

ECE 50863: Computer Network Systems

Spring 2021

1 Course Information

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

CRNs: 20281, 28266, 31735, 31736

Sections: 001, OL1, EPE, OXE

Campus: West Lafayette

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 the online sections.

Course Credit Hours: 3

Prerequisites: ECE 26400 (Advanced C Programming), ECE 20875 (Python For Data Science), and ECE 36800 (Data Structures).

Course Web Page: <https://web.ics.purdue.edu/~vshriva/courses/ece50863sp21/index.html>

Course Brightspace Page: <https://purdue.brightspace.com/d2l/home/210193>

Course Piazza Page: <https://piazza.com/purdue/spring2021/ece50863/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: 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 a hands-on experience of building practical and efficient networked systems and applications through various programming assignments.

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

5 Prerequisites

Strong programming skills in C (ECE 26400) and Python (ECE 20875) and familiarity with basic data structures (ECE 36800). 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.

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

PA1 and PA2 will be in Python while PA3 and PA4 will be in C. Each programming assignment will be due in 2-3 weeks following its release, and must be done individually with no collaboration allowed. Barring extraordinary circumstances (serious medical situations or family emergencies, accompanied by verification and a prior notification to the instructor), no extensions will be granted for programming assignments. 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 Course Schedule

Week	Dates	Topic	Programming Assignment
1	Jan 18 – Jan 22	Course Introduction Background	
2	Jan 25 – Jan 29	Internet Architecture Principles	
3	Feb 1 – Feb 5	Data Link Layer	PA0 release
4	Feb 8 – Feb 12	Network Layer	PA1 release
5	Feb 15 – Feb 19	Network Layer	
6	Feb 22 – Feb 26	Network Layer	PA2 release
7	Mar 1 – Mar 5	Network Layer	
8	Mar 8 – Mar 12	Transport Layer	
9	Mar 15 – Mar 19	Transport Layer	PA3 release
10	Mar 22 – Mar 26	Application Layer Socket Programming	
11	Mar 29 – Apr 2	Network Security	
12	Apr 5 – Apr 9	Router Architecture	PA4 release
13	Apr 12 – Apr 16	Software-defined Network Programmable Network	
14	Apr 19 – Apr 23	Datacenter Network	
15	Apr 26 – Apr 30	Future Directions in Networking	
16	May 3 – May 7	Final Exams Week	

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

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 the 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 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 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 course materials, including lecture slides, videos and lecture recordings, programming assignments, examinations, and solutions are subject to Purdue’s copyright policies. Students must 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 the course Brightspace table of contents, under “University Policies”.

14 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.

15 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.

16 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/.