ECE 46300: Introduction to Computer Communication Networks
Fall 2022

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 WTHR 172.

Course Credit Hours: 3

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

Course Web Page: https://engineering.purdue.edu/~vshriva/courses/ece46300fa22/index.html

Course Brightspace Page: https://purdue.brightspace.com/d2l/home/599947

Course Piazza Page: https://piazza.com/purdue/fall2022/ece463/home

2 Instructor(s) Contact Information

Instructor

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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 secure communication, 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. Data Link Layer – MAC Addressing, ARP, CSMA/CD, Switched Ethernet, MAC Learning, STP
5. Network Layer – IP Addressing, NAT, IP Forwarding, Distance Vector, Link State, BGP, DNS
6. Transport Layer – UDP, TCP Reliability, TCP Flow Control, TCP Congestion Control
7. Application Layer – Web, HTTP, TLS, HTTPS, HTTP/2, QUIC
8. Socket Programming
9. Secure Communication
10. Router Architecture
11. Datacenter and Software-defined Network

5 Prerequisites

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

6 Learning Resources, Technology, and Texts

1. **Required Material:** Lecture slides 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 secure communication, router architecture, software-defined network, and datacenter network.

4. an ability to implement distributed routing, forwarding, and reliability protocols.
5. an ability to implement network applications using socket interface.

8 Assessments

50% grade — Programming Labs

10% – Lab 1: MAC Learning, Forwarding, and STP

10% – Lab 2: Distributed Network Routing Protocols

15% – Lab 3: Reliable Transport

15% – Lab 4: HTTP Web Client and Server

10% grade — Problem Sets [9 problem sets (PS1–PS9); each PS will carry equal credit]

15% grade — Midterm Exam

25% grade — Final Exam

Lab 1 and Lab 2 will be in Python while Lab 3 and Lab 4 will be in C. Each lab must be done in a group of at most two students. Problem sets will be open-book and must be done individually with no collaboration allowed. Each problem set will be due in 1 week following its release. Midterm and Final exams will be closed-book with no collaboration allowed. Final exam will cover the entire syllabus. 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, problem sets, and exams. Students who are most active and helpful in answering questions on Piazza may receive bonus points.

Policy for Late Submissions

For Programming Labs:

If submitted within 24 hours (1 day) after the deadline — 30% grade penalty.
If submitted within 48 hours (2 days) after the deadline — 50% grade penalty.
No submissions will be accepted beyond 48 hours (2 days) after the deadline.

For Problem Sets:

If submitted within 24 hours (1 day) after the deadline — 50% grade penalty.
No submissions will be accepted beyond 24 hours (1 day) after the deadline.

9 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

10 Course Schedule

Week	Dates	Topic	Lab / Problem Set
1	Aug 22 – Aug 26	No Lecture [SIGCOMM Conference]	
2	Aug 29 – Sep 2	Course Introduction Packet vs. Circuit Switching Network Performance Metrics	
3	Sep 5 – Sep 9	**Labor Day Holiday** Internet Architecture Principles I Internet Architecture Principles II	 PS1 release
4	Sep 12 – Sep 16	Data Link Layer I Data Link Layer II Data Link Layer III	
5	Sep 19 – Sep 23	Data Link Layer IV Network Layer I Network Layer II	Lab 1 release PS2 release
6	Sep 26 – Sep 30	Network Layer III Network Layer IV Network Layer V	PS3 release
7	Oct 3 – Oct 7	Network Layer VI Network Layer VII Network Layer VIII	PS4 release **Lab 1 due**
8	Oct 10 – Oct 14	**Fall Break** Midterm Exam Revision **Midterm Exam**	Lab 2 release PS5 release
9	Oct 17 – Oct 21	Midterm Exam Recap Transport Layer I Transport Layer II	
10	Oct 24 – Oct 28	Transport Layer III Transport Layer IV Transport Layer V	 **Lab 2 due**
11	Oct 31 – Nov 4	Transport Layer VI Transport Layer VII Transport Layer VIII	Lab 3 release PS6 release
12	Nov 7 – Nov 11	Socket Programming I Socket Programming II Application Layer I	PS7 release
13	Nov 14 – Nov 18	Application Layer II Secure Communication Lab 3 Help Session	PS8 release **Lab 3 due**
14	Nov 21 – Nov 25	**Thanksgiving Break**	Lab 4 release
15	Nov 28 – Dec 2	Router Architecture I Router Architecture II	PS9 release
16	Dec 5 – Dec 9	Router Architecture III SDN and Datacenter Network Final Exam Revision	 **Lab 4 due**
17	Dec 12 – Dec 17	**Final Exams Week**	

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 (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 or urgent care medical care.

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. For COVID-19 concerns, students should see the Fall 2022: What you need to know guidance published July 27. 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.

13 Classroom Guidance Regarding Protect Purdue

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

Unless expressly allowed, students are expected to complete all the problem sets, exams, and programming labs by themselves (or within their chosen group for programming labs). 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 problem sets and exams. A student is considered in violation of the academic integrity 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 our course Brightspace under "University Policies". 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, problem set, 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, 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.

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. The CAPS website also offers resources specific to situations such as COVID-19.

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/.