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UNIT 6: NETWORKS, THE INTERNET, & IOT

Estimated Time in Hours: 24-27

<p><u>Big Idea(s)</u></p> <p>1 Ethics 3 Ubiquitous Connectivity 5 System Security 6 Adversarial Thinking 7 Risk 8 Implications</p>	<p><u>Enduring Understandings</u></p> <p>1.1, 1.2, 3.1, 3.2, 5.4, 6.1, 7.2, 8.1</p>	<p><u>Projects & Major Assignments</u></p> <ul style="list-style-type: none"> - Human Network - Build a Patch Cable - OSI Model Poster - Internet Widget (Code Lesson) - IOT Project - Detection System Presentation - Firewall Rules - Build Airgap Network
<p>Guiding Questions:</p> <ul style="list-style-type: none"> • How is the Internet organized and what role do standards and protocols play in keeping networks secure? • How does an adversary leverage connected networks to serve their purposes? • How do network security technologies keep our systems and data secure? 		
<p>Learning Objectives & Respective Essential Knowledge Statements</p>	<p>Materials</p>	<p>Instructional Activities and Classroom Assessments</p>
<p>3.1.1 LO: Students will explain how devices use layers to communicate across the Internet and describe the purpose of the layers EK: 3.1.1a</p>	<ul style="list-style-type: none"> • Notebook • Chart Paper • Yarn or String • “Computer Networks: Crash Course Computer Science #28.” <i>YouTube</i>, uploaded by CrashCourse, 13 Sep 2017, https://www.youtube.com/watch?v=3QhU9jd03a0&feature=youtu.be • [DOX3D!] Game: 	<p>Network Basics: (2-day lesson)</p> <p>In this lesson students learn how a network is formed and how it works.</p> <ul style="list-style-type: none"> • The lesson begins with a pre-assessment. Students brainstorm and list everything they know about networks on a piece of chart paper. Students are then put in groups of 5 - 7 students. The students are given a set of guidelines for a challenge to create a human network using the yarn or string. After the challenge, students reflect in their notebook on the strength of the network they developed and the weakness of the network they developed. Students then watch the Computer Networks video to understand what a network is and how it works.

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	<p>“Get the Game.” [d0x3d!], d0x3d.com, https://d0x3d.com/d0x3d/get_the_game.html</p>	<p>Following the video, the class discusses how networks carry two types of information, those that allow for the controlling of the data and the data itself. Students then play the [D0X3D!] Game.</p>
<p>3.1.1 LO: Students will explain how devices use layers to communicate across the Internet and describe the purpose of the layers EK: 3.1.1b</p>	<ul style="list-style-type: none"> • Notebook • “The Internet: Wires, Cables & Wifi.” Uploaded by Code.org, 6 Oct 2015, https://www.youtube.com/watch?v=ZhEf7e4kopM&feature=youtu.be • Cat5e Cable • RJ45 Jacks • Crimper Tool • Cable Tester 	<p>Understanding methods for sending data and the physical layer: (1-2-day lesson) In this lesson students learn how data can move through the network by wires, cables, or WiFi and build a physical patch cable.</p> <ul style="list-style-type: none"> • The lesson begins with students watching the video on Wires, Cables and WiFi. Following the video there is a discussion about how the wires, cables and WiFi are all a part of the physical layer. Students then build a physical cable. They follow the T-568B Wiring Standard. Once the students build the cable, it is tested using the cable tester to make sure it works properly. Students will use their cables later in the airgap network that they build later in the course. Students document the process of building the cable in their notebook and discuss the challenges they encountered.
<p>3.1.1 LO: Students will explain how devices use layers to communicate across the Internet and describe the purpose of the layers EK: 3.1.1b,c,d,e,f</p> <p>3.2.3 LO: Students will identify and distinguish between the</p>	<ul style="list-style-type: none"> • Notebook • Window Notes Sheet (access a blank Window Notes template at https://toolsforclassroominstructionthatworks.com/wp-content/uploads/2018/01/Window-Notes.pdf) 	<p>Understanding the Internet & OSI Model: (2-day lesson) In this lesson students learn about how devices use layers to communicate across the internet and the purpose of the layers.</p> <ul style="list-style-type: none"> • This lesson begins with a quick write. Students are asked the following questions: “What is the internet?” and “Is the internet the same thing as the World Wide Web?” Students share out their thoughts. Students watch The Internet video and The World Wide Web video. Students

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<p>purposes of network security devices and technologies. EK: 3.2.3a,b</p> <p>7.2.4 LO: Students will be able to explain how the decentralized and dynamic nature of networked systems create the potential for a system to fail or behave incorrectly due a component the designer didn't even know existed. EK: 7.2.4a,b</p> <p>8.1.2 LO: Students will explain how the idea of the open internet led us to new innovations that impact our daily lives and our security. EK: 8.1.2a,b</p>	<ul style="list-style-type: none"> • Poster Paper • “The Internet: Crash Course Computer Science #29.” <i>YouTube</i>, uploaded by CrashCourse, 20 Sep 2017, https://www.youtube.com/watch?v=AEaKrq3SpW8&feature=youtu.be • “The World Wide Web: Crash Course Computer Science #30.” <i>YouTube</i>, uploaded by CrashCourse, 4 Oct 2017, https://www.youtube.com/watch?v=guvsH5OFizE&feature=youtu.be • Shaw, Keith. “The OSI model explained: How to understand (and remember) the 7-layer network model.” <i>Network World</i>, <i>NetworkWorld.com</i>, 22 Oct 2018, https://www.networkworld.com/article/3239677/the-osi-model-explained-how-to-understand-and- 	<p>take window notes during each video. After the videos, the class reflects on what they wrote during the quick write at the beginning of the hour and discusses what they have learned from the videos. The discussion is guided to the layers of the OSI model discussed in the video. After the discussion, students read the article on the OSI Model Explained. Students then create a poster of the OSI Model. The poster labels each layer, explains what the layer does, has an image to represent what happens at that layer and gives an example that the students learned from the videos. Students then play the Keeping Tradition Secure simulation. The lesson is wrapped up with a class discussion.</p>
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	<p>remember-the-7-layer-network-model.html</p> <ul style="list-style-type: none"> • “Keep Tradition Secure.” Texas A&M University Division of Information Technology, https://keeptraditionsecure.tamu.edu/ 	
<p>3.1.2 LO: Students will explain how network standards and protocols allow different types of devices to communicate. EK: 3.1.2a,b,c,d</p>	<ul style="list-style-type: none"> • “CS Principles 2020-2021 Unit 2 Lesson 3: The Need for Addressing.” <i>Code.org</i>, https://curriculum.code.org/csp-20/unit2/3/ • “The Internet: IP Addresses & DNS.” <i>YouTube</i>, uploaded by <i>Code.org</i>, 10 Sep 2015, https://www.youtube.com/watch?v=5o8CwafCxnU&feature=youtu.be 	<p>Need for Addressing: (1-day lesson) In this lesson students learn about communication protocols and DNS.</p> <ul style="list-style-type: none"> • In this lesson students learn about creating communication protocols through an unplugged scheduling activity. Students then use the internet simulator for the process. After the activity there is a class discussion and then the students watch the video on IP Addresses & DNS.
<p>1.1.1 LO: Students will analyze online and offline behaviors in societies, i.e., themselves, peers, families, communities, and countries, and deduce the values that govern these behaviors. EK: 1.1.1c</p>	<ul style="list-style-type: none"> • Notebook • KWL Chart (find example KWL chart at https://www.timvandevall.com/templates/kwl-chart-template/) • IOT Security & Privacy Podcast: 	<p>Understanding IOT: (9 - 10-day lesson) In this lesson students learn what IOT is and the security issues with IOT. Students program and interact with IOT devices.</p> <ul style="list-style-type: none"> • This lesson begins with a pre-assessment using a KWL Chart, students identify what they know about the Internet of Things. Students then listen to the IOT Security & Privacy podcast using the Do You Hear What I

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<p>1.2.2 LO: Students will give examples of where/how tools are used in ways that were not intended by the system designer. EK: 1.2.2a,b</p> <p>5.4.1 LO: Students will identify historical consequences of software and hardware vulnerabilities, e.g., power outages, death, theft of trade secrets from other sovereign nations. EK:5.4.1b,c,d</p> <p>5.4.2 LO: Students will predict how physical systems that rely on software may be vulnerable to future attacks. EK: 5.4.2a,b,c,d,e,f,g</p> <p>6.1.1 LO: Students will explain how cybersystems are complex systems. EK: 6.1.1a,b,c</p> <p>6.1.2 LO: Students will explain how complexity impacts the failure of cybersystems.</p>	<p>Schneier, Bruce and Henage, Dan. "Crypto-Gram February 15, 2017." <i>The Crypto-Gram Security Podcast</i>, Libsyn, 15 Feb 2017, https://hwcdn.libsyn.com/p/7/8/c/78cf9bdc0d407209/crypto-gram-17-02.mp3?c_id=14318562&cs_id=14318562&destination_id=19374&expiration=1595269963&hwt=5a61155e604f4fac61c5c73593dea94e</p> <ul style="list-style-type: none"> • IOT devices (micro:bits, arduino) • "BBC micro:bit Combination Lock." Club Make, <i>TechWillSaveUs.com</i>, https://make.techwillsaveus.com/microbit/activities/combination-lock • Munro, Ken. "Internet of Things Security TEDxDornbirn." <i>YouTube</i>, uploaded by TEDx Talks, 20 Sep 2018, 	<p>Hear strategy. Students are given a graphical organizer to capture their notes during this process. Students identify and discuss IOT devices they use on a daily basis and how those devices are used. The W section of the KWL chart is updated with questions that students have about IOT devices. Students are then split into 2 groups and each group is given a project with a different IOT device. One group completes a project with microbits (electronic safe), one group with arduinos (programming boebots with arduino). Once students complete the project they share out with the class. The class then discusses what they think the security issues are with the IOT projects they completed. Students then watch the IOT Security video or the IOT Helping or Harming video. The class discusses what they learned and added it to the KWL chart. Students then select an IOT device to research and write a report on that includes possible security issues.</p>
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<p>EK: 6.1.2a,b,c,d,e</p> <p>7.2.1 LO: Students will be able to explain how cyberspace is a very large, complex system of cybersystems that include hardware, software, social, economic, and political components.</p> <p>EK: 7.2.1a,b,c,d,e</p> <p>8.1.2 LO: Students will explain how the idea of the open internet led us to new innovations that impact our daily lives and our security.</p> <p>EK: 8.1.2d,e,f,g</p>	<p>https://www.youtube.com/watch?v=pGtnC1jKpMg&feature=youtu.be</p> <ul style="list-style-type: none"> • Barker, Rose. "Internet of Things: Are Smart Devices Helping or Harming? TEDxSalem." <i>YouTube</i>, uploaded by TEDx Talks, 5 Apr 2018, https://www.youtube.com/watch?v=ipdTUJclKWI&feature=youtu.be 	
<p>3.2.3 LO: Students will identify and distinguish between the purposes of network security devices and technologies.</p> <p>EK: 3.2.3c,d,f,g</p> <p>7.2.4 LO: Students will be able to explain how the decentralized and dynamic nature of networked systems create the potential for a system to fail or behave incorrectly due a component the designer didn't even know existed.</p>	<ul style="list-style-type: none"> • Notebook • Window Notes Sheet (access a blank Window Notes template at https://toolsforclassroom/wp-content/uploads/2018/01/Window-Notes.pdf) • Poster Paper • Textbook: Stallings, William and Brown, Lawrie. <i>Computer</i> 	<p>Intrusion Detection, Firewalls and Intrusion Prevention Systems: (10-12-day lesson)</p> <p>In this lesson students learn about Intrusion Detection, Firewalls, and Intrusion Prevention Systems.</p> <ul style="list-style-type: none"> • Students read Chapter 8 in the textbook. After section 8.1, students create an intruders poster that has an image to represent each type of intruder and a definition next to the intruder. Students take Window Notes on section 8.2. & 8.3. Students are split up into 3 groups. Group 1 creates a presentation on section 8.4 - Host-Based Intrusion Detection, Group 2 creates a presentation on section 8.5 - Network-Based Intrusion Detection, and Group 3 creates a presentation on section 8.6 - Distributed or Hybrid Intrusion Detection. Each

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EK: 7.2.4c,d,e	<p><i>Security: Principles and Practice, Third Edition.</i> Pearson, 2015.</p> <ul style="list-style-type: none">• Firewall Rules Worksheet• “Firewall Pi.” Cyber Pi Projects, <i>CyberPiProjects.com</i>, https://www.cyberpi.projects.com/cyber-security#/firewall-pi/• Raspberry Pi	<p>group then presents about their detection system. After section 8.7 students add key vocabulary into their notebooks. Students take Window notes on section 8.8 and 8.9. Students take a quiz on this chapter.</p> <ul style="list-style-type: none">• Students read Chapter 9 in the textbook and take window notes for each section. There is a class discussion on Firewalls and Intrusion Prevention Systems. Students complete a firewall rules worksheet. Students add key vocabulary from Chapter 8 & 9 in their notebook. The lesson is wrapped up with a discussion on risks with and how intrusion detection and prevention systems work. <p>Assessment: <i>Students set-up a basic airgap network. They create a Firewall Pi and implement it in the airgap network.</i></p>
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