Context of the Lesson

The Big Idea: Students will learn about the differences between the local network and the internet alongside how information is sent at Layer 3 (packets, routers).

Prerequisite Knowledge and Skills:	Connections to SOLs:
• Knowledge of computing devices • Basic understanding of networked devices such as cellphones, tablets, and computers.	• Computer Science 5.17

Objectives of the Lesson	Formative Assessment
Learning Targets (I can...): • I can tell where the local network ends and the internet begins. • I can explain how a network works. • I can explain how data is sent over the internet. • I can explain what packets are. • I can name devices that help move information across the network.	• Verbal testing • Group and individual activities • Instructional aids • Written testing

Materials	
• Visual Aid for instructor to write on (e.g., chalkboard, projector, dry erase board, easel) • Handouts and writing utensil for students (optional) • Computer that can show videos (optional)	

Lesson Structure and Activities

Warm Up *[5-10min]* , answers to be written out by instructor on visual aid

Ask: What kind of devices connect to other devices? What kind of devices connect to the Internet?

• Responses will vary. (Any device that connects to another device is networked. But not all networks are the Internet. Radio, television, and phone call centers all connect to other devices without the Internet.)

Launch (Engage) *[5-10min]* :Teacher Directed Instruction:

Vocabulary:

Packet – A small piece of data or information sent across a network like mail to reach a destination across a network, or the Internet.

Switch – A device that connects to multiple other devices and allows them to be networked.

Router – A device that sends information across a network. Many routers contain switches.

Modem – A device that allows other devices connected to it to connect to the Internet. Many modern consumer modems from companies like Comcast and Verizon often come with routers, switches, or both built into the modem itself.

ISP – Internet Service Provider, a company that owns part of the connections that make up the internet and can sell access to it. Most internet users connect to the internet through a modem to an ISP.

Bandwidth – The amount of data that can be sent at the same time through a connection.

Computer networks allow devices, people, information, and ideas to be shared. Phone lines are a great metaphor. When you call someone, your call is sent to towers and phone lines and goes down those lines to reach somewhere it can then be relayed to its destination. Likewise, the Internet works by sending information from your computer down special lines across the world until it can find where its destination is. Like phones, this is done incredibly fast. The internet can send a message around the world in seconds. Another way to look at it is a team of lightning fast mailmen, taking mail to their cars and post offices and then out around the world, delivering it to special addresses and sending back replies to you in moments.

The uses of this technology are widespread. The internet and the networks that make it up are what allows two computers or devices to make video calls, visit websites, download music, or shop online.

When you send information over the internet, it is sent from a device, through a switch or router, becoming a number of packets, before being sent to a modem which sends it into the Internet to its destination, where it is reassembled. Usually a 'reply' is sent, where the process happens in reverse, a number of packets being sent to the Internet where they are reassembled in order on your device.

Packets move through physical cables and over wireless signals like Wi-Fi. If a packet were to be sent via a cable and that cable was damaged or disconnected, the packet can't be sent and the network or Internet connection to the destination is lost or interrupted. A good metaphor to use is a mailman's car driving through a city with lots of different roads and bridges. You have to find the shortest path that isn't broken, and if all of the roads and bridges are closed or broken or congested with traffic, you can't deliver the mail.

This means that information has to be sent across the local network before it can reach the Internet. Your smart TV has to talk to your switch, router, or modem before talking to your Internet provider. Your computer has to find some way to talk to your wireless printer across those devices.

Here's another example. Say your internet connection is broken. You could still use the technology behind the Internet to communicate between devices in your 'local network'. What if you wanted to print your assignment since your internet was out, but your printer was wireless? If your router isn't broken, you can connect to the router, which can tell you aren't trying to use the Internet, and will deliver your packets only to your printer and back.

Walk through the process of sending a web search from the search bar:
- Your device sends information to switches and routers detailing what you want to search
- That information is converted into packets
- Those packets are sent to a switch, router, or modem capable of communicating with your ISP
- Those packets are sent to your ISP from the switch, router, or modem
- Your ISP sends those packets to the next device it sees that claims it knows where they go
- Each device carries the packets onward, eventually reach the router connected to the website
- The website reads your packets, and sends back your search results or an error
- This all happens again, backwards until the result reaches you

This happens in seconds.

Explain you can use this to tell where something went wrong if you can't use a website. Did your information reach your modem? Is your ISP or Internet connection bad? Is the website down?

To explain this, here is a simple activity you can try. For every 3 students, 1 student will stand up and be a 'router'. Only routers can talk to routers. A student must whisper what they want to say to the router, who is allowed to whisper it to the router it thinks can best send the message to the correct student, regardless of which router the whispering student told the router to go to. The student can reply through their router and the process repeats.

Note that router students may ask the sitting students for more information. Just like in real life, if a router does not know how to interpret a message it will either ignore it, 'dropping' it or try and fix it before sending again.

If you tried this with whispering words like the famous telephone game, would the 'packet' whispers always end up 100% correct or take the best path? (No, someone will eventually make a mistake, just like how no Internet connection is perfect, and say the wrong thing.) What about with pieces of paper? What about electronically? (The same, it will not be 100% correct, but something to think about).

Explore *[10-25min]* :Joint/Guided Practice | Student Practice:
- Give classwork or assign homework on networks.
- [Show videos or diagrams explaining how the internet works.](#)
- Have students diagram the internet.

Summarize *[5-10min]* :Debrief :

• Ask: What is the difference between a local network and the internet? • Ask: Would it take less time to reach someone across the world with the internet or in your neighborhood?	
Extensions:	