ECE 50863: Computer Network Systems
Spring 2021

1 Course Information

**Course Number and Title:** ECE 50863, Computer Network Systems

**CRN:** 20281, 28266, 31735, 31736

**Sections:** 001, OL1, EPE, OXE

**Instructional Modality:** Section 001: Face-to-Face, Sections OL1, EPE, OXE: Asynchronous Online

**Lecture Time:** Mon, Wed, Fri 1:30–2:20pm in ME 1061. The lectures will be live recorded via Zoom and made available via Brightspace to online sections

**Course Credit Hours:** 3

**Prerequisites:** ECE 26400 (Advanced C Programming) or equivalent, ECE 20875 (Python For Data Science) or equivalent, ECE 36800 (Data Structures) or equivalent

**Course Web Page:** [https://web.ics.purdue.edu/~vshriva/courses/ece50863sp21/index.html](https://web.ics.purdue.edu/~vshriva/courses/ece50863sp21/index.html)

**Course Brightspace Page:** [https://purdue.brightspace.com/d2l/home/210193](https://purdue.brightspace.com/d2l/home/210193)

**Course Piazza Page:** [https://piazza.com/purdue/spring2021/ece50863/home](https://piazza.com/purdue/spring2021/ece50863/home)

2 Instructor(s) Contact Information

**Instructor**

Vishal Shrivastav  
Assistant Professor of Electrical and Computer Engineering  
Office: EE 334B  
Email: vshriva@purdue.edu  
Office Hours: Wed 4–5pm on Zoom

**Grader**

Thomas J Agnello  
Undergraduate Grader  
Email: tagnello@purdue.edu

3 Course Outline

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 more recent developments in computer networking, such as software-defined network, programmable data plane, and datacenter network. The course will also provide students with a hands-on experience of building practical and efficient networked systems and applications through various programming assignments.
4 Course Topics

1. Internet Architecture
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. Network Security
8. Router Architecture
9. Software-defined Network
10. Programmable Network
11. Datacenter Network

5 Prerequisites

Strong programming skills in C (ECE 26400 or equivalent) and Python (ECE 20875 or equivalent) and familiarity with basic data structures (ECE 36800 or equivalent). A prior course in Operating Systems will be useful but not essential.

6 Learning Resources, Technology, and Texts

1. Required Material: Lecture slides and lecture videos 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. While the class has a textbook, we will not follow its order of presentation; instead, we will use the textbook as a reference when covering each individual topic.

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 network security, router architecture, software-defined network, programmable data plane, and datacenter network.
4. an ability to implement distributed routing, forwarding, and reliability protocols.
5. an ability to implement networked applications using socket interface.
8 Assignments and Exams

Programming Assignments — 70% of the grade

1. PA0: Setting up the Environment [0%]
2. PA1: MAC Learning, Forwarding, and STP [10%]
3. PA2: Distributed Network Routing Protocols [20%]
4. PA3: Reliable Transport [20%]
5. PA4: HTTP Web Client and Server [20%]

Final Exam — 30% of the grade

The first two programming assignments (PA1 and PA2) will be in Python and the last two (PA3 and PA4) will be in C. Each programming assignment will be 2-3 weeks long and must be done individually. Barring extraordinary circumstances (serious medical situations or family emergencies accompanied by verification), no extensions will be granted for assignment submissions. Final exam will be closed-book with no collaboration allowed. The exam will cover the entire syllabus. Students who are most active (and helpful) in answering questions on Piazza may receive bonus points.

9 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 programming assignments 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>D+</th>
<th>D</th>
<th>D-</th>
<th>F</th>
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<tbody>
<tr>
<td>Score</td>
<td>95+</td>
<td>90+</td>
<td>85+</td>
<td>80+</td>
<td>75+</td>
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<td>65+</td>
<td>60+</td>
<td>55+</td>
<td>50+</td>
<td>45+</td>
<td>40+</td>
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10 Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Programming Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan 18 – Jan 22</td>
<td>Introduction and Background</td>
<td></td>
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<tr>
<td>2</td>
<td>Jan 25 – Jan 29</td>
<td>Internet Architecture Principles</td>
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<td>3</td>
<td>Feb 1 – Feb 5</td>
<td>Data Link Layer</td>
<td>PA0 release</td>
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<td>4</td>
<td>Feb 8 – Feb 12</td>
<td>Network Layer</td>
<td>PA1 release</td>
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<td>5</td>
<td>Feb 15 – Feb 19</td>
<td>Network Layer</td>
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<tr>
<td>6</td>
<td>Feb 22 – Feb 26</td>
<td>Network Layer</td>
<td>PA2 release</td>
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<td>7</td>
<td>Mar 1 – Mar 5</td>
<td>Network Layer</td>
<td></td>
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<tr>
<td>8</td>
<td>Mar 8 – Mar 12</td>
<td>Transport Layer</td>
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<tr>
<td>9</td>
<td>Mar 15 – Mar 19</td>
<td>Transport Layer</td>
<td>PA3 release</td>
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<td>10</td>
<td>Mar 22 – Mar 26</td>
<td>Application Layer and Socket Programming</td>
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<td>11</td>
<td>Mar 29 – Apr 2</td>
<td>Network Security</td>
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<td>12</td>
<td>Apr 5 – Apr 9</td>
<td>Router Architecture</td>
<td>PA4 release</td>
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<td>13</td>
<td>Apr 12 – Apr 16</td>
<td>Software-defined and Programmable Network</td>
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<td>14</td>
<td>Apr 19 – Apr 23</td>
<td>Datacenter Network</td>
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<tr>
<td>15</td>
<td>Apr 26 – Apr 30</td>
<td>Future Directions in Networking</td>
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<td>16</td>
<td>May 3 – May 7</td>
<td>Finals Week</td>
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11 Attendance Policy

Attendance for this class is not mandatory. However, students are encouraged to attend every lecture to keep-up with the course material.

12 Academic Integrity

Unless expressly allowed, students are expected to complete all exams and programming assignments by themselves. 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 assignments 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.” 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 assignment 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 materials, including lecture slides and notes, videos and lecture recordings, programming assignments, examinations, and solutions are subject to Purdue’s copyright policies. Please do not share, distribute, or post any material on an online web site without checking with the instructor.

13 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.

14 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.

15 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 have any questions, please contact Purdue Wellness at evans240@purdue.edu.

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.

16 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/