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
Sections: 001
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
Course Web Page: https://web.ics.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/ece46300/home

2 Instructor(s) Contact Information

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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 Internet architecture, naming and addressing, routing, forwarding, reliability, flow control, congestion control, and socket programming. The later part of the course will introduce students to topics such as secure communication, router architecture, datacenter and software-defined network. The course will also provide students with a hands-on experience of building practical and efficient networked systems and applications through various programming labs.

4 Course Topics

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

5 Prerequisites

Proficiency in C and Python and familiarity with basic data structures (ECE 36800).

6 Learning Resources, Technology, and Texts

1. **Required Material:** Lecture slides on Brightspace.

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 networked applications using socket interface.
# Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Problem Set / Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aug 22 – Sep 26</td>
<td>No Lecture</td>
<td></td>
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<tr>
<td>2</td>
<td>Aug 29 – Sep 2</td>
<td>Introduction&lt;br&gt;Packet vs. Circuit Switching&lt;br&gt;Network Performance Metrics</td>
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<tr>
<td>3</td>
<td>Sep 5 – Sep 9</td>
<td><strong>Labor Day Holiday</strong>&lt;br&gt;Internet Architecture Principles I&lt;br&gt;Internet Architecture Principles II</td>
<td>Lab 0 release&lt;br&gt;PS1 release</td>
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<tr>
<td>4</td>
<td>Sep 12 – Sep 16</td>
<td>Data Link Layer I&lt;br&gt;Data Link Layer II&lt;br&gt;Data Link Layer III</td>
<td></td>
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<tr>
<td>5</td>
<td>Sep 19 – Sep 23</td>
<td>Data Link Layer IV&lt;br&gt;Network Layer I&lt;br&gt;Network Layer II</td>
<td>Lab 1 release&lt;br&gt;PS2 release</td>
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<tr>
<td>6</td>
<td>Sep 26 – Sep 30</td>
<td>Network Layer III&lt;br&gt;Network Layer IV&lt;br&gt;Network Layer V</td>
<td>PS3 release</td>
</tr>
<tr>
<td>7</td>
<td>Oct 3 – Oct 7</td>
<td>Network Layer VI&lt;br&gt;Network Layer VII&lt;br&gt;Network Layer VIII</td>
<td>PS4 release</td>
</tr>
<tr>
<td>8</td>
<td>Oct 10 – Oct 14</td>
<td><strong>October Break</strong>&lt;br&gt;Midterm Revision&lt;br&gt;Midterm Exam</td>
<td>Lab 2 release&lt;br&gt;PS5 release</td>
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<tr>
<td>9</td>
<td>Oct 17 – Oct 21</td>
<td>Midterm Exam Recap&lt;br&gt;Transport Layer I&lt;br&gt;Transport Layer II</td>
<td></td>
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<tr>
<td>10</td>
<td>Oct 24 – Oct 28</td>
<td>Transport Layer III&lt;br&gt;Transport Layer IV&lt;br&gt;Transport Layer V</td>
<td></td>
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<tr>
<td>11</td>
<td>Oct 31 – Nov 4</td>
<td>Transport Layer VI&lt;br&gt;Transport Layer VII&lt;br&gt;Transport Layer VIII</td>
<td>Lab 3 release&lt;br&gt;PS6 release</td>
</tr>
<tr>
<td>12</td>
<td>Nov 7 – Nov 11</td>
<td>Socket Programming I&lt;br&gt;Socket Programming II&lt;br&gt;Application Layer I</td>
<td>PS7 release</td>
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<tr>
<td>13</td>
<td>Nov 14 – Nov 18</td>
<td>Application Layer II&lt;br&gt;Secure Communication&lt;br&gt;Router Architecture I</td>
<td>PS8 release</td>
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<tr>
<td>14</td>
<td>Nov 21 – Nov 25</td>
<td><strong>Thanksgiving Break</strong></td>
<td>Lab 4 release</td>
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<tr>
<td>15</td>
<td>Nov 28 – Dec 2</td>
<td>Router Architecture II&lt;br&gt;Router Architecture III&lt;br&gt;Router Architecture IV</td>
<td>PS9 release</td>
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<tr>
<td>16</td>
<td>Dec 5 – Dec 9</td>
<td>Software-defined Network&lt;br&gt;Datacenter Network&lt;br&gt;Final Revision</td>
<td></td>
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<tr>
<td>17</td>
<td>Dec 12 – Dec 17</td>
<td><strong>Finals Week</strong></td>
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9 Assignments and Exams

Programming Labs — 50% of the grade
1. Lab 0: Setting up the Environment [0%]
2. Lab 1: MAC Learning, Forwarding, and STP [10%]
3. Lab 2: Distributed Network Routing Protocols [10%]
4. Lab 3: Reliable Transport [15%]
5. Lab 4: HTTP Web Client and Server [15%]

Problem Sets — 10% of the grade [9 problem sets (PS1–PS9); each PS will carry equal credit]
Midterm Exam — 15% of the grade
Final Exam — 25% of the grade

The first two programming labs (Lab 1 and Lab 2) will be in Python and the last two (Lab 3 and Lab 4) will be in C. Each programming lab will be 3 weeks long, and must be done in group of at most two students. Problem sets will be open-book and must be completed individually with no collaboration allowed. Problem sets will be due in 1 week following their release. Barring extraordinary circumstances (serious medical situations or family emergencies accompanied by verification), no extensions will be granted for lab and problem set submissions. Midterm and Final exams will be closed-book with no collaboration allowed. Final exam will cover the entire syllabus. 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 after the deadline — 30% grade penalty
If submitted within 48 hours after the deadline — 50% grade penalty
No submissions will be accepted beyond 48 hours after the deadline

For Problem Sets:
If submitted within 24 hours after the deadline — 50% grade penalty
No submissions will be accepted beyond 24 hours after the deadline

10 Grading Scale

The breakpoints for letter grades will be decided by the instructor at the end of the semester adjusting for the difficulty level of problem sets, programming labs, and examinations. Normally, the grading follows the trend shown below.

<table>
<thead>
<tr>
<th>Grade</th>
<th>A+</th>
<th>A</th>
<th>A−</th>
<th>B+</th>
<th>B</th>
<th>B−</th>
<th>C+</th>
<th>C</th>
<th>C−</th>
<th>D+</th>
<th>D</th>
<th>D−</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score</td>
<td>95+</td>
<td>90+</td>
<td>85+</td>
<td>80+</td>
<td>75+</td>
<td>70+</td>
<td>65+</td>
<td>60+</td>
<td>55+</td>
<td>50+</td>
<td>45+</td>
<td>40+</td>
<td>≤40</td>
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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 will be taken at the beginning of each class and lateness will 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 or phone. 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 you must miss class at any point in time during the semester, please reach out to the instructor via email so that they can communicate about how you can maintain your academic progress. For COVID-19 concerns, please see the Fall 2022: What you need to know guidance published July 27. If you find yourself too sick to progress in the course, notify your advisor and instructor via email or Brightspace. They will make arrangements based on your 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 problem sets, exams, and programming labs by themselves (or within their chosen group of two 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 do not post or copy code!). If there is any doubt, please contact the instructor. We 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 and notes, problem sets, programming labs, examinations, and solutions are subject to Purdue’s copyright policies. Do 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 our course Brightspace table of contents, under University Policies.

16 Accessibility

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247. More details are available on our course Brightspace under Accessibility Information.

17 Mental Health/Wellness Statement

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack. Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are Mon-Fri, 8am-5pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc., sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect.

If you are struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you 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. You can access these wellness coaches from around the world 24/7. The College of Engineering has an exclusive agreement with TaskHuman which gives you FREE and UNLIMITED access to these resources. Over 3,200 calls have been made by College of Engineering students, staff, and faculty so far with an average satisfaction rating of 4.89/5.

Learn more here: 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 your 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 8am–5pm Monday through Friday. 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 Preparation

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. In such an event, information will be provided through Brightspace, Piazza, and/or email. You are expected to check the course page on Brightspace and Piazza, and read your @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/

See the University’s web site for additional information: https://www.purdue.edu/ehps/emergency_preparedness/