



# PACKET-SWITCHED NETWORKS

How the Internet Works  
Lesson 1 of 2

## Overview

Computer networks are built of hosts, data links, and routers. Routes are pathways that exist between two different hosts. Because there are many routes from one host to another, computer networks can be very resilient to the failure of routers and data links that exist between hosts. In order for data files to be sent from one host to another, they need to be split into smaller data packets. Packets from the same file can be sent over different routes.

This lesson provides a background introduction to the fundamental components of computer networks and illustrates visually how computer networks use packets to send large data files.



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## Standards

Standards are based on fifth-grade learning standards unless otherwise specified.

Computer Science
CSTA 1B-NI-04 AZ 5.NI.NCO.1 CSTA 1B-IC-18
CSTA Standards: <a href="https://www.csteachers.org/page/standards">https://www.csteachers.org/page/standards</a> AZ Computer Science: <a href="https://www.azed.gov/sites/default/files/2018/10/Arizona%20Computer%20Science%20Standards_3_5_Final%2006.24.2019.pdf?id=5bc90a611dcb2510102f55b8">https://www.azed.gov/sites/default/files/2018/10/Arizona%20Computer%20Science%20Standards_3_5_Final%2006.24.2019.pdf?id=5bc90a611dcb2510102f55b8</a>

Social Justice
NA
Learning for Justice: <a href="https://www.learningforjustice.org/sites/default/files/2021-11/LFJ-2111-Social-Justice-Standards-Anti-bias-framework-November-2021-11172021.pdf">https://www.learningforjustice.org/sites/default/files/2021-11/LFJ-2111-Social-Justice-Standards-Anti-bias-framework-November-2021-11172021.pdf</a>

English Language Arts
NA
AZ English Language Arts: <a href="https://www.azed.gov/sites/default/files/2016/12/5th%20Grade%20ELA%202016%20Final.pdf?id=585aa90eaadebe12481b8443">https://www.azed.gov/sites/default/files/2016/12/5th%20Grade%20ELA%202016%20Final.pdf?id=585aa90eaadebe12481b8443</a>

Math
AZ 5.MP.2
AZ Math: <a href="https://www.azed.gov/sites/default/files/2016/12/Math%20Final%2005Fifth%20Grade%20Standards%204">https://www.azed.gov/sites/default/files/2016/12/Math%20Final%2005Fifth%20Grade%20Standards%204</a>

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[2\\_2018.pdf?id=58546f66aadebe13008c1a31](#)

## Social Science

NA

AZ History and Social Studies:

<https://www.azed.gov/sites/default/files/2018/10/3-5%20Grade%20Band%20Standards%20at%20a%20Glance%206.10.19.pdf?id=5bd772a61dcb250b94e916ef>

## Learning Outcomes

By the end of this lesson, students will be able to:

- Identify fundamental pieces of computer network architecture, including: hosts, routers, and data links
- Describe how files and data streams are broken up into smaller packets before being sent from one computer to another

## Background

Computer networks are made up of three basic components: hosts, routers, and data links. To understand how each of these pieces work together to send large data files from one computer to another, watch these videos:

<https://www.youtubekids.com/watch?v=AYdF7b3nMto>

You may want to show this video to your students before or after the activities in the lesson plan.

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## Lesson Plan

Total time: **25 minutes**

Time	Teacher is...	Students are...	Materials needed
7 minutes	<p>Leading students in an exploratory talking circle or journaling activity by asking the following questions:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> <i>What is the Internet?</i></li> <li><input type="checkbox"/> <i>How does the Internet work?</i></li> </ul>	<p>Answering the teacher's questions and building on each other's responses.</p> <p>Possible responses:</p> <ul style="list-style-type: none"> <li>• The Internet is the web</li> <li>• The Internet is Google Chrome, Firefox, Safari...</li> <li>• The Internet is how I find information</li> <li>• The Internet works by downloading a video</li> </ul>	<p>A space for students to sit in a circle OR student science journals for reflection</p>
5 minutes	<p>Introducing students to the concept of packet switched networks. You can draw out the example using Slides 1 and 3 in <a href="#">Figures</a> for inspiration.</p> <p><i>A computer network works by sending data from one computer to another over <b>data links</b>. On the pathway between two computers, there are special computers called <b>routers</b>, which help figure out where the data needs to go. When many data links are used to connect different computers and routers, they form a network.</i></p>	<p>Listening and answering a teacher's questions that check for understanding.</p>	<p>A space for students to sit in a circle</p> <p>Whiteboard or projector/presentation monitor</p>

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	<p><i>This is kind of like how roads work. When you try to drive from one place to another, you have to use roads to travel. Usually, there is not just one straight road that takes you to the place you want to go. Instead, you need to go to different intersections with street signs and turn left or right onto different roads that form a pathway, or <b>route</b>, to your final destination.</i></p> <p><input type="checkbox"/> <i>Can you think about what happens when your normal route is blocked because of road work or a flood? Have to take a detour or another route</i></p> <p><i>In the same way, when one route is blocked or traffic-jammed on the Internet, it is possible for data to travel over different routes to get to the final destination. This is why the Internet is so <b>resilient</b>, or able to keep working even if one computer or router is having a problem.</i></p>		
7 minutes	<p>Explaining why the Internet uses packets for transporting files.</p> <p><i>We have already discussed how files are uploaded and</i></p>	<p>Listening and answering a teacher's questions that check for understanding.</p>	<p>A space for students to sit in a circle</p> <p>Whiteboard or projector/presentation monitor</p>

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downloaded from the Internet.

- Can anyone remind us of an example of a computer file?  
Video, photo,  
Word document

Some computer files are quite large...too large for the data links to carry in one piece. This is like how sometimes, trucks need to move something very large using the roads, but the thing they need to move is too big to fit on the road or on a single truck.

- Can you think of how trucks might solve this problem?  
Breaking the big thing (like a portable building) into smaller pieces that can be carried by many trucks)

The Internet works in a similar way. When a file is too big to be sent over a data link, computers and routers will break the file into smaller pieces that get carried across the network. When the pieces arrive at the final destination, they are put back together to form the original file. Use Slide 2 from

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	<i>Figures to help illustrate this point.</i>		
6 minutes	<p>Guiding students in an exit activity. This could be a Kahoot that draws on <a href="#">Quiz Questions</a> or a reflection using science journals, NearPod, or other exit ticketing system and <a href="#">Reflection Questions</a>.</p> <p>Conversely, you could also use your exiting ticket to see what students feel murkiest about with questions like:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> What feels the most clear about computer networks?</li> <li><input type="checkbox"/> What feels the muddiest about computer networks?</li> </ul>		

## Assessment Ideas

### Quiz Questions and Answers

Use these questions in whatever format you use in your class to check for understanding, including Kahoot, iClicker, or Google Classroom quizzes.

Q: List the three main parts of a computer network.

A: hosts, data links, and routers

Q: What is a packet?

A: A piece of data that is sent over a computer network. Large files are broken into smaller packets so that they can be transported over data links.

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Q: What is a host?

A: A computer that sends or receives data packets.

Q: What is a router?

A: A special computer that forwards packets to the next data link in the network.

Q: What are the steps that take place when a file is sent from one host to another over a computer network?

A: First, the file is split into smaller packets at the sending host. Then, each packet is forwarded from router to router until they are finally forwarded to the destination host. At the destination host, the packets are put into the correct order using packet numbers. Then the destination host has a copy of the original file.

Q: Imagine Computer A wants to send Computer B a picture file called puppy.png. The file is 1000 bytes. A packet can only be 100 bytes. How many packets does the puppy.png file need to be split into before it can be sent over the network?

A: 10 packets.

## Reflection Questions

You can use these in whatever format you use in your class for reflection, including science journals, Near Pods, exit tickets, or in Exploratory Talking Circles.

Q: How might a streaming video being sent over a computer network look different than a picture file being sent over a computer network?

A: Instead of all the packets needing to arrive at the final host before the file is put together, the host shows a user the pieces of data one at a time.

Q: What do you think happens if a data link “goes down.” For example, some computer networks have data links that travel all the way across the ocean. Occasionally, [sharks chomp through the cables that make the data link!](#) If a shark chomps through a data link, do you think packets can still travel from one host at one end of the ocean to another host at the other end? Why or why not?

A: Students’ answers may vary. They should make notes about redundancy and resilience and how there may be multiple routes between two hosts.