

CSCI 4417/5417 Introduction to System Administration

3 Credit Hours

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Introduction

System Administration is a body of knowledge and a set of practices that focuses on business *operations* (as opposed to software development, though we will explore the relationship between development and operations extensively). Its concerns are numerous and varied, but focus primarily on day-to-day, sometimes minute-to-minute, operations of organizational hardware and software that supports the organization's overall mission.

System Administration is also closely connected to Network Administration (the two are sometimes referred to interchangeably) - an understanding of networking concepts is essential. We will, as part of our work, create and configure a network environment (a 'cloud network') into which we will launch and configure servers.

Understanding server operating systems is also an essential - core - concept. We will be working with both Windows Server and (various) Linux OS-Based servers, in part exploring the similarities and differences between them and various use-cases for each.

Course Description (From 2026-2027 Undergraduate Catalog)

"A survey of concerns related to management and design of computing systems and services. Topics include the practice of system administration, overview of network operating systems, best practices for system administration, fundamentals of Unix and Windows system administration, network design, and remote network access. The course will provide hands-on experience with setting up and administering Unix and Windows network operating systems."

I. Purpose

- > To convey an understanding of basic principles of computer system administration and distributed systems.
- > To convey an understanding of modern practices associated with highly competitive and successful organizations (versus historical examples) - DevOps.
- > To give students practical experience with the principles being conveyed.

II. Prerequisites

CSCI 2150 – Computer Organization,
CCSI 2200 – Unix Fundamentals, and
CSCI 2400/3400 – Computer Hardware & Network Administration

III. Major Topics

- > System administration: what it is, what it entails; professional certification and support organizations; technical aspects; customer service aspects; managerial aspects
- > To convey an appreciation for the different types of system administration certification programs
- > Typical duties of a system administrator
 - Technical aspects: hardware, software, infrastructure, etc.
 - Customer service aspects: education, communication, etc.
 - Managerial aspects: policy, finance, communications, planning, etc.
- > To convey enough of a working knowledge of system administration to allow students to read contemporary literature on system administration (e.g., trade journals)
- > Cloud Computing (primarily Amazon Web Services; discuss others)
- > Network operating systems: what they are, how they differ from other operating systems, how they work
- > Operating System Installation (AWS)
- > Installation/configuration of Apache web servers
- > Process management
 - Windows 2019: process management: task manager
 - Linux: process management: **ps** utility, **top**, **htop**
- > User account management
 - Discuss and practice account management in Windows 2019
 - Discuss and practice account management in Linux
- > Windows 20xx vs. Linux capabilities
- > Microsoft Active Directory
- > DNS / DHCP
- > File Systems
 - Discuss Windows file systems: Fat, NTFS
 - Discuss Linux file systems: ext, ext2, ext4, BTRFS, XFS, ReiserFS; journaling vs. non-journaling FSs
 - Redundant Array(s) of Independent Disks (RAID)
 - Distributed File Systems (DFS)
 - Network Attached Storage (NAS)
 - Storage Area Networks (SAN)
 - Permissions
- > Backup and restore
- > Logging
- > Automating repetitive tasks using scripting (BASH, PowerShell)
- > DevOps (including The Phoenix Project: A Novel about IT, DevOps, and Helping Your Business Win (Lean, The Three Ways, project management (Kanban Boards), integration of Development and Operations, types of work, etc.)
- > Use of policy in network administration
- > Administering Windows operating systems: basic issues
 - Overview: comparison between Windows systems
 - Support utilities for system administration such as net commands, **ipconfig**, **arp**; Windows Process Explorer
- > Administering Unix-based operating systems: basic issues
 - Overview: comparison between Unix systems

- Support utilities for system administration such as **sudo**, **chmod**, **passwd**, **useradd** (& **adduser**), **usermod**, **userdel** (& **deluser**), **chattr**, **service**, **systemctl**, **kill**, **top**, **htop**, **ping**, **nslookup**, **tracert**; RPM and APT files
 - Network Address Translation (NAT)
- > Basic issues in remote network access
- > To present basic issues in computer and network security, including
 - Firewalls;
 - Network and host scanning;
 - Password security;
 - Change management
- > Scaling resources & load balancing

IV. Learning Outcomes

At the conclusion of the course a student will be able to:

- > Demonstrate ability to respond to organizational needs related to technical aspects, customer service aspects, and managerial aspects. (Student Outcomes 2a, 4b, 5b)
- > Demonstrate ability to accomplish the following tasks in a lab setting
- > Configure a Unix-based and a Windows-based network operating system on a multi-computer platform in two ways:
 - With statically configured IP addresses
 - With dynamically configured (DHCP-based) IP addresses
- > Configure a DNS server for a cloud-based environment to support local recognition of hostnames
- > Configure an HTTP server for a Unix-based operating system to support web-based document access
- > Demonstrate knowledge and understanding of various types of file systems and storage implementations in enterprise environments (RAID, NAS, SANs, etc.)
- > Demonstrate ability to determine when writing scripts to automate standard system administration tasks would increase the effectiveness and decrease the overhead of system administration
- > Demonstrate ability to write clear prose that documents observations on system behavior, and actions taken to accomplish sysadmin-related tasks.
- > Demonstrate knowledge of responsibilities of systems administrators at various employment levels.
- > Demonstrate a basic understanding of standard sysadmin-related certification programs (e.g., Cisco, AWS, Microsoft, Network+), together with an appreciation for the advantages and disadvantages of each.
- > Demonstrate a working knowledge of networking terms and concepts pertaining to system administration, including, but not necessarily limited to, terms that characterize the following attributes of networks and aspects of network operation
 - Multi-computer configuration such as multiprocessor, multicomputer, cluster
 - NOS configuration such as registry, user profiles, /etc, "dot" files, directories, LDAP, DNS, DHCP
 - File system operation such as shares, NFS, mount points, Windows DFS

- File system authentication such as access control lists, Unix and Windows file permissions, drop boxes, **chown** vs. “take permission” models of object privilege
- User authentication such as domain, NIS
- Internet services such as IIS, Apache

V. Contacting Me

There are two best ways to contact me throughout the semester: email and Discord.

Email is most common: ramseyjw@etsu.edu. I have a Discord channel set up, though, which often will result in a quicker response. I usually have Discord running on my phone as well as Outlook, but the phone will alert me when a Discord message arrives. I will share the invite link once the semester begins. Having said that, if I’m in class when you send me a message, I will respond as soon as possible after the class is over.

I am also available, via Zoom, most Saturdays and Sundays (by appointment, of course). On occasion, I’ve hosted optional classes to assist students (usually Sundays at 2:00).

VI. Grade Assignments (Approximate)

- > 2 Exams @ 150-200 points each
- > Project 500 points
- > 8 - 13 Labs @ 50 points each (Weather and holidays permitting)
- > Quizzes totaling ~100 points (~10 points each)

Exams & quizzes will be posted on D2L. You’ll have a six days to complete quizzes (they will be available Mondays at 12:01am and will be due Saturdays at 11:59pm. Quizzes will be set for three attempts with the highest score counted. Questions include feedback, so if you get a question wrong, look at its feedback before attempting it again.

The midterm and final exams will be conducted in class on the dates specified in the 2026 Spring Schedule document. (See [Exam Policies](#) below for more information).

VII. Lab Reports

Lab reports shall include a summary of the lab activities conducted, including 3-5 screenshots, and answers to research questions that will be included in the instructions. The lab report, generally, will be due by the Saturday night (@ 11:59pm) following the lab period and will follow the guidelines posted on D2L. Read the Lab Report Instructions!

Refer to the included document entitled “LabInstructions.docx” for specifications associated with lab reports. This document is also available on D2L.

VIII. Project

There will be a project to be completed over the course of the semester. This project is designed to be non-trivial and will take time to successfully complete. It is based on a real-world use-case encountered by your kindly instructor years ago and will require the creation of a Bash

script that will perform a number of operations. A set of instructions will be distributed early in the semester. We will discuss the project throughout the semester.

IX. Exams

- During any in-class quizzes and tests, cell phones shall be set to silent and either placed face down on the desk or stowed in a book bag or purse.
- Unless otherwise instructed, quizzes/exams are to be completed without reference to outside sources (AI, Google, W3Schools, old lab code, etc.).

The Midterm and Final Exams will be administered in class (See the 2026 Fall Schedule document for dates). The exams will consist of two parts: a Q/A (traditional – M/C, T/F, etc.) part and a short answer part. Exam materials will be hosted on D2L and will be made available at the beginning of the exam period.

The use of Artificial Intelligence (e.g., ChatGPT, Grok, etc.) and/or search engines, cell phones, notes, or any outside materials during exams is **expressly prohibited**, unless specifically permitted by the instructor (it won't be). Any student caught violating this policy will receive a grade of 'o' for the exam and will be charged with Academic Misconduct (see below) in accordance with University policy.

X. Grading Scale

Percentage	Letter Undergraduate	Letter Graduate
93-100	A	A
90-92	A-	A-
87-89	B+	B+
83-86	B	B
80-82	B-	B-
77-79	C+	C+
73-76	C	C
70-72	C-	C-
67-69	D+	F
60-66	D	F
0-59	F	F

XI. Late Penalties for Work Not Submitted On Time

- > In-class/remote Quiz/Exercises: **Cannot be made up.**
- > Tests: Cannot be made up; in the event that a student must miss an exam (a bona fide emergency - i.e., an emergency that includes documentation that the student can provide: a doctor's excuse, for example), they must make prior arrangements with the instructor to make it up.

XII. Attendance Policy

Per East Tennessee State University [policy](#), class attendance for classes in which you've enrolled is expected and required. This applies to both lecture and lab meetings. If you miss a lecture, it is your responsibility to get a copy of the notes (assignments, announcements, etc.) from your classmates. [Academic honesty](#) standards will be enforced.

DO NOT send me emails asking how many absences have been recorded. Again, it is your responsibility to track your attendance in any given class. Emails like that only serve to further clutter what has become an overfilled inbox in Outlook and will be deleted without response.

It is difficult to catch up once you fall behind. Because of the strong correlation between attendance and success in this course, *the following attendance policy will be applied*: Absences beyond 3 will directly affect your *final* grade as follows:

ABSENCES	PENALTY
1-3	None
4	- 5 points applied to final grade average
5+	Additional -5 points per absence applied to final grade average

You must attend at least two-thirds of a day's scheduled class time to be considered present. Repeated lateness (be advised: repeated tardiness is one thing that really annoys me) or early departures may be counted as an absence at the discretion of the instructor and following a warning. The instructor may or may not call roll and will apply the above policy at his discretion.

At the instructor's discretion, the following grade adjustments will be applied for excessive absences:

0-3	No adjustment
4	-5 points applied to Final Grade Average
5+	Additional -5-point adjustment per absence

<=3	4	5	6	7	8	9	10+
0	-5	-10	-15	-20	-25	-30	(n-3)*5

Penalties for excessive absence

Tardiness

I've noticed over the years what seems to be an increasing number of students who habitually arrive for class after the class's schedule start time. If you are late to class, be sure to remind me after class to update the roll sheet to reflect your presence (tardiness) for that class – you will

already have been counted 'absent' (see above), so you'll want the record to accurately reflect your participation in the day's activities.

If you rack up 3 tardies during the semester, any late arrival to class thereafter will be recorded as an absence for purposes of this policy (see above).

Face it, folks, chronic absences/tardiness from/to the workplace is never acceptable. It is not acceptable in my class either.

XIII. Other (items pertinent to course and not represented in other sections)

Hardware

Most, if not all of our labs will be conducted in the AWS cloud environment or, possibly, using one or more of Microsoft's Virtual Labs. You will need some form of external storage – a flash drive, external hard drive, or cloud storage – to store key files in order to access your servers online.

For lab work, you may use the workstations provided in the Lab rooms or your personal devices. The AWS environment is web-based and compatible with all modern browsers. We will be doing one AWS CLI-based lab that will require the software to be installed on your machine, if you're using it. It should already be installed on the Lab workstations. AWS has changed things up in the past year, which is going to require a little flexibility. You will receive an email inviting you to join the class on AWS Academy (free of charge). We will use this environment for most of our labs.

Software

Amazon has provided our class with an academic grant to use the EC2 and VPC (more on that later, in class) this semester, up to \$50.00 worth of services per student. As mentioned earlier, they've been changing things this year.

We will also make extensive use of remote management software - PuTTY and Microsoft's Remote Desktop Connection (which I usually refer to as 'RDP' - Remote Desktop Protocol). I'll show you how to use the Windows CLI (or PowerShell) in lieu of PuTTY and/or FileZilla, which is handy when you're in a hurry. We'll be using Microsoft's command line interface (cmd.exe) and PowerShell for several labs. All of this software is either already installed on your personal machines or can be obtained at no cost to you (I'll show you, if you don't already know)

XIV. Academic Integrity Policy

East Tennessee State University maintains an [official policy](#) regarding Academic Conduct. This policy will be enforced in this class.

All work MUST be your OWN work! This applies to projects, quizzes, exams, and lab reports.

Any use of personal devices during lecture and assessment (exams) - apart from accessing D2L to take the exam - is expressly prohibited.

A violation of this policy will result in a grade of 'o' for the assignment, with appropriate documentation. Subsequent violations will result in a 'o' for the assignment and formal charges of academic misconduct (see below).

In cases of academic misconduct, the following rules will apply:

- > The 1st offense will result in a numeric grade of 'o' assigned for the project, lab, quiz, homework, exam, or other graded activity for all involved.
- > The 2nd offense will result in an 'F' for the course.

If it has been determined that an act of academic misconduct has occurred during the course, it will be referred to the College of Business and Technology's Associate Dean for Undergraduate Students. All academic misconduct is tracked by the university. Repeated instances of misconduct may lead to suspension or expulsion.

XV. Collaboration

You are encouraged to discuss material addressed in the course, including assignments, with members of the class and others. Helping one another find and understand problems in assignments is permitted as long as an honest individual attempt has been made to solve the problem. Everyone, however, must do his/her own work. Completing an assignment "by committee" and submitting it as an individual work is academic misconduct unless the assignment has been designated as a team assignment. Your name on submitted work is an affirmation that the work is yours alone.

One issue: We'll be using Discord, at least in part, for communication. There should be no 'code sharing' via Discord or any other medium. You are welcome to discuss strategies for solving problems, but not to share solutions. Any student(s) caught violating this section shall be subject to the provisions of the ETSU Academic Misconduct Policy (see above).

Please refer to the [ETSU Academic Misconduct Policy](#) for more information.

XVI. Use of Personal Computing Devices During Lecture/Lab

Students may not use personal devices during lecture. If you receive a phone call during lecture that may be important, please excuse yourself from the classroom before answering in order to avoid disrupting lecture. You can, and I encourage you to do so, take notes using paper and pen/pencil during lecture. But use of personal devices

(absent special provisions through Disability Services), or instructions to the contrary during lecture, is prohibited.

During lab meetings, students are welcome to use their personal devices to complete lab assignments if they prefer such use to the department-provided PCs. Note: many students have taken advantage of the dual monitor configuration in lab to display instructions on one monitor and work from the other. Others have used their personal devices in conjunction with the lab machines. The instruction sets for each lab tend to be somewhat detailed. Whatever works best for you is fine. Do bear in mind, though, that if you're using your personal machine with some microscopic font size, as many students seem to prefer to do, it is exceedingly difficult for me (with my steadily degrading eyesight) to help you without just asking you to get up and let me take your chair.

Cell Phones

Students are responsible for ensuring that their cell phones are set to "silent" or "vibrate" for the duration of each class meeting. Texting or other use of cell phones during lecture is prohibited.

If you are observed texting during lecture, you will be issued a warning. A second offense will result in your leaving the class for the remainder of the class period.

XVII. Text

The Phoenix Project: A Novel about IT, DevOps, and Helping Your Business Win; IT Revolution Press; ISBN-13: 978-19422788294

We will be reading from this book throughout the semester. It provides an excellent, if fictional, view of IT operations, starting with a broken shop and progressing through the protagonist's efforts to turn things around.

The text can be obtained free of charge through the Sherrod Library's subscription to <https://libs.etsu.edu/links/safari.html>.

Recommended References

The following books are not required, but do contain a lot of information that the reader would find useful in pursuing a career as a system administrator

- > *UNIX and Linux System Administration Handbook (5th Edition); Prentice Hall; ISBN-13: 978-0134277554*
- > *Windows Server 2019 Unleashed; Sams Publishing; ISBN-13: 978-0134583754*
Though this isn't a terribly expensive book, much, if not all, of its material is available via Microsoft's TechNet.
- > *The Practice of System and Network Administration, Volume 1, 3rd ed.; Addison-Wesley; ISBN-13: 978-0321919168*
- > *The Accidental Administrator: Linux Server Step-by-Step Configuration Guide; ISBN-13: 978-1453689929*
This book offers a lot of clearly explained material regarding Linux System Administration. The author, Dan Crawley, uses CentOS instead of Ubuntu. CentOS is a forked distro of Red Hat Linux, while Ubuntu hails from a Debian background. So readers of this book will

obtain a good introduction to the world of RHL, its similarities to, and differences from Ubuntu.

- > **Windows Sysinternals Administrator's Reference; ISBN-13: 978-0735656727**
Mark Russinovich is a Technical Fellow in the Windows Azure group at Microsoft. He is coauthor of Windows SysInternals Administrator's Reference, co-creator of the Sysinternals tools available from Microsoft TechNet, and coauthor of the Windows Internals book series. Aaron Margosis is a Principal Consultant with Microsoft Public Sector Services. He specializes in application development on Windows platforms, with a focus on security, least privilege, and compatibility in locked-down environments. We'll be using Process Explorer in lab. I'll try to incorporate some of the other Sysinternals tools as appropriate. In addition to the tools, the book provides valuable insight into the 'under the hood' activities of Windows.

XVIII. Other Useful Resources

Naturally, the web is full of resources for any topic, but here are some that may be particularly useful. This is not an exhaustive list!

- > <https://www.usenix.org/>
- > <https://help.ubuntu.com/>
- > <http://technet.microsoft.com/en-US/library/hh801901>
- > <http://www.admin-magazine.com/>
- > <http://www.theregister.co.uk/>
- > <http://blog.soundtraining.net/>
- > <http://powershell.com/cs/>
- > <http://linuxconfig.org/bash-scripting-tutorial>
- > <https://www.vmware.com/support/workstation.html>

Students can also find more computer science research materials at Sherrod Library's Research Guide for Computer & Information Sciences

(<http://sherrod.etsu.edu/tools/rg/computer.html#dblist>).