Unit 2 Lesson 1

Welcome to the Internet

Resources

Unit 2 Lesson 2

Building a Network

Resources

Unit 2 Lesson 3

The Need for Addressing

Resources

Name(s)_____ Period _____ Date _____

Activity Guide - The Need for Addressing

Planning Your Week
You're trying to make plans to see your classmates. You need to meet with every classmate once during the week and can only meet with one person each day. Each time you complete the activity is a different week

Before completing the activity for each week
- If you are a group of 5, everyone cross out Sunday
- If you are a group of 4, everyone cross out Sunday and Saturday
- Before starting to schedule each week, choose a random day of that week when you're busy and cross it out

During the activity
- Talk with your group to fill in your schedule.
- Week 1 you can speak out loud. After that you can only talk on the Internet Simulator.

When you're done
- Go through each day of the week and point to the person you're scheduled to meet with
- Check that everyone's schedules agree

Week 1	
Day	**Classmate Name**
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	
Sunday	

Week 2	
Day	**Classmate Name**
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	
Sunday	

Week 3	
Day	**Classmate Name**
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	
Sunday	

Week 4	
Day	**Classmate Name**
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	
Sunday	

Communication Problems: As you use the simulator, record any problems you face and brainstorm solutions.

Problems Communicating	Potential Solutions

Group Rules: Make up a set of group rules your group think makes the most sense for communicating to complete this challenge. Include the ways messages should be formatted and some examples in the space below.

Explain your rules
Write some sample messages that follow your rules

Unit 2 Lesson 4

Routers and Redundancy

Resources

Teacher Guide - Routers & Redundancy

Before The Lesson

Testing the Simulator: It may be helpful to test the simulator ahead of time so you know what students will see. You can do this by having the Internet Simulator open in multiple tabs. The example below already has multiple routers setup and shows a teacher joining two separate routers, sending messages back and forth, then viewing the router logs to see how the messages traveled.

Router Preparation: In this lesson, students will be connecting to a central router according to their group number. It is helpful to have these routers setup ahead of time. It's also helpful to have extra routers with no one connected to them - even though students won't be using them directly, they will still relay messages during the last half of this activity.

To setup routers ahead of time, go to the Internet Simulator in Code Studio and press the Add Router button several times

During The Lesson

Responsible Messaging: This simulator can feel like an anonymous chat program and students may use this to try and send overly personal or non-school appropriate messages to each other. Here are some strategies to avoid this:

- **Be Proactive & Upfront**: let students know their messages are being monitored and can be traced back to their accounts. There is a 'Teacher View' button you can use to see the username of who sent individual messages (see below)
- **Avoid Downtime:** Unstructured time in the lesson can lead to off-task messages. As best as you can, try to keep the pace of the lesson moving so there is always something for students to do
- **Provide Specific Prompts:** This lesson includes several specific types of messages for students to send. There is never a point where students are asked to send 'whatever you want' to another student in the class.
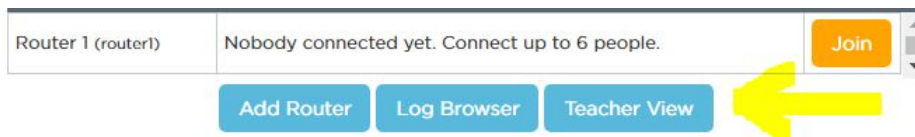
Unit 2 Lesson 5

Packets

### Resources

Name(s)_____ Period _____ Date _____

Activity Guide - Packets

Why Packets?
When you send messages over the Internet there's always a chance for errors. If you're sending a huge file, and in the middle of the transmission you have a single error, you'd need to resend the entire file. The solution to this problem is to split the message into smaller chunks called packets. While errors could still occur, now they'll only affect the single packet, rather than the entire message. This of course introduces new challenges that we'll explore in this activity.

Protocol 1 - Just Send All the Packets
Write a single sentence that uses 5 - 10 packets. Send all the packets at once to your partner. Then click "Log Browser". **Set the Router logs to "show my traffic" and "show all routers"**
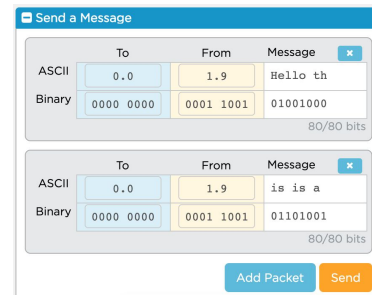
Question 1: Do all of the packets in your sent messages always follow the same path? If not, describe at least two different paths packets took.

_____

_____

_____

Question 2: Did every packet arrive in the correct order? Describe what went wrong and whether your partner was able to read the message. If neither you nor your partner had an issue try sending another message.

_____

_____

_____

Protocol 2 - Check for Errors
Create a protocol that will solve the problems you saw with Protocol 1 by doing some error-checking. The sender should be able to construct a single multi-packet message that is sent at once. Afterwards they can keep communicating to fix any errors in the transmission. Things to consider:
- How will the receiver know the order of the packets or if any are missing?
- How will the receiver request missing packets and what will the sender do in response?
- How will both sender and receiver know the full message arrived successfully?

Write the details of your protocol in the space below or the back of this sheet.

_____

_____

_____

_____

_____

Unit 2 Lesson 6

HTTP and DNS

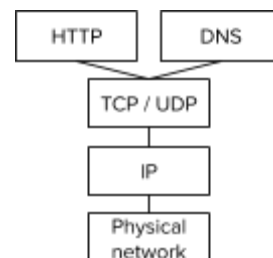### Resources

Name(s)_____ Period _____ Date _____

Activity Guide - Layers of the Internet

Layers of the Internet

The internet is actually made up of many protocols that all work together to move information around a vast network of devices. These protocols are designed to work together and build upon each other like layers, with higher layers relying on the ones below them.

Together these layers and protocols solve all the different problems necessary for the computer to work at a scale where billions of devices can communicate with one another.

Protocol / Layer	What Problem Does It Solve?	How Does It Work?
Physical Network	Physically connecting devices to one another so that information can move through the network.	Fiber optic cables, wifi signals, or copper wires physically connect the computers, smart phones, servers, etc. that make up the Internet. Computers don't need to be directly connected to each other, just a single point on the network.
IP: Internet Protocol	Uniquely identifying people on the internet and routing messages between them.	Each device on the internet is given a unique IP address. Packets sent on the internet include to and from IP addresses. Routers along the way use this information to move data along a path of direct connections. Routing happens dynamically, meaning the path is unpredictable and changes based on network conditions.
TCP: Transmission Control Protocol	Send large messages over the Internet when accuracy is most important. You would either use TCP or UDP.	Messages are divided into packets and sent all at once. Packets are numbered so that they can be re-ordered and missing packets can be requested by the receiver. TCP is slower than UDP because error checking like this takes more time, but it is much more reliable.
UDP: User Datagram Protocol	Send large messages over the Internet when speed is most important. You would either use TCP or UDP.	Messages are divided into packets and sent all at once. There is no error-checking to ensure all packets arrive or that they're in order. UDP is faster than TCP but more errors are possible. This is useful
DNS: Domain Name System	Translate human-readable domains like code.org or example.com into IP addresses that can be used by the Internet.	When you try to go to a domain like example.com, you computer first contacts a system of servers collectively called the DNS which keeps track of the IP addresses associated with each domain name. Communication with DNS servers happens over the Internet, meaning the request to and from servers are sent as TCP/IP packets.
HTTP: HyperText Transfer Protocol	Allow computers to request and share webpages, audio, images, videos, and other file types on the Internet, collectively known as the world wide web.	Computers communicate in plain text like GET to request files or send data. The server that receives the request responds with the files requested which are displayed by your browser. HTTP requests are sent between computers over the internet as part of TCP/IP packets. The world wide web is just files that are requested using HTTP and sent over the Internet.

Unit 2 Lesson 7

Project - Internet Dilemmas Part 1

Resources

Name(s)_____ Period _____ Date _____

Project Guide - Internet Dilemmas

CODE

Background

You are the Chief Technology Advisor for a candidate running for elected office. Your candidate is relying on you to help inform her about important technological dilemmas and come up with good policy ideas to address them. For this project you'll investigate a social dilemma related to the Internet and prepare a report summarizing your findings and making a policy recommendation for your candidate.

Step 1 - Pick Your Dilemma

Net Neutrality	Internet Censorship	The Digital Divide
Background: Internet users love services like streaming movies, video chatting, or online gaming. All of this content needs to travel over the Internet, however, and the companies that build and maintain networks are complaining about the increased demands being placed on their networks. Your candidate is hearing more and more about a debate called "net neutrality" and would like a more informed opinion as part of her platform.	**Background:** While the Internet is used to share many useful services and information, there are growing concerns about the way that the Internet can be used to spread damaging information ranging from national secrets to calls for violence. Censoring this information may provide some people with increased security, but potentially risks free speech and the safety of social and political activists. Your candidate would like to have a policy that balances these two concerns in a way that makes sense for our digital age.	**Background:** While technology is increasingly integrated into daily life, there are still many who lack access to the Internet or digital technology. In rural areas there are challenges building networks to connect geographically sparse populations, but even in cities some groups or areas have relatively less access to the Internet or knowledge of how to use it. Your candidate is worried that while technology is bringing social and economic benefits to many, there are others being left behind.
Core Question: When and how should internet service providers be allowed to treat some kinds of internet traffic different from others?	**Core Question:** When and how should the government be allowed to censor or block internet traffic, if at all?	**Core Question:** When and how should resources be invested to close gaps between those who do and don't use the Internet?
Impacted Groups ● Internet Service Providers (ISP) ● Internet Content Provider ● Everyday internet Users	**Impacted Groups** ● Everyday internet user ● Intelligence Agencies ● Political activists	**Impacted Groups** ● Those lacking internet access ● Internet Service Providers (ISP) ● Schools and libraries
Sources ● "How the end of net neutrality could change the internet" (video): link ● "'Net Neutrality' is ending. Here's how your internet could change" (article): link ● "Wikipedia - Net Neutrality": link	**Sources** ● "Free Speech Or Hate Speech: When Does Online Hate Speech Become A Real Threat?" (audio article): link ● "Internet Censorship Explained" (video): link ● Wikipedia - Internet Censorship: link	**Sources** ● "Eliminating the Digital Divide" (video): link ● "Internet/Broadband Fact Sheet" (article): link ● Wikipedia - the Digital Divide: link

Step 2 - Review the One-Pager and Rubric

Review the one pager template and rubric to make sure you understand what you'll be responsible for creating for this project and how it'll be evaluated.

Step 3 - Review the Concept Bank

This concept bank includes the key terms and concepts covered in this unit. Quickly review them before reading your articles so that you'll be ready to identify them in your articles. You can also refer to these as you complete your one-pager.

Protocols / Layers	Networks	Packets and Routing	World Wide Web	Internet Principles
Physical internet, IP, TCP, UDP, HTTP, DNS	Fiber optic cable, copper wire, wifi, router, path, direct connection, bandwidth	Packet metadata, IP addresses, dynamic routing,	Web pages, browsers, servers, domain, world wide web	Redundancy, fault tolerance, scalability, open protocols

Step 4 - Review Your Sources

Review the three sources provided or additional ones you find online. For each source take notes on instances when your impacted groups are mentioned or technical details are explained.

Source	Notes on Impacted Groups	Notes on Technical Details

Name(s)_____ Period _____ Date _____

Internet Dilemma Policy One Pager

To complete this one pager fill in each of the sections below. All text in italics is included to explain how to fill in the one pager and can be deleted before you submit.

Core Question
Copy and paste this directly from your dilemma above

Impacted Groups
Fill in the table below with your Impacted Groups. You may optionally add new groups or split one of the ones assigned into smaller subgroups if it will help better explain who's involved in the dilemma.

Impacted Group and Description	Interests, Benefits, and Harms
Group 1: Write the name of the group and provide a brief description / examples of who they are *Can be bullets*	*Explain the interests of this group, as well as ways that they could benefit or be harmed because of the dilemma.* *Can be bullets*
Group 2: Write the name of the group and provide a brief description / examples of who they are *Can be bullets*	*Explain the interests of this group, as well as ways that they could benefit or be harmed because of the dilemma.* *Can be bullets*
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Technical Background
Explain the technical background necessary to understand the problem. Include:

- *Background on layers / protocols / principles of the Internet necessary to understand the dilemma*
- *Use the concept bank on the first page to help brainstorm ideas to include. A strong description will reference several of these concepts*
- *Make sure your descriptions are approachable for your candidate, who does not have as strong of a background in the way the Internet works*
- *This can be completed in bullets*

Recommended Policy Solution
Give a recommendation for what policy or solution your candidate should advocate for. Your solution could be a law that should be passed or repealed, a government policy, or a technological solution your candidate should promote.

Recommended Policy: *In at most two sentences summarize the solution / action your candidate should support*	

Pros / Who Benefits
    ● *Can be bullets*
	Cons / Who is Harmed?
	    ● *Can be bullets*

Category	Extensive Evidence	Convincing Evidence	Limited Evidence	No Evidence
Completed research guide demonstrates use of multiple sources	Research guide indicates referencing three or more sources. provided are referenced	All three provided sources are referenced	Only one or two sources were referenced	No evidence that sources were used
Interests, benefits, and harms of all impacted groups are clearly explained	Interests, benefits, and harms for all groups, including possibly additional groups beyond the required three, are provided.	Interests, benefits, and harms of most groups are provided and accurate.	Interests, benefits, and harms are either limited, inaccurate, or incomplete.	No description of impacts on different groups
Technical details reflect an accurate and detailed understanding of the internet	Extensive technical details are provided demonstrating broad understanding of how the internet works	Many technical details are provided that accurately reflect how the internet works	Few technical details provided. Some may be inaccurate.	No technical details provided
Technical details are clear and described for a non-technical audience	All technical details are clear and easily read by a non-technical audience	Most of the technical details provided can be understood by a non-technical audience	Many of the technical details provided are confusing to a non-technical audience	No technical details provided
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Reasonable benefits and harms of the policy choice on different impacted groups are provided	Benefits and harms to all impacted groups are clearly explained	Benefits and harms to most impacted groups are clearly explained	Benefits and harms are limited or not tied to specific groups	No benefits and harms are provided

Unit 2 Lesson 8

Project - Internet Dilemmas Part 2

Resources

Name(s)_____ Period _____ Date _____

Project Guide - Internet Dilemmas

Background
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Name(s)_____ Period _____ Date _____

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Pros / Who Benefits • *Can be bullets*	**Cons / Who is Harmed?** • *Can be bullets*

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Name(s)_____ Period _____ Date

EXEMPLAR: Internet Dilemma Policy One Pager

Core Question
When and how should internet service providers be allowed to treat some kinds of internet traffic different from others?

Impacted Groups

Impacted Group and Description	Interests, Benefits, and Harms
Internet Service Providers (ISP) - The companies that build the networks that make up the Internet.	They would like to charge more for certain types of traffic to travel over their networks. This would make them more money. Many new services like Netflix also send huge amounts of data but aren't currently required to pay more for all that traffic. ISPs would like to charge more for "fast lanes"
Internet Content Providers - Companies like Netflix, Google, and others that build websites, apps, and services that use the Internet	They would prefer that ISPs could not charge them more money depending on who they are or the data they send. Large companies like Netflix would be giving up money. Small companies are worried they couldn't compete if bigger companies can pay for "fast lanes".
Consumers - Everyday citizens using the Internet	They'd like to have access to high quality services without paying lots of money. Fast lanes might make certain services work better but over the long term could prevent even better ones from being able to compete.

Technical Background

- Visiting a website actually means a company like Netflix sends you data
- This data travels over a network of wires and cables that ISPs build and maintain
- Big pieces of data like a movie are split into smaller pieces called packets to send to your computers
- Packets include numbers called IP addresses, that indicate who the information is going to and from.
- Data is sent through the network by computers called routers, they can see the IP address on a packet to know how to move through the packet through the network.
- Since ISPs own the routers, they can see this IP address to know who is sending data through their network.
- Some content, like streaming video, requires many more packets than other types, like an email, and also it's more important that it get sent quickly.
- ISPs can tell whether the data they're sending is a streaming video, which needs to move quickly, or an email, which could move relatively more slowly

Recommended Policy Solution

Policy: Allow ISPs to create fast lanes only for certain kinds of content like streaming video, but do not allow them to charge different companies different prices for the same data type.	
Pros / Who Benefits - Makes sure content that needs a fast lane still move quickly - Prevents large companies in a specific type of industry (e.g. streaming video) from crowding out small ones - Consumers still get the content they want with high speed content prioritized	**Cons / Who is Harmed?** - ISPs will be upset they can't charge more money - Streaming video might still crowd out other content types.

Unit 2 Lesson 9

Assessment Day

Resources