

Networking

Level: 3

Career Cluster: Digital Technology

Program: Information Technology

Pathway(s): Networking Systems and Security

Course Catalog Description

Course that introduces students to the principles of computer networks, including data communication, network models, infrastructure design, and connectivity using wired and wireless technologies. Students apply industry-relevant concepts such as protocols, addressing, routing, switching, security, and troubleshooting to design, analyze, and maintain network systems while demonstrating technical communication and problem-solving in real-world scenarios.

Summary

Course that provides students with a comprehensive understanding of how computer networks support communication, data exchange, and digital systems. Students explore foundational concepts including network types, the OSI model, data transmission, network media, topologies, and infrastructure design while developing technical skills in configuring devices, managing connectivity, and analyzing network performance. Through hands-on learning, students apply knowledge of protocols, addressing, routing, switching, and wireless technologies to build and maintain functional network environments. The course emphasizes network security, troubleshooting strategies, and performance optimization, while integrating professional skills such as collaboration, technical communication, and documentation. Students engage in real-world scenarios and complete a culminating project that demonstrates their ability to design, test, and present a network solution that meets defined user or organizational needs.

Notes

The updated course reflects a clear transition from a primarily technical, task-oriented curriculum to a more comprehensive, standards-driven program that integrates both foundational knowledge and professional skill development. The original course focused heavily on identifying network types, understanding the OSI model, applying protocols such as TCP/IP, and working with hardware, routing, switching, and troubleshooting procedures as discrete technical competencies. In contrast, the revised course restructures these concepts into clearly defined learning progressions that emphasize deeper conceptual understanding of networked systems, data communication, infrastructure design, and performance analysis. The updated course also expands beyond technical skills to include intentional development of cybersecurity awareness, wireless networking, and system optimization. Additionally, there is a significant enhancement in career readiness through the inclusion of dedicated sections on work-based learning, leadership, and professional communication, as well as a culminating project that requires students to design, test, and present a complete networking solution.

Student Learning Outcomes

1. Career Exploration and Postsecondary Opportunities

Objective: *Students will analyze career pathways in information technology, exploring industry roles, workplace expectations, required education, certifications, professional organizations, and postsecondary opportunities available in Colorado in order to make informed academic and career decisions.*

- 1) Identify employment opportunities in various fields with a focus in the area of information technology
 - a. Recognize the work typically performed, tools and technology used, and nature of work environments
 - b. Identify potential certifications within the careers
 - c. Find membership organizations associated with the careers
 - d. Understand the necessary education associated within the careers
- 2) Define professionalism within the context of information technology
 - a. Criticism and evaluation
 - b. Presentation
 - c. Assessment
- 3) Recognize laws, regulations, and ethics significant to the fields of information technology
- 4) Identify postsecondary opportunities offered in the state of Colorado
 - a. Technical college, community college, 4-year institutions
 - b. Certificates, associates, bachelor, and advanced degree opportunities

2. Foundations of Networked Systems

Objective: *Students will explain the purpose of computer networks and analyze how networked systems support communication, resource sharing, and digital operations.*

- 5) Define networking terminology and explain the purpose of a computer network
- 6) Differentiate among peer-to-peer, client-server, LAN, MAN, and WAN network models
- 7) Describe how networks support file sharing, printing, communication, access, internet, and management services
- 8) Compare network types based on scale, function, and intended use
- 9) Analyze how network design affects efficiency, access, and communication
- 10) Evaluate networking scenarios to determine the most appropriate network type

3. Network Models and Data Communication

Objective: *Students will explain how data moves across a network and interpret the role of layered models in digital communication.*

- 11) Explain how data is transmitted across networked systems
- 12) Identify the seven layers of the OSI model and summarize the function of each layer
- 13) Analyze how layers interact to move data accurately and efficiently

- 14) Interpret how encapsulation supports communication between devices
- 15) Compare the OSI model to practical networking tasks and technologies
- 16) Apply networking vocabulary to explain how packets travel from sender to receiver

4. Network Media, Topologies, and Infrastructure

Objective: *Students will examine the physical and logical components of network infrastructure and evaluate how design choices affect performance and reliability.*

- 17) Identify common network topologies, including star, bus, ring, and mesh
- 18) Describe the characteristics of wired and wireless transmission media
- 19) Compare twisted pair, fiber optic, coaxial, and wireless media for bandwidth, distance, and cost
- 20) Explain how physical infrastructure supports communication across a network
- 21) Analyze how topology impacts troubleshooting, expansion, and performance
- 22) Evaluate infrastructure choices for a given organizational or classroom network scenario

5. Network Devices and Connectivity

Objective: *Students will analyze the function of common network devices and apply device selection knowledge to support effective network communication.*

- 23) Identify and describe the function of hubs, switches, routers, access points, firewalls, and gateways
- 24) Differentiate between Layer 1, Layer 2, and Layer 3 network devices
- 25) Explain how switches and routers direct traffic across local and wide area networks
- 26) Compare devices based on purpose, placement, and function within a network
- 27) Select appropriate devices for a given network design scenario
- 28) Justify device choices using technical reasoning and communication requirements

6. Addressing, Protocols, Routing, and Switching

Objective: *Students will explain how addressing and protocols support communication and apply core routing and switching concepts to network operations.*

- 29) Explain the purpose of protocols in networking
- 30) Describe the role of TCP/IP in digital communication
- 31) Identify how IP addressing supports device communication on a network
- 32) Explain the difference between routing and switching
- 33) Analyze how data paths are determined between source and destination devices
- 34) Apply protocol and addressing concepts to interpret basic network communication scenarios
- 35) Evaluate how routing and switching decisions affect network performance and reliability

7. Wireless Networking and Network Services

Objective: *Students will analyze wireless networking concepts and evaluate the services that enable users and devices to communicate securely and efficiently.*

- 36) Describe how wireless networking supports connectivity in modern environments
- 37) Identify common wireless standards and explain their purpose
- 38) Compare wired and wireless network implementations
- 39) Explain the role of common network services in communication and access
- 40) Analyze how service needs differ between small and large network environments
- 41) Evaluate wireless design considerations such as coverage, interference, speed, and access control

8. Network Security, Safety, and Risk Reduction

Objective: *Students will apply safe practices and evaluate strategies used to protect network infrastructure, devices, and data.*

- 42) Demonstrate safe handling of equipment, cables, and lab tools in networking environments
- 43) Explain common security risks that affect networked systems
- 44) Identify practices that reduce threats to network infrastructure and user data
- 45) Analyze vulnerabilities in wired and wireless network environments
- 46) Evaluate the role of authentication, permissions, and secure configuration in network protection
- 47) Recommend network security improvements for a given scenario
- 48) Justify responsible and ethical behavior when managing network access and digital resources

9. Network Troubleshooting and Performance Analysis

Objective: *Students will apply diagnostic strategies to identify, analyze, and resolve common network problems.*

- 49) Explain the purpose of systematic troubleshooting in networking
- 50) Identify common connectivity, hardware, configuration, and performance issues
- 51) Apply troubleshooting models to isolate network problems
- 52) Interpret symptoms to determine possible causes of failure
- 53) Test and revise solutions based on observed evidence
- 54) Document troubleshooting steps, findings, and outcomes clearly
- 55) Evaluate the effectiveness of a solution using performance and reliability criteria

10. Work-Based Learning and Professional Practice

Objective: *Students will apply networking knowledge and professional behaviors in authentic workplace contexts.*

- 56) Apply technical networking skills during hands-on labs, simulations, or service-based tasks
- 57) Demonstrate punctuality, organization, and accountability during project work
- 58) Communicate technical information clearly to peers, instructors, or stakeholders
- 59) Document procedures, configurations, and troubleshooting steps using professional language

- 60) Evaluate their own work processes and identify areas for improvement
- 61) Reflect on how workplace expectations influence technical decision making

11. Leadership and Collaborative Network Operations

Objective: *Students will demonstrate leadership and collaboration skills while contributing to shared technical goals and team-based problem solving.*

- 62) Collaborate with team members to design, build, test, or troubleshoot network solutions
- 63) Demonstrate leadership by organizing tasks, supporting peers, and contributing to team goals
- 64) Practice respectful communication during technical discussions and critiques
- 65) Evaluate team processes and individual contributions
- 66) Defend technical decisions using evidence and networking concepts
- 67) Reflect on leadership growth and set goals for continued improvement

12. Final Assessment Project

Objective: *Students will design, document, test, and present a networking solution that demonstrates technical knowledge, problem solving, and professional communication.*

- 68) Design a network solution for a defined scenario, user group, or organizational need
- 69) Develop documentation that explains the network structure, devices, media, and services used
- 70) Apply addressing, connectivity, and security concepts within the project design
- 71) Test the proposed network for functionality and reliability
- 72) Troubleshoot issues identified during implementation or simulation
- 73) Present and justify design choices using appropriate networking terminology
- 74) Evaluate project outcomes and recommend next steps for improvement or expansion

13. Career and Technical Student Organizations

Objective: *Using the CTSO Resource Document, chapter activities will provide some of the best opportunities CTSO members will have to learn by doing. A successful program of work creates a positive learning atmosphere in the classroom. CTSO members learn how to accept responsibility, work as a team, manage a budget, and handle success and failure. Per the CTE Admin Handbook, CTSOs are embedded into curriculum.*

Professional Development

Prepare each member for entry into the workforce and provide a foundation for success in a career. Becoming a professional does not stop with acquiring a skill, but involves an increased awareness of the meaning of good citizenship and the importance of labor and management in the world of work.

Community Service

Promote and improve goodwill and understanding among all segments of the community through services donated by CTSO chapters, and to instill in its members a lifetime commitment to community service.

Business and Industry Connections

Increase awareness of quality job practices and attitudes, and increase the opportunities for employer engagement and eventual employment.

Financial Leadership

Plan and participate in activities to allow all members to carry out the chapter's projects. Educate members on their own personal finance for current and future success.

Public Relations

Make the general public aware of the good work that students in career and technical education are doing to better themselves and their community, state, nation, and world.

Social Activities

To increase cooperation in the school and community through activities that allow CTSO members to get to know each other in something other than a business or classroom setting.

Academic Standards Alignment

Colorado CTE courses are required to integrate academic and essential skills into course content. The following academic standards have been identified as aligned to this course and should be integrated throughout instruction.

[CO CTE Academic Standards Resources](#) (Rubrics, integration strategies, etc)

[CDE Colorado Academic Standards Online](#) (Online standards lookup tool)

Note: Mathematics and Science standards will be added in the future. Visit the [Colorado Academic Standards](#) page for the most current version.

Reading, Writing and Communicating Crosswalk

Course: Networking

Colorado Academic Standards – Reading, Writing, and Communicating

Standard	Prepared Graduate Competency	Description	Course Evidence / Alignment
Standard 1: Oral Expression and Listening	Prepared Graduate 1 – Collaboration	Collaborate effectively as group members or leaders	Students collaborate during network design labs, troubleshooting activities, and team-based problem-solving tasks that require active listening and coordination.
Standard 1: Oral Expression and Listening	Prepared Graduate 2 – Oral Presentations	Deliver effective oral presentations	Students explain network designs, OSI layer functions, troubleshooting approaches, and security considerations to peers and instructors.
Standard 2: Reading for All Purposes	Prepared Graduate 4 – Informational Texts	Read a wide range of informational texts	Students read and interpret technical networking documentation, protocols, standards, diagrams, and

			industry resources.
Standard 2: Reading for All Purposes	Prepared Graduate 5 – Language in Context	Understand how language functions in different contexts	Students use precise networking terminology and adapt communication when explaining concepts to technical peers versus non- technical audiences.
Standard 3: Writing and Composition	Prepared Graduate 7 – Informational Writing	Craft informational/explanatory texts	Students produce written documentation such as network diagrams, configuration notes, lab reports, and troubleshooting explanations.
Standard 3: Writing and Composition	Prepared Graduate 9 – Writing Process	Demonstrate mastery of the writing process	Students revise and refine technical documentation to ensure clarity, accuracy, and professional presentation.
Standard 4: Research Inquiry and Design	Prepared Graduate 10 – Research and Ethics	Gather and ethically use information	Students research networking technologies, protocols, and standards organizations, evaluate sources, and apply information ethically and responsibly.

Free Resource Links

1. Career Exploration and Postsecondary Opportunities

- CompTIA IT Pathways (certifications, networking careers, industry pathways)
<https://www.comptia.org/content/it-careers-path-roadmap>
- O NET Online Technology Careers (job roles, skills, work environments)
<https://www.onetonline.org>
- CareerOneStop IT Careers (career exploration, job outlook, education pathways)
<https://www.careeronestop.org/ExploreCareers/explore-careers.aspx>
- Colorado Community Colleges (postsecondary programs, degrees, certificates)
<https://cccs.edu>

2. Foundations of Networked Systems

- Cisco Networking Basics (network fundamentals, communication, infrastructure)
<https://skillsforall.com>
- Computer Hope Networking Guide (network basics, terminology, concepts)
<https://www.computerhope.com>
- Khan Academy Internet Introduction (internet basics, networking overview)
<https://www.khanacademy.org/computing>
- IBM Networking Overview (network purpose, architecture, systems)
<https://www.ibm.com/topics/networking>

3. Network Models and Data Communication

- Cisco OSI Model Guide (OSI layers, data communication, protocols)
<https://www.cisco.com>
- Cloudflare Learning Center OSI Model (layers, data flow, networking models)
<https://www.cloudflare.com/learning/ddos/glossary/open-systems-interconnection-model-osi/>
- GeeksforGeeks OSI Model (protocol layers, encapsulation, communication)
<https://www.geeksforgeeks.org/osi-model/>
- TechTarget Networking Models (OSI vs TCP IP, communication processes)
<https://www.techtarget.com>

4. Network Media Topologies and Infrastructure

- Cisco Network Topologies (topologies, infrastructure design, configuration)
<https://www.cisco.com>
- Network Encyclopedia Cabling Types (twisted pair, fiber, coaxial media)
<https://networkencyclopedia.com>
- Electronics Tutorials Network Topology (physical design, layouts, performance)
<https://www.electronics-tutorials.ws>
- Fiber Optic Association (fiber media, cabling, infrastructure standards)
<https://www.thefoa.org>

5. Network Devices and Connectivity

- Cisco Networking Devices Overview (routers, switches, connectivity)
<https://www.cisco.com>
- HowToGeek Networking Hardware Guide (devices, functions, network setup)
<https://www.howtogeek.com>
- Network Direction Device Comparison (switches vs routers, network devices)
<https://networkdirection.net>
- GeeksforGeeks Networking Devices (hardware, roles, connectivity)
<https://www.geeksforgeeks.org>

6. Addressing Protocols Routing and Switching

- Cisco TCP IP Basics (protocols, addressing, routing)
<https://www.cisco.com>
- Cloudflare IP Address Guide (IP addressing, packet movement)
<https://www.cloudflare.com/learning>
- IBM TCP IP Overview (communication protocols, addressing systems)
<https://www.ibm.com>
- GeeksforGeeks Routing and Switching (routing concepts, switching processes)
<https://www.geeksforgeeks.org>

7. Wireless Networking and Network Services

- Cisco Wireless Networking Basics (wireless standards, connectivity, design)
<https://www.cisco.com>
- Intel Wireless Networking Guide (WiFi standards, performance, connectivity)
<https://www.intel.com>
- Electronics Tutorials Wireless Networks (wireless types, design considerations)
<https://www.electronics-tutorials.ws>
- TechTarget Network Services (network services, communication, applications)
<https://www.techtarget.com>

8. Network Security Safety and Risk Reduction

- CISA Cybersecurity Resources (network security, risk reduction, protection)
<https://www.cisa.gov>
- Stay Safe Online (cyber hygiene, security awareness, safety practices)
<https://staysafeonline.org>
- Kaspersky Network Security Basics (threats, vulnerabilities, protection)
<https://www.kaspersky.com/resource-center>
- Cisco Network Security Fundamentals (secure networking, risk prevention)
<https://www.cisco.com>

9. Network Troubleshooting and Performance Analysis

- Cisco Troubleshooting Guide (network diagnostics, troubleshooting methods)
<https://www.cisco.com>
- CompTIA Troubleshooting Process (diagnostic steps, problem solving, analysis)
<https://www.comptia.org>

- Lifewire Network Troubleshooting (common issues, solutions, diagnostics)
<https://www.lifewire.com>
- SolarWinds Networking Tools (monitoring, troubleshooting, performance analysis)
<https://www.solarwinds.com>

10. Work Based Learning and Professional Practice

- LinkedIn Learning IT Skills (professional development, technical skills)
<https://www.linkedin.com/learning>
- Indeed Career Guide IT (communication, workplace readiness, skills)
<https://www.indeed.com/career-advice>
- Google IT Support Resources (technical support, workplace tools, communication)
<https://grow.google>
- Coursera IT Professional Certificates (technical training, applied skills)
<https://www.coursera.org>

11. Leadership and Collaborative Network Operations

- MindTools Leadership Skills (leadership, teamwork, communication)
<https://www.mindtools.com>
- Harvard Business Review Leadership (teamwork, collaboration, decision making)
<https://hbr.org>
- Toastmasters Leadership and Communication (presentation, communication skills)
<https://www.toastmasters.org>
- Atlassian Teamwork Guide (collaboration, project coordination, teamwork)
<https://www.atlassian.com/team-playbook>

12. Final Assessment Project

- GitHub (project documentation, collaboration, version control)
<https://github.com>
- Cisco Packet Tracer (network simulations, design, testing)
<https://skillsforall.com/resources/lab-downloads>
- CodeHS Networking Projects (hands on projects, networking applications)
<https://codehs.com>
- Microsoft Learn Labs (hands on training, networking labs, configuration)
<https://learn.microsoft.com/training>



Technology Student Association – National Competitive Events

Webmaster

Objective: *Students will design, build, launch, test, document, and explain a multi-page website that addresses the annual TSA Webmaster design challenge.*

- Research the annual TSA Webmaster topic and identify the website's purpose, audience, content needs, and technical requirements.
- Plan the website structure using a sitemap, wireframes, page layouts, or other web design planning tools.
- Develop a multi-page website that communicates the team's solution to the annual theme and problem.
- Apply technical practices related to file management, links, navigation, accessibility, usability, browser compatibility, and responsive layout.
- Launch the website on a publicly accessible web server according to TSA submission requirements.
- Test and troubleshoot the website for broken links, layout errors, access issues, readability, and functional problems.
- Participate in an interview explaining the website, technical decisions, research, troubleshooting process, and development workflow.

Resources

- Technology Student Association – Webmaster competition guidelines
<https://tsaweb.org/competitions-programs/tsa/themes-problems>
- Mozilla Developer Network – HTML, CSS, and JavaScript documentation
<https://developer.mozilla.org/>
- W3Schools – Web development tutorials
<https://www.w3schools.com/>
- GitHub Pages – Website hosting for student projects
<https://pages.github.com/>



Technology Student Association – National Competitive Events

Software Development

Objective: *Students will design, develop, document, test, and present a software application that responds to the annual TSA Software Development challenge.*

- Analyze the annual TSA Software Development challenge and identify the intended users, purpose, and functional requirements.
- Plan the software application using appropriate design tools such as pseudocode, flowcharts, diagrams, wireframes, or system diagrams.
- Develop a functioning software product using programming practices appropriate to the selected platform.
- Create documentation that explains the software purpose, development process, features, testing, and revisions.
- Apply quality assurance practices through testing, debugging, and refinement.
- Prepare a presentation or demonstration that explains the software solution and development decisions.
- Evaluate the final software using TSA criteria for functionality, design quality, documentation, usability, and presentation.

Resources

- Technology Student Association – Software Development competition guidelines
<https://tsaweb.org/competitions-programs/tsa/themes-problems>
- GitHub Docs – Version control and project collaboration
<https://docs.github.com/>
- Visual Studio Code Documentation
<https://code.visualstudio.com/docs>
- Cisco Packet Tracer
<https://www.netacad.com/courses/packet-tracer>