

Module 1: The Physical Internet

Module: Quick Look

Abstract:

Networking Infrastructure is an important concept that many high school curriculums do not cover. One of the easiest ways to present students with Networking Infrastructure concepts is to discuss ways of how data is communicated over the Internet. The purpose of this module is to provide structure for a teacher to prepare students for the opportunity to actively engage in various roles within a “How the Internet Works” simulation using household/classroom items.

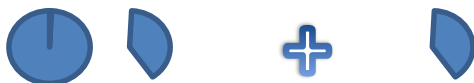
Intended Audience:

- Any student with basic understanding of the Internet and desire to understand it better

Material Requirements:

- desks , chairs, tables ~ whatever is available in your room
- steel wire (50+ feet ~ depends on size of room)
- wire cutters
- binder clips or paper clips (6+)
- packet information slip (10+) – (**PacketInformationSlips.docx**)
- initial picture request slips (10+) – (**InitialPictureRequestSlips.docx**)
- signs for at least two websites – example ~ Google and/or Wikipedia
- signs for at least seven routers labeled: **Router #**
- signs for at least three computer labeled: **Computer #**
- blank grid pictures (3+) – (**BlankGridPicture.png**)
- three printouts of each requested picture (6+) – (**GooglePicture1.png, GooglePicture2.png, WikipediaPicture1.png, WikipediaPicture2.png**)

Total Instructor-Preparation + Set-up Required:



- 45 – 60 minutes of reading and analyzing the simulation PowerPoint (**Simulation.pptx**) and printing out all needed materials. The simulation PowerPoint provides a complete overview of the procedure including animations of what the students will do.
- 10 – 20 minutes collecting various materials at home and/or school
- *Note: if wire is not readily available, a trip to the store will be necessary which will increase planning time as well as incurring an unexpected cost of paying for the wire either with personal or school funds (check with appropriate supervisor to see if reimbursement is available).*
- 15 – 20 minutes of set-up of desks, wires, and signs

- *Note: you can involve students in the setup but please be aware of possible risks in cutting wire as injuries can occur from sharp ends of the wire (eye protection is required)*

Total Class-Time Required:



- 15 – 30 minutes of prepping students for the simulation
- 45 – 90 minutes of engaging in simulation

Key Terms:

- | | |
|-----------------------|-------------------------|
| • The Internet | • Switches |
| • End System | • Packet |
| • Routers | • Acknowledgment |
| • Servers | • Request |

The following resources are available in the module to assist you with preparing to present the topic in class:

- **Module: Suggestions** prepares you to use the module and developing your lesson plan.
- **Module: Scope & Sequence** provides you with the objectives for your students, the basic instructional content, and ways to have students demonstrate their understanding of the protocol through a project.
- **Module: Extensions** identifies ways for you to enrich or modify the suggestion to better meet the needs of your students.

Module: Suggestions

The following are suggestions to assist you in preparing for use of this module:

- After reading through the entire module, plan your unit of study based upon your comfort with module content, your ability to set-up and manage the simulation, and how much available time you have in your schedule.
- If necessary, utilize the supporting materials accompanying this module (Module1_Resources.docx) to increase your understanding of topics within this module. You could also provide students with this information as needed.

Module: Scope & Sequence

Suggested Timeline:

15 – 30 minutes ~ Present & discuss “*How the Internet Works!*” and/or prep students for simulation

15 – 30 minutes ~ Simulation: Round 1 “Implementation”

30 – 45 minutes ~ Simulation: Round 2+ “Optional Extension(s)”

Teacher should present the following information to students:

Learning Objectives:

Upon completion of this module, the student will be able to:

- Define the Internet
- Identify the components involved and explain their role
 - sender, receiver, packet, end system, routers, switches, servers
- Describe the process of how the Internet works

Sequence of Instructional Content:

1. How the Internet Works

- You may find that you would like to just have a quick conversation about “How the Internet Works.” This is an appropriate approach especially if you are going to accomplish *Module 2*.
- Depending on your previous instruction on this topic, you can determine how much time needs to be spent discussing. Please take a look at *Module 2: Suggestions* for more information in preparing you for this discussion if you want to go beyond just a conversation.
- Key terms to present and explain during the discussion include sender, receiver, packet, end system, routers, switches, and servers.
- By the end of this discussion, students should be comfortable with the role of each component of the communication process

2. Prepping Students for the Simulation

- Explain the concept of the simulation: the class will use various physical items to replicate how information is transmitted from sender to receiver through the Internet
- Feel free to show various slides of the Simulation PowerPoint (**Simulation.pptx**) to help describe the simulation to your class. You may find it helpful to create notecards,

handouts, or other instructions to give to each group so that they are aware of their role during the simulation.

- Show the students the various slips that they will be filling out as an end system (computer or web server)
- Practice filling out each as necessary
- If you are having the students assist with the set-up, you can take class time at this point of the instruction to do so.
- Please review the Simulation PowerPoint's section on **Setup**

3. Simulation: Round 1

- Make sure that all necessary equipment is set-up, printed, and/or readily available
- Discuss the protocol of the simulation ~ see **Implementation of Simulation** section of the Simulation PowerPoint (example of protocol is that only one message can be sent at a time per wire)
 - i. Depending on your students, you may want to write the protocol on the board for them to reference during the simulation
- Assign student(s) to various roles: computer, router, end system
- Conduct a walk-through or practice message before the simulation starts so that everyone is aware of the protocol being used and how to send messages on the wires
- Execute the basic simulation of having each computer send two messages; one message to two different websites requesting a picture
- Observe the students' attention to the protocol, check the request cards as well as the packet slips for accuracy, and/or verify that the picture is generated correctly
 - i. If students are not following the protocol, you can decide whether you would like for them to stop or have them start over
- After the simulation discuss some of the **Guiding Questions/Statements** listed below

4. Simulation: Optional Extensions

- If time allows, choose one of the **Module: Extensions** listed below to challenge students to handle anything from new roles to new experiences that haven't been discussed.

Guiding Questions/Statements

- How fast can the data be transferred?
- What parts of the simulation limited the speed of the transfer?
 - *Bandwidth, routers choosing bad path, didn't know when packet was lost*
- Did you develop certain procedures that enabled you to determine when a packet was lost?
- How long did you wait before you assumed the packet was lost?
- Who is charged with resending a packet/acknowledgment?

Module: Extensions

- After a successful Round 1, in which students were successful with communicating with a website, the following optional variations can be used to supplement and increase the challenge for the simulation:
 - Packets can be removed midstream in which the students acting as the “computer” would need to determine how to handle this situation
 - Adding blockages to the wires so that the routers must determine new paths (additional binder clips can be used)
 - Timing this simulation to find the fastest teams of students
 - Changing roles of each person and running more than once to see if certain people are better as routers versus end systems and discussing the challenges with each role