fund](#).

20 Emergency Preparedness

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor’s control. In such an event, information will be provided through course web page, Piazza, and/or email. Students are expected to check the course web page and Piazza, and read their @purdue.edu email on a frequent basis.

Updates and emergency information will be posted on Purdue’s home page. Students are urged to sign up for emergency text alerts. Text message sign up procedures can be found at: <http://www.purdue.edu/securepurdue/>.

For additional information, go to: https://www.purdue.edu/ehps/emergency_preparedness/.