ECE 46300: Introduction to Computer Communication Networks
Fall 2023

1 Course Information

Course Number and Title: ECE 46300, Introduction to Computer Communication Networks.

CRN: 57741

Section: 001

Campus: West Lafayette

Instructional Modality: Face-to-Face

Lecture Time: Mon, Wed, Fri, 2:30–3:20pm in BHEE 170.

Course Credit Hours: 3

Honors Contract: Yes

Prerequisites: ECE 36800 (Data Structures) and proficiency in C programming language.

Course Web Page: https://engineering.purdue.edu/~vshriva/courses/ece46300fa23/index.html

Course Brightspace Page: https://purdue.brightspace.com/d2l/home/832653

Course Piazza Page: https://piazza.com/purdue/fall2023/ece46300/home

2 Instructor(s) Contact Information

Instructor

Vishal Shrivastav
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Teaching Assistants (TAs)

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3 Course Description

The goal of this course is to provide students with a proper grounding in the fundamentals of computer networking. The course will cover classic concepts such as packet vs. circuit switching, Internet architecture principles, naming and addressing, routing, forwarding, reliability, flow control, and congestion control. The later part of the course will introduce students to more advanced topics such as router architecture, software-defined network, and datacenter network. The course will also provide students a hands-on experience of writing network applications through socket programming.

4 Course Topics

1. Packet vs. Circuit Switching
2. Network Performance Metrics
3. Internet Architecture Principles
4. Socket Programming
5. Data Link Layer – MAC Addressing, ARP, CSMA/CD, Switched Ethernet, MAC Learning, STP
6. Network Layer – IP Addressing, NAT, IP Forwarding, Distance Vector, Link State, BGP, DNS
7. Transport Layer – UDP, TCP Reliability, TCP Flow Control, TCP Congestion Control
8. Application Layer – Web, HTTP, TLS, HTTPS, HTTP/2, QUIC
9. Router Architecture
10. Datacenter and Software-defined Network

5 Prerequisites

Proficiency in C programming language and knowledge of data structures (ECE 36800).

6 Learning Resources, Technology, and Texts

1. **Required Material:** Lecture slides and practice problem sets on Brightspace.
2. **Additional Reading:** Computer Networks: A Systems Approach (5th edition), by Peterson and Davie, Morgan Kaufmann, 2011, Hardcover ISBN: 9780123850591, eBook ISBN: 9780123850607.

7 Learning Outcomes

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

1. an understanding of the architectural principles underlying the Internet design.
2. an understanding of the design of various layers in the network stack, including data link layer, network layer, transport layer, and application layer.
3. a familiarity with router architecture, software-defined network, and datacenter network.
4. an ability to implement network applications using socket interface.

A student who also successfully fulfills the Honors contract will have additionally demonstrated:

1. an ability to implement distributed routing, forwarding, and reliability protocols.

8 Honors Contract

This course offers an Honors contract to aid students to go beyond the material of the regular course and to produce work that engages deeper learning. Students who sign up for the Honors contract will be required to complete **two** extra programming labs in addition to the regular programming labs for this course. The labs under Honors contract will account for 10% of the total grade and may be done in groups of at most two students. Any student is eligible to contract a course for Honors credit so long as his/her cumulative GPA is 3.00 or above. The student does not need to be in the Honors College. Once an Honors contract is successfully completed in a "regular" course, the word "Honors" is added to the name of the course, and this is the version that goes on the transcript. To opt for Honors contract, students must request a Grade Mode Change via myPurdue before the end of the 2nd week of classes in the semester (Sep 1, 2023).

9 Assessments

25% grade — Programming Labs

Lab Description	Regular	Honors
Lab 1: HTTP Web Client	10%	6%
Lab 2: HTTP Web Server	15%	9%
Lab H1: Distributed Routing	–	5%
Lab H2: Reliable Transport	–	5%

75% grade — Exams

All labs will be in C (except for Lab H1 which will be in Python). Each regular lab (Lab 1 and Lab 2) must be done individually. However, labs under Honors contract (Lab H1 and Lab H2) may be done in groups of at most two students. There will be three exams (2 midterms and 1 final) each carrying 25% credit. All three exams will be closed-book with no collaboration allowed. The syllabus for the exams will be non-cumulative, i.e., the syllabus for the next exam will not include topics covered in previous exams. Barring extraordinary circumstances (serious medical situations or family emergencies, accompanied by verification and a prior notification to the instructor), no extensions or make-ups will be granted for labs and exams. Students who are most active and helpful in answering questions on Piazza may receive bonus points.

Policy for Late Submissions

If a lab is submitted within 24 hours (1 day) after the deadline — 30% grade penalty.
No submissions will be accepted beyond 24 hours (1 day) after the deadline.

Policy for Re-grade Requests

Students may submit re-grade requests for programming labs within 48 hours (2 days) after the grades are released. All re-grade requests must be submitted on Piazza as a private post with the title "Re-grade request for Lab [X]" followed by a justification for the re-grade request (without a justification, the request will be ignored). Any emails sent to the TAs or the instructor about the re-grade requests will also be ignored.

10 Course Schedule

Week	Dates	Topic	Lab
1	Aug 21 – Aug 25	Course Introduction Packet vs. Circuit Switching Network Performance Metrics	
2	Aug 28 – Sep 1	Internet Architecture Principles I Internet Architecture Principles II Socket Programming I	
3	Sep 4 – Sep 8	**Labor Day Holiday** Socket Programming II Data Link Layer I	
4	Sep 11 – Sep 15	Data Link Layer II	Lab 1 release
5	Sep 18 – Sep 22	Data Link Layer III Data Link Layer IV Data Link Layer V	
6	Sep 25 – Sep 29	Midterm Exam 1 Revision **Midterm Exam 1** Network Layer I Network Layer II	Lab H1 release
7	Oct 2 – Oct 6	Midterm Exam 1 Recap Network Layer III Network Layer IV	
8	Oct 9 – Oct 13	**Fall Break** Network Layer V Network Layer VI	 **Lab 1 due**
9	Oct 16 – Oct 20	Network Layer VII Network Layer VIII Network Layer IX	Lab 2 release
10	Oct 23 – Oct 27	Transport Layer I Transport Layer II Transport Layer III	
11	Oct 30 – Nov 3	Transport Layer IV Midterm Exam 2 Revision **Midterm Exam 2** Transport Layer V	 **Lab H1 due**
12	Nov 6 – Nov 10	Midterm Exam 2 Recap Transport Layer VI Transport Layer VII	Lab H2 release
13	Nov 13 – Nov 17	Application Layer I Application Layer II	
14	Nov 20 – Nov 24	**Thanksgiving Break**	
15	Nov 27 – Dec 1	Router Architecture I Router Architecture II	 **Lab 2 due**
16	Dec 4 – Dec 8	Router Architecture III SDN and Datacenter Network Final Exam Revision	 **Lab H2 due**
17	Dec 11 – Dec 16	**Final Exams Week**	

11 Grading Scale

The breakpoints for letter grades are shown below. The final letter grade will be based on each student's raw cumulative score at the end of the semester (normalized to 100 while accounting for the weight of each assessment). It may be possible that the raw cumulative score is "curved up" to adjust for the difficulty level of assessments, potentially resulting in a better final letter grade. For example, a student's raw cumulative score of 74 (B–) 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 applied uniformly to every student's raw cumulative 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+	$\leq$40

12 Attendance Policy

This course follows the University Academic Regulations regarding class attendance, which state 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 is not possible, the student should contact the instructor as soon as possible by email. For absences that do not fall under excused absence regulations (see below), this course follows the following procedures:

1. Student should not come to class if they are feeling ill, but they MUST email the instructor with the subject line: [course code] absence. The instructor does not need details about the student's symptoms. The student should just let the instructor know that they are feeling ill and cannot come to class. If it is an emergency situation, the student should follow the University regulations on emergent medical care (see below).
2. Unless it falls under the University excused absence regulations (see below), any work due should be submitted on time via the course Brightspace.
3. If that day's class involves assessed work such as a test or presentation, student and the instructor will plan if and how the student can make up the work, following the assignment guidelines. This plan must be done before the next class period, so again, the student should email the instructor immediately when they know that they will miss class.
4. The most important consideration in any absence is how it will affect the student's achievement of the assignment objectives and the course learning outcomes.

For cases that fall under excused absence regulations, the student or their representative should contact or go to the Office of the Dean of Students (ODOS) website to complete appropriate forms for instructor notification. Under academic regulations, excused absences may be granted by ODOS for cases of grief/bereavement, military service, jury duty, parenting leave, or emergent medical care. The processes are detailed, so the student should plan ahead.

13 Academic Integrity

Unless expressly allowed, students are expected to complete all exams and programming labs by themselves (or within their chosen group of two for programming labs under Honors contract). However, students are allowed to discuss general issues with other students (programming techniques,

clearing up confusion about requirements, etc.). Students may discuss particular algorithmic issues on Piazza (but they must not post or copy code!). If there is any doubt, students should contact the instructor. Course staff will be using software designed to catch plagiarism in programming labs and copying on exams. 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". Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information is submitted the greater the opportunity for the university to investigate the concern. More details are available on the course Brightspace under "University Policies and Statements". 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 on a programming lab or exam, students involved will receive a 0; the second instance of cheating will result in a failing grade in the course.

Use of Copyrighted Materials: All course materials, including lecture slides, practice problem sets, programming labs, exams, and solutions 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.

14 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 and Statements".

15 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.

16 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.

17 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

18 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.

19 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. Relevant changes to this course will be posted onto the course web page and Piazza or can be obtained by contacting the instructor via email. Students are expected to check the course web page and Piazza, and read their @purdue.edu email on a frequent basis.

A link to Purdue's information on Emergency Preparation and Planning is located on the course Brightspace under "University Policies and Statements". This website covers topics such as Severe Weather Guidance, Emergency Plans, and a place to sign up for the Emergency Warning Notification System. Students are encouraged to download and review the *Emergency Preparedness for Classrooms document (PDF) or (Word)*.

The first day of class, the instructor will review the **Emergency Preparedness plan for their specific classroom**, following Purdue's required Emergency Preparedness Briefing. Students are advised to make note of the following items:

1. The location to where one will proceed after evacuating the building if one hears a fire alarm.
2. The location of the Shelter in Place in the event of a tornado warning.
3. The location of the Shelter in Place in the event of an active threat such as a shooting.