

CSCE 5653 Network Security (3 credit hours)

Catalog Description: This course will be focused on understanding and applying foundational principles in security to real computer networks. Students will study and implement several real attacks and take advantage of several recreated vulnerable systems in order to understand the modern landscape of network security. Students will also be looking at various case studies of attacks and defense strategies, including known exploit proofs-of-concept, published papers, and documents from security agencies and cyber-security research firms.

Prerequisites: Graduate standing in CSCE department

- It is assumed that the students are familiar with some programming languages, such as C, C++, Java, or Python.
- It is recommended that the students have a reasonably good background in computer networks.

Textbook: There is no required textbook. We suggest several texts.

- **Recommended:** William Stallings, *Cryptography and Network Security: Principles and Practices*, 7th ed., Upper Saddle River, NJ: Prentice Hall, 2017. ISBN-13: 978-0-13-444428-4
- Computer & Internet Security: A Hands-on Approach, Second Edition, Wenliang Du, ISBN: 978-1733003926 (hardcover) and 978-1733003933 (paperback)
- PoC||GTFO
<https://www.oreilly.com/library/view/pocgtfo/9781492067528/>
- MIT's list on Computer Systems Security
<http://css.csail.mit.edu/6.858/2019/reference.html>
- Security Engineering: A Guide to Building Dependable Distributed System, Ross J. Anderson
<https://www.cl.cam.ac.uk/~rja14/book.html>
- Hands-On Ethical Hacking and Network Defense, Michael T. Simpson, Nicholas Antill, 3rd Edition, 2016, Cengage Learning, ISBN: 987-1-285-45467-2

Goals: The goal of the class is for students to understand how to communicate securely over an insecure network.

Student Learning Outcomes: By the end of this course, students will be able to:

- Describe concepts, threats, operational challenges as well as solutions in securing systems and networks
- Explore a range of existing problems and tensions in modern network security
- Use offensive cybersecurity tools to attack computer and network systems to understand how to defend against attacks
- Evaluate the threats to a computer or network system
- Apply real-world security principles through hands-on practices and tools to assess, defend, and investigate systems and networks

Topics Covered

The course is organized into multiple cycles and each cycle will focus on one topic in network security from theory to practice. We will first study the theory behind various attack vectors as well as countermeasures, and then gain deep insights through hands-on construction and experimentation with real-world implementations.

- Network basics and security introduction (2 weeks)
- Network attacks (5 weeks)
- Unwanted traffic (e.g., DoS, spam, malware) (3 weeks)
- Web security (3 weeks)
- Network defense (3 weeks)

Grading

Course grades will be determined by these weights:

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| Homework assignments: | 50% |
| Participation: | 25% |
| Project: | 25% |

The final class grade will be assigned according to the following 10-point scale:

A: 90-100%, B: 80-89.9%, C: 70-79.9%, D: 60-69.9%, F: <60%

The grades may or may not be curved.

Academic Honesty Policy

As a core part of its mission, the University of Arkansas provides students with the opportunity to further their educational goals through programs of study and research in an environment that promotes freedom of inquiry and academic responsibility. Accomplishing this mission is only possible when intellectual honesty and individual integrity prevail. Each University of Arkansas student is required to be familiar with and abide by the university's 'Academic Integrity Policy' at <http://provost.uark.edu/> and <https://honesty.uark.edu/policy/>. Students with questions about how these policies apply to a particular course or assignment should immediately contact their instructor.

Ethics and Responsibilities

In this class, we will apply both offensive and defensive security techniques to non-production hardware/software systems. Every student must act responsibly adhering to the University of Arkansas Code of Computing Practices and the Computer and Network Security Policy.

Class/laboratory schedule: Meets either 3 times a week for 50 minutes or 2 times a week for 75 minutes for 15 weeks.

Relationship of course to ABET Computer Engineering Student Outcomes

- CE4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
- CE6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
- CE7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Relationship of course to ABET Computer Science Student Outcomes

- CS4. An ability to recognize professional responsibilities and make informed judgements in computing practice based on legal and ethical principles.
- CS6. An ability to apply computer science theory and software development fundamentals to produce computing-based solutions.

Relationship of course to ABET Computer Science Topics

- T1. Techniques, skills, and tools necessary for computing practice.
- T2. Principles and practices for secure computing.
- T8. Networking and communication.

CSCE 5653 – Network Security (3)
Spring 2022 (Jan. 18 – May 5), CSCE 5653 001, Class Number #11321

General Information

- Class website: <http://learn.uark.edu>
- Time/Location: MWF, 10:45 – 11:35 a.m., JBHT 236
- Instructor: Dale Thompson, Ph.D., P.E.
 - Office hours
 - Mon., Tues., Wed., 2-4pm or by appointment
 - Call via Teams, call the office phone, or in-person during office hours
 - To schedule a meeting during alternate times, click here:
<https://calendly.com/drt-csce/15min>
 - Office: JBHT 504
 - Phone: 479-575-5090
 - Email: *drt@uark.edu*

Course Mode of Delivery

The course delivery mode will be face-to-face. While some asynchronous delivery may be involved, the bulk of content is delivered face-to-face during the regularly scheduled class time.

Attendance Policy

The University of Arkansas will primarily offer in-person instruction in the 2021-2022 academic year. Most of the university's academic programs have essential in-person components. Class attendance is the responsibility of each student and expected. If you are absent, it is your responsibility to obtain assignments, notes, and any class information given. **If you must quarantine, self-isolate, or miss class during the semester because of COVID-19 or other illness, please contact the instructor via email and do not come to class.** Class information will be provided to students who must miss class due to COVID-19 or other excused absences on a short-term basis. Contact the Center for Education Access (CEA) to determine if you think that you have a disability that permits you from participating in person.

Assignment Late Policy

All assignments will be given with a strict deadline, and students are required to submit their assignments on or before the deadline. **Late submissions will not be accepted.** In case of extenuating circumstances, students are advised to contact the professor as soon as practical.

Office Hours

Office hours will be primarily virtual using Teams or phone but walk-ins during posted office hours are also permitted. Students are encouraged to schedule a time.

Mask Policy

You must wear a mask while in class for your protection and for the protection of those around you. Masks must be properly worn, over your nose and mouth, at all times especially when entering and leaving the classroom. If you do not have a mask, please let me know, and a mask

will be provided for you. Eating and drinking is not permitted during class. Individuals should leave the classroom to eat or drink, as necessary. If you require accommodations due to a disability, please contact the Center for Educational Access. Students who do not comply with the mask requirement will be reported to the office of the Dean of Students.

Vaccinations

The UA strongly encourages everyone who is eligible and able, to become fully vaccinated. We fully understand that there are students who do not wish to receive a vaccination at this time, can't receive a vaccination for medical or other reasons, and others who simply do not want to participate. While state law prohibits requiring it, **COVID-19 vaccination is encouraged** as our primary means of mitigating the spread of the virus. Those who receive vaccination protect themselves from serious illness, hospitalization, and in some cases even death, while protecting those around them, supporting our plans to have a more traditional in-person semester and hopefully avoid interruptions in the school year.

Communication Plan

In this class our official mode of communication is through uark.edu email. Students are responsible for checking their UARK accounts regularly. All communication between student and instructor and between student and student should be respectful and professional.

Continuity Plan

In the event of an extended campus closure, the continuity plan for this course includes the following:

- We will use our Blackboard course as the portal for the delivery of course materials and uark.edu email for communications. Please check both of these areas immediately for guidance and directions from me.
- I will use either Teams or the office phone to connect with students during my regularly scheduled office hours and by appointment.

Technology/Software Requirements

Access to a reliable Internet connection is required for this course. A problem with your Internet access may not be used as an excuse for late, missing, or incomplete coursework. If you experience problems with your Internet connection while working on this course, it is your responsibility to find an alternative Internet access point, such as a public library or Wi-Fi hotspot.

Unauthorized Use of Class Recordings

Instructors may record the class and make the class available to students through Blackboard. These recordings may be used by students **ONLY** for the purposes of the class. Students may not download, store, copy, alter, post, share, or distribute in any manner all or any portion of the class recording, e.g. a 5-second clip of a class recording sent as a private message to one person is a violation of this provision. This provision may protect the following interests (as well as other interests not listed): faculty and university copyright; FERPA rights; and other privacy interests protected under state and/or federal law. Failure to comply with this provision will result in a referral to the Office of Student Standards and Conduct for potential charges under the

Code of Student Life. In situations where the recordings are used to gain an academic advantage, it may also be considered a violation of the University of Arkansas' academic integrity policy.

Unauthorized Recording by Student

Recording, or transmission of a recording, of all or any portion of a class is prohibited unless the recording is necessary for educational accommodation as expressly authorized and documented through the Center for Educational Access with proper advance notice to the instructor.

Unauthorized recordings may violate federal law, state law, and university policies. Student-made recordings are subject to the same restrictions as instructor-made recordings. Failure to comply with this provision will result in a referral to the Office of Student Standards and Conduct for potential charges under the Code of Student Life. In situations where the recordings are used to gain an academic advantage, it may also be considered a violation of the University of Arkansas' academic integrity policy.

Recording of Class Lectures

By attending this class, student understands the course may be recorded and consents to being recorded for official university educational purposes. Be aware that incidental recording may also occur before and after official class times.

Unauthorized Use and Distribution of Class Notes

Third parties may attempt to connect with you to buy your notes and other course information from this class. I will consider distributing course materials to a third party without my authorization a violation of my intellectual property rights and/or copyright law as well as a violation of the University of Arkansas' academic integrity policy. Continued enrollment in this class signifies your intent to abide by the policy. Any violation will be reported to the Office of Academic Initiatives and Integrity.

Please be aware that such class materials that may have already been given to such third parties may contain errors, which could affect your performance or grade. Recommendations for success in this course include coming to class on a routine basis, visiting me during my office hours, connecting with the Teaching Assistant (TA), and making use of Student Success Center. If a third party should contact you regarding such an offer, I would appreciate your bringing this to my attention. We all play a part in creating a course climate of integrity.

Class Cancellation and Learning Continuity

Inclement Weather Policy

- If the University of Arkansas is closed, then there will not be class. Inclement weather information will be available via the university's web sites
 - <http://www.uark.edu>, via the RazALERT emergency communications system
 - <http://emergency.uark.edu> and through notification of local and regional media
- If the Fayetteville Public Schools are closed *because of the weather*, then there will not be class.
- If there is inclement weather and the U of A and the Fayetteville Public Schools are open, the instructor may decide to cancel class and notify students as discussed below.
- **If you feel that you cannot safely come to class, then do not come. Use your own judgment.**

Class Cancellation Policy for Other Situations

If class is cancelled for other situations not covered by the Inclement Weather Policy, the students will be notified as discussed below.

Notification Procedure

- Students will be notified of class cancellation by posting an announcement in the class learning management system, which is typically in Blackboard, and the announcement will be flagged to email the announcement to all students' uark.edu email.
- The main CSCE Department will be notified.

Learning Continuity

The instructor will ensure that course content is not materially affected by cancelled classes. To make up missed class time, recorded lectures, assignments, readings, instructional materials, or other alternative forms of instruction will be used.

Emergency Procedures

Many types of emergencies can occur on campus; instructions for specific emergencies such as severe weather, active shooter, or fire can be found at emergency.uark.edu.

Severe Weather (Tornado Warning)

- Follow the directions of the instructor or emergency personnel
- Seek shelter in the basement or interior room or hallway on the lowest floor, putting as many walls as possible between you and the outside
- If you are in a multi-story building, and you cannot get to the lowest floor, pick a hallway in the center of the building
- Stay in the center of the room, away from exterior walls, windows, and doors

Violence / Active Shooter (CADD)

- CALL - 9-1-1
- AVOID - If possible, self-evacuate to a safe area outside the building. Follow directions of police officers.
- DENY - Barricade the door with desk, chairs, bookcases or any items. Move to a place inside the room where you are not visible. Turn off the lights and remain quiet. Remain there until told by police it's safe.
- DEFEND - Use chairs, desks, cell phones or whatever is immediately available to distract and/or defend yourself and others from attack.

Changes to the Syllabus

The standards and requirements set forth in this syllabus may be modified at any time by the course instructor. Notice of such changes will be by announcement in class or by changes to this syllabus posted in Blackboard.