



Computer Engineering IV: Networking and Troubleshooting

Course Information

Grade(s):	11-12
Discipline/Course:	Technology Education
Course Title:	Computer Engineering IV: Networking and Troubleshooting
Prerequisite(s):	Computer Engineering III: Computer Repairs; Computer-Control Circuits <i>or</i> Computer Engineering III: Computer Repairs, Computer-Control Circuits (Semester) with teacher's permission
Course Description: <i>Program of Studies</i>	The dive into Information Technology (IT) continues as we explore the fundamentals of Networking. This course focuses on the standards aligned to CompTIA Network+ (a standard IT certification) expanding on 'how a computer works'. Projects revolve around the building and maintaining a local area network with several computers and servers. Topics will include: networking & network connectivity, data transmissions & communication, servers & operating systems, cloud computing, network Security, network troubleshooting, designing and installing a network. The content of this course is aligned with CompTIA Network+ standards.
Course Essential Questions:	<ul style="list-style-type: none"> ● How do devices on a network communicate? ● How has the increase in data flow impacted networks? ● Why is it important to protect a network? ● What hardware is necessary to build a network? ● What software is necessary to build a network? ● What tools are available to maintain a network? ● How has artificial intelligence affected networking?
Course Enduring Understandings:	<ul style="list-style-type: none"> ● Devices on a network communicate using hardware and software. ● A network must be protected through maintenance in order to keep data flowing safely and efficiently. ● Artificial Intelligence affects networking and should be carefully handled to ensure the network is protected properly.

Credits/ Duration:	1 credit(s) / 1 year
Course Materials/Resources:	CompTIA Network+
FPS Course Academic Expectation(s):	SE: Synthesizing and Evaluating UC: Using Communication Tools
Year at a Glance (Units)	Unit 1 - Introduction to Networking (3 weeks) Unit 2 - Network Connectivity (8 weeks) Unit 3 - Data Transmissions & Communication (8 weeks) Unit 4 - Servers & Operating Systems (8 weeks) Unit 5 - Network Security (4 weeks) Unit 6 - Cloud Computing (3 weeks) Unit 7 - Network Troubleshooting (3 weeks) Unit 8 - Designing and Installing a Network (3 weeks)

Unit Number and Title:	Unit 1 - Introduction to Networking
Duration:	3 weeks
Resource(s):	N/A
Unit Overview:	Discuss the usefulness of a computer network and the basic configurations.
Learning Goals	
Standard(s):	<u>Connecticut Technology Education:</u> CADD.02.06 Send and access information through a network. CADD.04.03 Define and apply computer terminology AVC.05 Analyze and apply laws affecting communication enterprises to maintain up-to-date compliance with key regulations influencing the industry. <u>CompTIA Network+:</u> 1.1 OSI model layers and encapsulation concepts 1.2 Network topologies 1.4 IPv4 vs IPv6 1.7 Common Protocols 2.1 Network Devices
Essential Question(s):	<ul style="list-style-type: none"> ● What is a computer network? ● What is “network topology”? ● How do computers communicate with each other? ● How does digital citizenship affect being a network administrator?
Enduring Understanding(s):	<ul style="list-style-type: none"> ● Network topology defines how devices on a network are physically connected to each other. ● Network configurations can enhance security and improve network performance. ● Computer networks enable access to resources and information. ● Computer networks enable entertainment and recreation.

<p>Learning Goal(s): <i>Students will be able to use their learning to:</i> (Content/ Skills)</p>	<p>Content: (Students will know...)</p> <ul style="list-style-type: none">● OSI and TCP/IP are different network models.● devices communicate to one another through a network.● artificial intelligence plays an important role in networking. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none">● explain the different network topologies.● discuss common network protocols.● identify hardware used to build a computer network.● consider the impact of digital citizenship on a network administrator.
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Unit Number and Title:	Unit 2 - Network Connectivity
Duration:	8 weeks
Resource(s):	Computers, Lab tools and equipment, various consumables
Unit Overview:	How are devices connected to a computer and what role does WIFI play in connecting to a network system?
Learning Goals	
Standard(s):	<u>Connecticut Technology Education:</u> CADD.02.06 Send and access information through a network. CADD.04.03 Define and apply computer terminology <u>CompTIA Network+:</u> 1.3 Cable types 2.2 Bandwidth management 2.4 Antenna Types 5.2 Troubleshooting and tools 5.4 Interference
Essential Question(s):	<ul style="list-style-type: none"> ● What type of network connections exist? ● What are the advantages/disadvantages to connecting to a network with a wire? Wireless? ● How is data transmitted from one device to another? ● What types of wireless technologies exist?
Enduring Understanding(s):	<ul style="list-style-type: none"> ● There are various different ways to connect to a network such as Ethernet. ● 802.11 WIFI is a standard network connection method. ● There are various categories of ethernet cables depending on the project at hand.
Learning Goal(s):	Content: (Students will know...)

*Students will be able to use
their learning to:*
(Content/ Skills)

- the different categories of ethernet cables.
- there are differences between copper wire, fiber “wire” and wireless connectors.
- the 802 standard (specifically 802.3 & 802.11)
- the properties of light
- fiber-optic cable characteristics as they relate to transmission of data.
- wireless networking advantages and disadvantages.

Skills: (Students will be able to...)

- make an RJ-45 Ethernet Cable.
- connect devices on a network.
- apply 802.3 and 802.11 standards.
- setup a wireless network.

Unit Number and Title:	Unit 3 - Data Transmissions & Communication
Duration:	8 weeks
Resource(s):	Computers, Lab tools and equipment, various consumables
Unit Overview:	Data travels in packets which must be encoded and decoded.
Learning Goals	
Standard(s):	<u>Connecticut Technology Education:</u> CADD.02.06 Send and access information through a network. CADD.04.03 Define and apply computer terminology <u>CompTIA Network+:</u> 1.1 OSI Model & TCP/IP 1.2 Satellite, cable, leased line, and DSL 1.4 Configure a subnet and use appropriate IP addressing schemes 1.5 FTP, SFTP, TFTP, HTTP, SMTP, POP, IMAP 1.6 DHCP 1.8 Virtual Private Network 2.1 Bridge, Hub Switch, Router, Cable Modem, DSL Modem 2.1 VoIP 2.2 Routing protocols 2.3 VLAN 3.1 Cyclical Redundancy Checks 5.3 Protocol Analyzer
Essential Question(s):	<ul style="list-style-type: none"> ● What is the process for data to be sent through a network? ● What is ethernet? ● What are protocols? ● What is the difference between IPv4 and IPv6?

	<ul style="list-style-type: none"> • What is a Router? Bridge? Hub? Switch? • Why is a VLAN useful? • What are the fundamentals of voice and audio signals? • What is HTTP? FTP? SMTP? POP? IMAP?
Enduring Understanding(s):	<ul style="list-style-type: none"> • Data is transmitted from a sender to a receiver within packets. • An IP address is a unique identifier for a network device. • DNS (Domain Name System) are easy to remember names for online sources such as websites. • DHCP (Dynamic Host Configuration Protocol) assigns IP addresses to devices. • A Router must be used to establish a home network. • Web services are used on a regular basis via Universal Resource Locators (URLs).
Learning Goal(s): <i>Students will be able to use their learning to:</i> (Content/ Skills)	<p>Content: (Students will know...)</p> <ul style="list-style-type: none"> • digital signals and digital encoding. • data encoding, transmission and the OSI model. • IPv4 addressing. • what a firewall does. • understand latency. • the difference between: “Internet”, “Intranet”, and “Extranet”. • a major telecommunications system has various parts. • VPNs and their use. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none"> • use network protocol analyzer to encode/decode transmissions. • interpret the structure and contents of a UDP frame. • assign IP addresses to nodes (static or DHCP). • connect to a public DNS. • use common ports to allow data onto a network. • configure a router. • build a VLAN. • transmit video and audio signals. • use common protocols to direct data.

	<ul style="list-style-type: none"> demonstrate remote access.
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Unit Number and Title:	Unit 4 - Operating Systems & Servers
Duration:	8 weeks
Resource(s):	Computers, Lab tools and equipment, various consumables
Unit Overview:	Computers, Lab tools and equipment, various consumables
Learning Goals	
Standard(s):	<u>Connecticut Technology Education:</u> CADD.02.06 Send and access information through a network. CADD.04.03 Define and apply computer terminology <u>CompTIA Network+:</u> 1.1 OSI Model and TCP/IP 1.2 Storage Area Network 1.5 FTP, SSH, Telnet, NFS 1.7 Datacenter Network Architecture 5.3 Command line tools 5.5 Collisions 5.5 DNS Issues
Essential Question(s):	<ul style="list-style-type: none"> What is the advantage to Windows Server? Linux Server? What is an active directory? What is RAID? What is a NAS? What are the different server types and services? What is virtualization?

Enduring Understanding(s):	<ul style="list-style-type: none"> ● A server needs a specific operating system for a given purpose. ● An Active Directory structure has domains, trees and forests. ● There are differences and benefits to Windows Server OS vs Linux servers. ● Microsoft peer-to-peer network is different from a Microsoft client/server network.
Learning Goal(s): <i>Students will be able to use their learning to:</i> (Content/ Skills)	<p>Content: (Students will know...)</p> <ul style="list-style-type: none"> ● different server operating systems. ● how networking protocols evolved. ● the uses and features of Windows Server. ● describe UNIX/Linux servers operating systems. ● describe macOS Server. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none"> ● select operating system for specific uses. ● setup a server to perform a given task on the network. ● build an active directory on Local Area Network. ● create a virtual machine. ● demonstrate the use of a server operating system. ● apply RAID. ● work in a virtualized environment.

Unit Number and Title:	Unit 5 - Network Security
Duration:	4 weeks
Resource(s):	Computers, Lab tools and equipment, various consumables
Unit Overview:	Security of a network is a top priority to prevent unwanted attacks.
Learning Goals	
Standard(s):	<u>Connecticut Technology Education:</u> CADD.02.06 Send and access information through a network. CADD.04.03 Define and apply computer terminology <u>CompTIA Network+:</u> 1.5 SSL, TSL, SSH 2.1 Firewall 2.4 SSID, WPA, WPA2 3.2 Hardening and Security policies 4.2 Common types of attacks 4.4 Remote access methods 4.5 Physical security 5.3 Protocol Analyzer/Packet Capture
Essential Question(s):	<ul style="list-style-type: none"> ● What physical methods of security are necessary to protect a network? Digital? ● What is a firewall? ● How can a wireless network be protected?
Enduring Understanding(s):	<ul style="list-style-type: none"> ● A layered approach to security is required to protect networks from different types of attacks. ● A firewall monitors and controls incoming network traffic based on predetermined security rules, thus protecting a network. ● Since wireless networks are inherently less protected than hardwired networks they should use

	strong authentication protocols.
Learning Goal(s): <i>Students will be able to use their learning to:</i> (Content/ Skills)	Content: (Students will know...) <ul style="list-style-type: none"> ● network vulnerabilities or security breaches. ● networks have general security measures. ● there are different authentication protocols. Skills: (Students will be able to...) <ul style="list-style-type: none"> ● use various network security tools. ● create secure data that uses encryption and/or authentication. ● physically secure a network. ● apply security measures to a Local Area Network. ● use a firewall to prevent unwanted data.

Unit Number and Title:	Unit 6 - Cloud Computing
Duration:	3 weeks
Resource(s):	Computers, lab tools and equipment, various consumables
Unit Overview:	Much of our data is now in “The Cloud”, but what exactly does this mean?
Learning Goals	
Standard(s):	<u>Connecticut Technology Education:</u> CADD.02.06 Send and access information through a network. CADD.04.03 Define and apply computer terminology <u>CompTIA Network+:</u> 1.8 Summarize cloud concepts and connectivity options
Essential Question(s):	<ul style="list-style-type: none"> • What is cloud computing?
Enduring Understanding(s):	<ul style="list-style-type: none"> • Cloud computing is a way to access computing resources over the internet, instead of having to own and maintain your own infrastructure. • Cloud computing, by eliminating the need to purchase infrastructure can save money on IT costs.
Learning Goal(s): <i>Students will be able to use their learning to:</i> (Content/ Skills)	Content: (Students will know...) <ul style="list-style-type: none"> • various cloud deployment models. • specific cloud implementations. Skills: (Students will be able to...)

	<ul style="list-style-type: none"> ● use a cloud service to transmit data. ● exemplify cloud computing. ● explore various types of cloud computing
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Unit Number and Title:	Unit 7 - Network Troubleshooting
Duration:	3 weeks
Resource(s):	Computers, lab tools and equipment, various consumables
Unit Overview:	When something goes wrong how can it be fixed? Troubleshooting is essential to solving any problem.
Learning Goals	
Standard(s):	<u>Connecticut Technology Education:</u> CADD.02.06 Send and access information through a network. CADD.04.03 Define and apply computer terminology <u>CompTIA Network+:</u> 3.1 Latency and Jitter 3.3 UPS 5.1 Explain the network troubleshooting methodology.
Essential Question(s):	<ul style="list-style-type: none"> ● What happens if a network loses power? ● How can a network be recovered? ● On what layer of the OSI model might a problem exist? ● What is the WIFI password?
Enduring Understanding(s):	<ul style="list-style-type: none"> ● Networks are complex systems with different components, and any can fail at any time. ● When troubleshooting a problem it is important to gather as much information as possible.

	<ul style="list-style-type: none"> ● Power loss can be caused by a variety of things such as natural causes, power outages and equipment failure.
Learning Goal(s): <i>Students will be able to use their learning to:</i> (Content/ Skills)	<p>Content: (Students will know...)</p> <ul style="list-style-type: none"> ● common network issues ● power backup scenarios ● system recovery strategies and methods. ● common wireless connectivity problems. <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none"> ● demonstrate the troubleshooting process. ● identify which layer of the OSI a problem is related to. ● use tools to identify and resolve a network problem. ● install/use a UPS ● discover problems on a network. ● use the proper tool(s) to resolve an issue.

Unit Number and Title:	Unit 8 - Designing and Installing a Network
Duration:	3 weeks
Resource(s):	Computers, lab tools and equipment, various consumables
Unit Overview:	This is the part of a network a typical user does not see. What does it take to create a network?
Learning Goals	
Standard(s):	<u>Connecticut Technology Education:</u> CADD.02.06 Send and access information through a network. CADD.04.03 Define and apply computer terminology <u>CompTIA Network+:</u> 1.2 Termination - Demarcation Point, Smart Jack 1.3 Termination Points - 66 Block, 110 Block, Patch Panel 1.7 Backbone
Essential Question(s):	<ul style="list-style-type: none"> • What hardware is needed to build a network?
Enduring Understanding(s):	<ul style="list-style-type: none"> • Network design is a process, not a product. • Networks must be scalable and flexible, as well as reliable and secure.
Learning Goal(s): <i>Students will be able to use</i>	Content: (Students will know...) <ul style="list-style-type: none"> • how to identify network specifications

<p><i>their learning to:</i> (Content/ Skills)</p>	<ul style="list-style-type: none">● names of organizations that develop important networking and electrical standards.● what is IEEE? ANSI? TIA?● what are the parts of a network classified as?● what is a “Home Router”? <p>Skills: (Students will be able to...)</p> <ul style="list-style-type: none">● create a list of factors to consider when designing a network● use network design tools to create a model● select a naming convention for a network.● use a structure to manage a network
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