The ICT4me Curriculum

About ICT4me

ICT4me is an after school and summer curriculum for middle school youth to develop ICT fluency, interest in mathematics, and knowledge of information, communication, and technology (ICT) careers. This problem-based curriculum capitalizes on youth interest in design and communication technologies. ICT4me provides structured interactions with ICT professionals, including having youth participate in engineering design and development teams. ICT4me's promotes a train-the-trainer approach to building capacity in informal ICT learning.

Build IT vs. ICT4me
ICT4me is a derivative of the Build IT curriculum co-developed between SRI International and Girls Inc. of Alameda County. Questions about the Girls Inc. implementation of Build IT can be directed to them at http://www.girlsinc-alameda.org/about/contact.

SRI is no longer supporting the development of ICT4me, so the curriculum materials are offered as is.

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Electronic Versions of Materials

Electronic versions of all materials in this unit are available for download from the website at http://ict4me.sri.com/.

Contact Information

Please contact the SRI International Inquiry line for questions about ICT4me.
https://www.sri.com/contact/form

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Unit 4

Design in Networked Technologies

Overview

Youth are introduced to the concept of a network, and learn about the different types of computer networks that they encounter in their everyday lives: such as wired and wireless networks, and PANs, LANs, and WANs. Basic graph theory provides a mathematical framework for understanding networks. Youth gain hands-on experience in utilizing various networked technologies and in building a networked device by constructing an interactive whiteboard. In the second half of the unit, youth work in groups to apply what they have learned, designing and prototyping a Classroom of the Future that utilizes networked technologies. Technology-focused field trips and ICT professional visits enhance youths' experience with technology, and the unit concludes with presentations and reflections at Family Tech Night.

Enduring Understandings

- Networked technology, such as the Internet or a local network, allows people to send and receive information across devices, such as computers or phones.
- Different types of networks (such as PAN, LAN, and WAN) solve certain problems, and different types of connections are better in certain situations.
- Networks have different topologies (layouts) that are made up of the nodes and links of the network. Topologies can tell us about the characteristics of the network, such as how long it will take information to get to a device.

★ Essential Questions

- Why would you want to use a network?
- How do computer networks and the computers they connect impact your life?

Contents

Week 1: Networked Devices

Summary

Schedule

Introduce Unit 4.	Introduce Unit 4.	10 min
Challenge	Explore telephone and PDA technologies, the devices and their networks.	60 min
Main Activity	Sketch the networks.	40 min
Discussion/Reflection	Impact of networks in life.	30 min
Total Time		**2 hr 20 min**

Essential Questions

- Why would you want to use a network?
- How do computer networks and the computers they connect impact your life?

Design Process Concepts Involved

- Define it.
- Sketch it.
- Test it.
- Use it.

Materials

- Design Process chart
- Laptops
- 9-volt batteries
- Wire strippers
- 1 Magnifying glass
- Design Notebooks
- Internet access
- 30 feet of telephone wire
- 1 300 ohm resistor
- Colored pencils/crayons
- 2 basic telephones that can be used to make a network.
- 1 telephone that can be dismantled. (Use a phone that you can take apart and see the inside workings of as in the drawings for the stations.)
- 2 cellular phones that can be dismantled. (Use a cell phone that you can take apart and see the inside workings of as in the drawings for the stations.)
- Screwdrivers to dismantle phone (identify these prior to the activity).
- Several magnets or other materials that can be used to keep the screws from the phones from falling off the tables.
- 2 or 3 personal digital assistants (PDAs) that have infrared and at least 1 that has cellular capabilities.
- Large piece of paper (legal size or a little larger poster size); something that can be folded and kept in Design Notebooks.
- Macaulay, David. *The New Way Things Work*. Houghton Mifflin/Walter Lorraine Books; Rev Sub edition (October 26, 1998)
- Telephone, cell phone, PDA, telephone network
- 2 *The New Way Things Work* drawings of networked technologies (pg 351).
- Station 1: Telephone Components activity sheet
- Station 1: Telephone Directions & Questions activity sheet
- Station 2: Cellular Telephone Components activity sheet
- Station 2: Cellular Phone Questions & Directions activity sheet
- Station 3: Telephone Network activity sheet
- Station 3: Telephone Intercom Questions & Directions
- Station 4: PDA Components
- Station 4: PDA Questions & Directions

Getting Ready

Overview

In Unit 4, youth will design a classroom of the future. They will learn about types of networks (PAN, LAN, WAN), types of connections (wired, wireless), and the many devices that can be connected to a network (phones, pens, computers, cameras). In preparing for their design, youth will disassemble phones, create their own interactive whiteboard, and explore network topologies.

- **Hardware** of the network (for example, phones in Week 1)
- Network connectors (for example, wires and radio waves in Week 2)
- Types of networks (PAN, LAN, WAN)
- Network layout or topology

The ICT Professional Field Trip is very important in this unit. A site visit is written into the Unit as Week 4, but you can arrange the site visit at any time. Visit a place that is developing new, networked tools, like Leap Frog (to see its smart pens), LiveScribe (for its smart paper), or Adobe. There are many researchers also working on developing new technologies for broader use, such as Johnny Lee at Carnegie Mellon. In particular you want to visit a place that creates tools that might spark the youths' imagination in designing the classroom of the future.

Weeks 6 through 9 are sessions dedicated for youth to create their own network, in a project called "The Networked Classroom of the Future." Youth will design networks including devices to use in the network, interview users for feedback on their designs, and incorporate user feedback into their final designs. Youth will also create a physical model of their networks and give "demonstrations" on how the network can function.

Glossary

- **Bluetooth** **Wireless** - the industry standard for connecting PANs via a secure, radio frequency. It connects all devices that are within a 30 feet radius to each other. In this project, the computer's software will communicate with the Wii remote via Bluetooth.
- **Infrared (IR) light.** Infrared light is not visible to the human eye. Technology using infrared light transmitters have to be in the line of sight of the infrared receiver. For example, a TV remote control has infrared technology and has to line up to the TV receiver in order for the remote control to work.
- **PDA** (personal digital assistant) - a handheld device that entails a computer, telephone, the Internet and other networked features.
- **Sneakernet** (as in the shoes the carrier wears) - a term used to describe the transfer of files between computers by "walking over" a flash drive, floppy disc, CD-ROM or other portable media.

Background

In Week 1, youth have a chance to explore several devices: telephones, cell phones, and PDAs. The important point is that these devices have internal workings and connect to different networks.

In the "Challenge," youth will be working in stations to investigate network devices. There are many questions designed to encourage youths' thinking about networks. The idea is to encourage youth to think about network connections that they use everyday. These same questions can be used to guide discussion immediately following the activity. Below are some tips for preparing the stations. Facilitation tips for each station are listed in the Challenge activity.

Tips for Station Preparation

- Plan for adult assistance for Week 1's station activity.
- Make sure you have all of the tools and hardware you will need for the stations. You may want to acquire extra phone chords, telephones, or cell phones if you have a large group.
- Prepare the stations in advance, so that youth walk into session with stations ready.
- Test each station in advance, and be prepared to lead a discussion on the topics for each station.
- If the diagrams provided in the Activity Pages do not reflect the equipment you acquired, make simple diagrams that look like your equipment. These should be simple diagrams—they could be drawings, images found on the Internet (you can Google the names and brands of the equipment you are using), or you can take pictures and paste them on paper labeling the parts.
- Make sure all diagrams are labeled with tools and parts.
- You could have a laptop for each station that is opened to a book-marked page that shows an example of how the hardware works.
- Explain to youth about wire safety. Tell youth that batteries connected to wires are considered "live wires". Live wires get hot and can give electric shocks. Explain to youth that they should handle any wires with care, especially if they think it is a live wire.

Warm-Up

Time: 10 minutes

Purpose: Introduce types of networks and goals of Unit 4.

Materials:
- Chalk board or paper
- Chalk or pens

To Do

1. Pose the following problem to the youth: If you couldn't talk to your friend (for whatever reason), how could you get a message to them? (Encourage diverse responses such as e-mail, text message, hand-written note or letter, call.)
2. List all of the responses on the board or paper. Then tell youth to note, for each, the type of both device and network used. Use a table like the one below if you want to capture all of the ideas. "What is the medium? What is the network? How does the information travel through the network?" The point is to get the youth thinking about how information travels through different media, and not whether they know the right names or answers.

Method	Tool	Network	How Information Travels
Text Message	Cell Phone	SMS or Sprint	Through the air

3. Point out some similarities and differences among the networks used. For example, you may note that many of the choices use the Internet.
4. Tell youth that that's what they are going to be learning about in Unit 4: the hardware and network options people have, and how all use these networked technologies to solve problems. By the end of the unit, they are going to design the classroom of the future. But, first, the ways in which these devices and networks work must be investigated.

Challenge

Time: 60 minutes; 10 minutes at each station

Purpose: Youth compare technologies and the networks they use to connect.

Materials:

- Laptops
- 9-volt batteries
- 30 feet of telephone wire
- Design Notebooks
- Internet access
- Wire strippers
- 1 300-ohm resistor
- Colored pencils/crayons
- 2 basic telephones that can be used to make a network.
- 1 telephone that can be dismantled. (Use a phone that you can take apart and see the inside workings of as in the drawings for the stations.)
- 2 cellular phones that can be dismantled. (Use a cell phone that you can take apart and see the inside workings of as in the drawings for the stations.)
- Screw drivers to dismantle phone (identify these prior to the activity).
- Several magnets or other materials that can be used to keep the screws from the phones from falling off the tables.
- 1 Magnifying glass
- 2 or 3 personal digital assistants (PDAs) that have infrared and at least 1 that has cellular capabilities.
- Large piece of paper (legal size or a little larger poster size); something that can be folded and kept in Design Notebooks.
- Telephone, cell phone, PDA, Creating Your Own Telephone Network
- 2 The New Way Things Work drawings of networked technologies (pg 351).
- Station 1: Telephone Components activity sheet
- Station 1: Telephone Directions & Questions activity sheet
- Station 2: Cellular Telephone Components activity sheet
- Station 2: Cellular Phone Questions & Directions activity sheet
- Station 3: Telephone Network activity sheet

To Do

1. Set up four stations.
2. Put youth into pairs.
3. Have everyone bring their Design Notebooks for sketching between stations.
4. Spend 10 minutes introducing youth to each station, including a demonstration on beaming.
5. Youth rotate through a station (10 minutes at each station), sketching, and then moving to the next station, sketching, etc. until they have completed all the stations.
6. Follow the station sessions with a 10-minute discussion debrief.
7. Below are the facilitation tips for each station (set up directions and directions for youth are in the Activity Pages). Overall, remember to ask open-ended questions, remind youth of wire safety, and if youth are finished with a station early ask them to sketch what they found.

Station 1: Telephone Components

Facilitation Tips:

- You may want to look at a simulation online of how your phones connect.
- If youth are having a hard time understanding what they are looking at, ask them questions about form and function. For example, they might know that a microphone receiver picks up sound, so where should a microphone receiver be located on the phone?
- The goal is for youth to understand that telephones connect through a network of wires.
- If youth have been through the cell phone station, ask them to compare this way phones connect to a cell phone's wireless network.

Station 2: Cellular Telephone Components

Facilitation Tips:

- You may want to look at a simulation online of how cell phones connect.
- If youth have a difficult time seeing the cell phone parts, urge them to use the magnifying glass.
- Having two cell phones are ideal, one for taking apart and looking inside and one for looking at the exterior of the entire phone.
- If youth have a hard time understanding what they are looking at, ask them questions on form and function. For example, if microprocessors and memory card holds all of the contact information and controls all of the phone's functions, should it be noticeably big or small?

Station 3: Telephone Network

Facilitation Tips:

- This station has live wires; explain to youth wire safety.
- You might want an adult volunteer looking over this station, or if you are facilitating alone think of your position in the room. Think of how can you check in with this station frequently.
- You may want to look at a simulation online of how landline phones connect.
- You may want to prepare extra chords and exposed wires in case wires get cut on accident.

Station 4: PDA Components

Facilitation Tips:

- This station can use Smartphones (such as cell phones that have PDA-like functionalities), or other hand-held.
- Make sure to have the Internet disabled.
- If you are using technology youth are not familiar with you could create a short "how to" guide that youth can follow. Make the directions specific so youth don't get stumped on the guide.
- You might want an adult present to explain how to send a message.
- If youth have trouble sending messages, ask them open-ended questions that cause them to think about their process.
- Make sure to have a group discussion where youth explain how they sent messages, and about the differences between Infrared, Bluetooth, and Wi-Fi technologies.

8. After youth have looked through all the stations, discuss the following as a group:

- How does this landline phone connect to your friend's phone? (Two copper wires connect to the phone company, my friend's phone also connects to the phone company, and phone company connects us.)
- Can you explain how the cell phone works? (Cell phones are fancy radios. A cell tower picks up the signal that a call was made and sends that signal out until it connects with the identified phone to receive the call.)
- What makes it possible hear the person on the other end of the phone in the intercom phone connection? (One wire connects the phones and the other connects the battery to power the connection.)
- What are the different ways that this PDA can communicate with other PDAs? (Could be infrared, Bluetooth, wireless, or phone.)
- It is important to discuss the wireless aspect of Bluetooth, Infrared, and Wifi. Have a discussion on wireless communication and how it differs from phones that use wires. For example you can discuss cell phones vs. landlines; the difference between Bluetooth, Infrared, and Wifi).

Main Activity

Time: 40 minutes

Purpose: Draw the networks that connect telephones, cell phones, and PDAs.

Materials:
- Poster paper
- Colored markers
- Internet access
- 2 The New Way Things Work posters

To Do

1. In pairs, youth have been sketching **3 different types** of networks in their Design Notebooks. Youth use these sketches to each create a drawing of these networks on a small poster size piece of paper. These drawings can be left up on a wall and added to during this unit.
2. Encourage youth to express the fundamentals of the network, but have fun with the drawings. Use *The New Way Things Work* posters as an example.
3. Youth can put themselves and their friends into the drawings and create wacky networks if they like.
4. Have youth visit website resources for ideas on how the networks work:
   - For all cell phone instructions visit: http://repair4mobilephone.org/cell_phone.html
   - See the How Telephones Work animation at: http://electronics.howstuffworks.com/telephone.htm
     - For cell phone parts see:
     - http://www.connected-earth.com/Learningresources/Funandgames/Gadgets/Insideyourmobilephone/index.htm
     - http://www.howstuffworks.com/cell-phone6.htm
   - To see how a wireless network (Wi-Fi) works visit: http://computer.howstuffworks.com/wireless-network.htm
   - To see how Bluetooth Works visit http://nds2.nokia.com/tutorials/support/global/phones/bluetooth/english/index.html
   - How Information Travels on the Internet, see:
     - http://www.intel.com/content/www/us/en/education/k12/the-journey-inside/explore-the-curriculum/internet/lesson3.html
   - Here's information about how to connect to the Internet:
     - http://www.learnthenet.com/english/animate/connect.html

Hint: some of the same cables, satellites, and cellular technologies carry data and voice.

Discussion/Reflection

Time: 30 minutes

Purpose: Youth share their network posters and discuss the networked technologies in their lives and possible future technologies.

Materials:
- Network posters created by the youth

To Do

1. Ask youth to share their posters, describing how the networked technologies shown work.
2. Ask each youth to do at least a bit of troubleshooting; you might ask, "What would you do if you weren't able to get a signal with a cell phone? What would you do if you couldn't access a specific website from your PDA? What would you check?"
3. After everyone has shared, ask youth if, as they added technologies to their drawings, they thought of any new technologies that they'd heard of or came up with any that haven't yet been invented. Ask them to briefly describe them and how they work.

Week 2: Network Connectors

Summary

Schedule

Warm-Up	Introduce handhelds. Set up logins for your chosen online social network and local server.	30 min
Challenge	Compare sending notes using Bluetooth and infrared.	50 min
Main Activity	*Leaving Messages for Your Friends* Leave notes (or files) in chosen online social network and on local server.	50 min
Discussion/Reflection	Reflect on communication and collaboration features of networks.	20 min
Total Time		**2 hr 30 min**

Essential Questions

- Why would you want to use a network?
- How do computer networks and the computers they connect impact your life?

Design Process Concepts Involved

- Obtain user feedback.
- Build it.
- Test it.

Glossary

Types of Networks

- **Personal Area Network (PAN; also known as a peer-to-peer network)** - a small network made up of a person or family's personal digital assistants (PDAs), mobile phones, computers, printers, digital cameras and video game consoles. The network can be connected through wires and wirelessly. Each device has equal status and control. Bluetooth and infrared are ways to connect PANs wirelessly.
- **Local Area Network (LAN)** - a small group of networked computers in close proximity to each other, such as in an office building, a school, or a home. At a school or office, a LAN *often* requires 1) a login/permission and 2) being physically connected to the network through a cable, on campus. This is a client-server network with at least one server providing services to the clients' computers. A LAN can be connected wirelessly or by cables.
- **Wide Area Network (WAN)** - a network of computers over a large geographic area, such as a state or country. WANs often connect multiple smaller networks (such as LANs). The world's most popular WAN is the Internet. In a WAN, there are multiple servers and clients. A WAN can be connected wirelessly or by cables.

Ways to Connect Networks

- **Cables** - (Ethernet) cables connect a computer to a LAN or WAN. Other cables (through USB ports, usually) connect peripherals (cameras, printers, etc.) to a computer.
- **Infrared (IR) Wireless** - infrared beaming is one wireless way to connect computers or other devices together. Infrared operates in a similar manner to a TV remote control. It has to be used in line of sight of the devices and has only a short range. It allows your laptop to exchange data with other computers or devices like mobile phones. An infrared-enabled device can only connect with one other device at a time.
- **Bluetooth**  **Wireless** - the industry standard for connecting PANs via a secure, radio frequency. It connects all devices that are within a 30 feet radius to each other. A Bluetooth-enabled device can talk to one or many devices within its range.
- **Wi-Fi Wireless** - the wireless equivalent of an Ethernet cable. Wi-Fi routers are connected to a LAN or WAN through a cable. Computers or other devices that are Wi-Fi-enabled communicate with the routers via secure radio waves (similar to Bluetooth).
- **Server (**typically shortened from "server computer") - enable LANs and WANs – without a server, LANs and WANs aren't possible (yet). A server is the computer that enables other computers in the network to connect to the LAN or WAN (Internet). A computer becomes a server if it is on all the time and runs certain "connector" programs, such as an e-mail server, a web server, or a back-up server.

Materials

- Colored pencils/crayons
- Design Notebooks
- Projector
- Document camera
- Handhelds/PDAs
- Internet access
- Large piece of paper (legal size or a little larger poster size); something they can fold and keep in their Design Notebooks.
- Access to ICT4me space on online social network space
- Wireless access or Ethernet that all can access.

Getting Ready

Overview

In this week's activities, youth learn about different networks: PANs, LANs, and WANs. In exploring the types of networks, they will have an opportunity to learn about wired and wireless connections. The important thing to learn this week will be which kinds of networks (PAN, LAN, WAN) solve certain problems, and in which situations the different connections (Bluetooth vs. infrared) are better.

For the activities, you can choose to use handhelds only, personal computers only, or some combination of the two. We recommend that you use handhelds for the PAN activities (infrared vs. Bluetooth) and computers for the LAN vs. WAN comparison. Handhelds handle infrared and Bluetooth technologies easily. Computers are designed to connect to servers and the Internet more easily.

Make sure the devices you use have (1) web access; (2) access to a local server where youth can post documents or notes; (3) infrared; and (4) Bluetooth.

Background

It will be useful to keep the Graph Theory model in mind when thinking about all network activities. In Graph Theory, there are nodes/vertices and edges/links. Think of computers or handhelds as the nodes, and the connectors (wireless or cables) as the edges.

Use the warm-up time to introduce youth to handhelds, if applicable, and to get them set up with logins for your chosen online social network space and their local server.

Keep Bluetooth off until you are ready for the youth to use it.

SET UP AN ONLINE SOCIAL NETWORK SPACE: Follow the instructions in the Technology Guide for setting up a group and users in an online space such as Ning. Youth will use the group you create in this space to upload files. Set up a discussion forum called "Sharing Files" within your online group. Post one file in the "Sharing Files" discussion forum as an example.

SET UP THE SERVER CONNECTION AT THE SCHOOL OR SITE: Learn how the server is set up on your site; create a folder for the youth to post their files. Provide the youth with the path to that server and instructions on how to post the file. Most systems use the drag and drop method.

ON A PC, YOU CAN CREATE A NETWORK: Click on the start menu and click Network. If network and file sharing are turned off, ask for permission to create a new Network. To create a network click on "Set up Connection or Network." Click "Set up a wireless ad hoc (Computer-to-computer) network. Create a network name and password that is easy to remember such as Network: "ICT4me AffiliateName", Password: "ICTRocks!".

Next, on another (client computer), click Network. Click on "Connect to a Network," and join the network you just created using the same password.

If you don't have access to a server, you can set up a laptop to act as a server that other youth use their laptops (clients) to access.

ON A MAC THAT WILL ACT AS THE SERVER: Click the wireless icon at the top of your screen for the wireless pull down menu, then select Create Network. You'll see a window that says "Please enter the following information to create a computer-to-computer network." **Name the network you want to create** (e.g. Anne's Network) and click OK.

Next, **note the name of your computer** under the System Preferences folder, then Sharing folder. (e.g. Anne's Computer). The clients will select this computer name to connect to (see On The Clients' Macs).

Next, **configure your Public folder under your Home directory** (the one that looks like a house from your hard drive. The default for the Public folder is to be read only. It also contains a folder called Drop Box which only permits writing. If you want to make the Public folder readable *and* writable, you need to change its permission properties. To do this, select Get Info on the Public folder. Then, open Ownership and Permissions, which can be found on the bottom of the information panel. Then, where it says Others, change it from Read Only to Read & Write.

ON THE CLIENTS' MACS: Click the wireless icon and select the **name of the network** you want to join (e.g. Anne's Network).

Go to your hard drive where you'll see the Network icon on the left navigation. Select it. The **name of the computer** you want to connect to will appear under My Network (e.g. Anne's Computer); select this computer and click the Connect button.

You'll see this computer's main **home directory** (Home symbol and then the same name that appears on the computer (e.g. Anne) appear in the left navigation along with the network. Select this home directory. You'll then see a folder named Drop Box. You can place your files here. You'll be able to add and remove files.

Warm-Up

Time: 30 minutes

Purpose: Introduce youth to handhelds.
Set up online social network space and local server access.

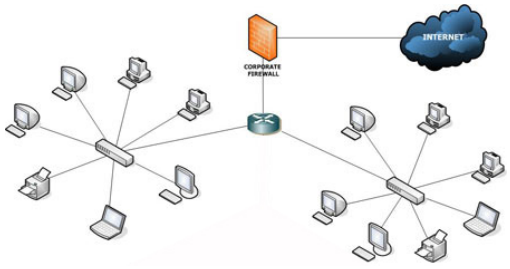
Materials:
- Handhelds with Internet access, infrared and Bluetooth
- Computers with Internet access

To Do

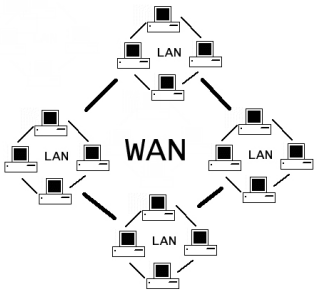
1. Explain to youth that they are going to be exploring different types of networks (PANs, LANs, and WANs) this week. Show them some images of PAN, LAN, and WAN to discuss the three kinds of networks. (PANs sometimes are part of LANs and several LANs make up a WAN. The most popular WAN is the Internet.)

PAN

LAN



WAN



2. Then, explain that these networks connect both through wires, and without wires. The focus this week will mostly be on wireless connections because more and more devices are connecting to each other and the Internet that way. There are different ways to connect wirelessly and they have different advantages and disadvantages.
3. Use overhead to introduce handhelds. Each youth gets one handheld.
4. Tell the youth that there will be “listen” time, when they’ll need to return the stylus to its holder, shut off the handheld, and put the handheld aside. You’ll also let them know when it’s “play” time – when they can use the handheld to explore the communication applications introduced.
   - Have them open Notes (go to Start menu and then Programs if it’s not listed under Start) and write a note. This is “play” mode.
   - Once everyone has written an appropriate note, youth should return to “listen” mode.

Challenge

Time: 50 minutes

Purpose: Explore a PAN, by sending notes using Bluetooth and infrared.
Sketch types of networks to Design Notebooks.

Materials:
- Design Notebooks
- Pens
- Flip chart and pens

To Do

1. Tell youth that they are going to explore with the smallest kind of network, a PAN.
2. Ask them to describe a PAN and the devices that can be connected through it. (Examples: personal computer, telephone, headphones, cell phone, printer, camera.)
3. Ask them to explain how these devices can be connected (i.e., with cables that connect a phone to a camera, or a cell phone to the headset and wirelessly.) Probe to see what they know about wireless connections, since they may have heard of Bluetooth or beaming.
4. Tell them that they are going to compare two types of wireless connections: Bluetooth and infrared beaming.
5. Have them figure out how to send messages with two kinds of wireless technologies in teams of 4.
6. Introducing infrared beaming. (It is important to start with infrared beaming, so that they can play around without Bluetooth for a bit.)
   - Create a Note. Then, click OK.
   - Notice the red button on your handheld (similar to the one on a television). You have to align your red button with somebody else's to beam the file you just created.
   - Have them try it: tell them to hold onto the note they created, and then select Beam. Tell them they won't choose a number but each handheld must be pointed at another handheld.
7. Introducing Bluetooth:
   - Have youth view the Bluetooth demo at: http://nds2.nokia.com/tutorials/support/global/phones/bluetooth/english/index.html
   - Show them how to enable their handhelds (or laptops if not using the handhelds)
   - Tell them to turn on Bluetooth under Settings. Then, they should go to Notes under the Start menu (they may then need to go to Programs), create a note, and click OK.

- Tell them to hold onto the note they created; a menu with Bluetooth as an option will appear. Choose the device number you want to send to. (Note: all handhelds are numbered on the outside based on the ID number they are programmed with.)

8. Set the context for youth: tell them to imagine that they've been asked to choose one to communicate with their friends to complete a project. The only problem is that they can't talk to them directly. They'll have to send them messages with infrared or Bluetooth.
   - Try writing a story together. Which method works better? Why? (Either method could work, depending on how they decide to write the story – sequentially or with multiple paths.)
   - Tell them to try sharing and compiling all their friends' birthdays. Which method works better? Why? (Again, either method could work well. Look for their explanations to see if they understand that infrared is unidirectional and linear, whereas Bluetooth is multidirectional.)
9. Let youth try for 15 minutes, then get together as a large group.
10. Ask who prefers Bluetooth. Call on youth to share why. Encourage youth to state a different reason than the ones already stated by other youth.
11. Ask who prefers infrared. Call on youth to share why. Encourage youth to state a different reason than the ones already stated by other youth.
12. Capture their reasons under Bluetooth and infrared on the flip chart.
    - Bluetooth: recognizes you, don't need line of site, don't need server or wireless network.
    - Infrared: fast, good for sending between two people, more secure
13. Ask youth to add new technologies they've experienced to their drawings from Week 1.

Main Activity

Time: 50 minutes

Purpose: Compare two networks for posting notes.

Materials:
- Flipchart and pens

To Do

1. Set the context by telling youth:
   - You and your friends need a way to leave messages for each other over the next week for a community project. You won't see each other.
   - The community project offers two environments to choose from:
     - Online social network space for files
     - And/or a folder on your school's server.
   - Your challenge is to test both, choose one, and justify your choice based on 1) how the network (LAN vs. WAN) will enable you to communicate, and 2) what features of the application will help you communicate.
2. Ask the youth if they remember what a LAN and WAN are. If not, clarify. Then, explain that online social network space is like a WAN, and the school server is like a LAN.
3. Introduce the online social network space that you've chosen:
   - Now you are going to explore the WAN, through [name of online social network]
   - Who remembers using [name of online social network] last year? (If youth have done previous Units with this online social network, if not, then no need to ask the question)
   - Go to [name of online social network] (see Technology Guide for details) on your laptop and project the logins. (Tell each youth their login and password.)
     - For computers: How would you access [name of online social network] (Open a web browser, type in URL.
     - For handhelds: Go to [name of online social network] from your handhelds. What do you think we need to do to get there? (Open a web browser, type in the URL.)
4. Once everyone is logged into the online social network:
   - Direct youth to the group you've set up for them. They should go there by default when they login – check to make sure prior to the session.
   - Have youth select the Files section.
   - They should then follow the steps to upload their document under Files.
5. Introduce the school server. Explain that now they are going to try uploading a document to the school server. Fill out the instructions below before you give them to the youth. To the youth:

- If you are using handhelds:
  - Create a document in Application on your handheld and save it.
  - Go to _____
  - Follow the steps to upload your document under files.
- If you are using a laptop
  - Create a document in Application on your handheld and save it.
  - Go to _____
  - Follow the steps to upload your document under files.

6. Once youth have a chance to experience both systems, go around the group, and ask everybody to share which network they would choose to communicate with the others and give one reason why. Encourage youth to state a different reason than the ones already stated by other youth. Capture their reasons on a flip chart. Guide them towards describing the benefits and disadvantages of using a LAN or a WAN for communicating with each other for this community project.

Note: An online social network is visible to all who have access to it; there are other ways to communicate: chat, private message, discussion board, and wall. The server at your site is only visible to you—in school; you can only post and download files.

Discussion/Reflection

Time: 20 minutes

Purpose: Reflect on the types of networks used for different situations.

Materials:
- Posters youth created

To Do

1. Ask youth to share their posters, describing how the networked technologies shown work and why they would choose one technology over another to send a message. (For example: Put it on the online social network space so that people who have web access and the online social network space account will have access to it. Only send it using infrared because it's a private note and I want to make sure only my friend sees it. Bluetooth because everyone who walks into the group near my computer should receive it. On the school's local area network so that everyone in the school, but not everyone on the Web can access it.)
2. Ask each youth to do at least a bit of troubleshooting; you might ask, "What would you do if you couldn't access a specific website from your PDA? What would you check? (Check a site you know is up (like Google) to make sure it's your connection and not the website. If it's your Internet connection, check your network settings to see if you have Internet access.) How would you tell someone where to meet you online in [name of online social network space]? (Go to URL of the online social network space, and give them the name of the group, making sure it's public to them.)"
3. After everyone has shared, ask youth if, as they added technologies to their drawings, they thought of any new technologies that they'd heard of or came up with any that haven't yet been invented. Ask them to briefly describe them and how they work.
4. Ask youth to reflect on the following questions:
   - How do computer networks and the computers they connect impact your life?
   - What part of the design process did we accomplish this week?
   - What did we do to prepare to design our classroom of the future?

Week 3: Network Layouts (aka Topologies)

Summary

Schedule

Warm-Up	Reintroduce graphs (from graph theory).	10 min
Challenge	Play graph games.	1 hour
Main Activity	Explore the basic types of network topologies and their properties.	50 min
Discussion/Reflection	Reflect on the purpose of different networks.	20 min
Total Time		**2 hr 20 min**

Essential Questions

- Why would you want to use a network?
- How do computer networks and the computers they connect impact your life?

Design Process Concepts Involved

- Research it.

Glossary

- **Network Topologies** - describe the layout of different kinds of networks. There are ring, mesh, star, fully connected, line and tree topologies. Network topology is a subset of the mathematics known as "graph theory."
- **Graph Theory** - the math that describes connections (networks). In graph theory, simplified drawings (with dots and lines) are used to represent the connections among distinct objects, people, or locations. For example, subway maps are really simplified graphs that are good at showing the connections between stations but aren't really useful for determining the distance between stations. These drawings should be as simple as possible in order to see the routes and the transfer points. The basic building blocks for these simplified drawings are nodes (vertices) and edges (links, lines). Paths are shown with arrows or lines.

- **Links, Edges, or Lines** - the graphical way of representing connections between nodes. In network architecture, they represent cables or wires that connect one computer to another.
- **Nodes or Vertices** - the objects being connected in a system or network. In network architecture they are usually computers or servers.
- **Troubleshooting** - a form of problem solving. It is the systematic search for the source of a problem so that it can be solved. Troubleshooting is often a process of elimination - eliminating potential causes of a problem.

Materials

- Computers with Internet access
- Bookmarks of websites to visit
- 100 feet of yarn or sturdy string
- Post-It notes or index cards
- Masking tape
- Examples of Graphs activity sheet
- Koosh balls or objects that can be tossed without hurting anyone or breaking (rubber balls are ok)
- The Colorful Houses of Tourist Town activity sheet
- The Colorful Sidewalks of Tourist Town activity sheet
- Mail Carrier's Tour activity sheet
- The Painter of Lines in the Street activity sheet
- Network Topologies 1 activity sheet
- Network Topologies 2 activity sheet

Getting Ready

Overview

Youth will learn about the physical configuration of networks (network topologies). The focus is on the layout rather than any virtual connections.

In session A, they will play with graph theory problems to build a foundation for college-level math. The object of these games is to learn about graph sizes, degrees, diameter, and other properties related to graph theory. In the Session B, the youth will do a hands-on, kinetic exploration of network topologies. Youth will learn how different kinds of networks fail and where the problem may be.

Youth will also develop problem-solving skills through discussions of how a network can break and how to troubleshoot a network failure.

Background

Do all the activities beforehand, especially the graph theory activities in the "Challenge" section.

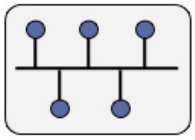
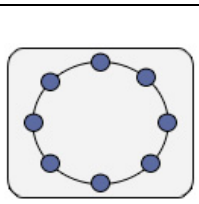
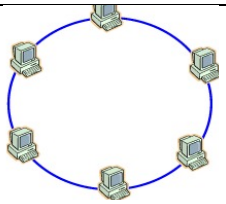
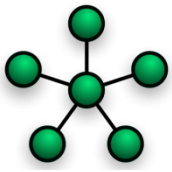
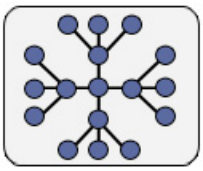
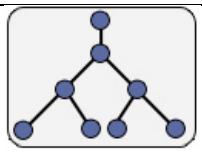
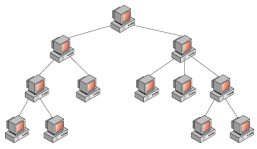
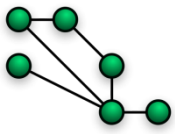
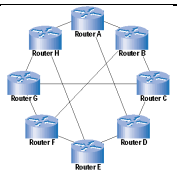
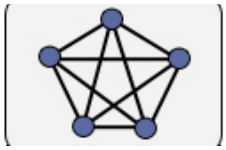
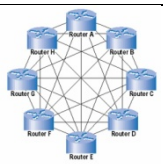
> Note: If you need to cut out anything, take less time on the "Main Activity", but **do not** cut out the math.

You may want to have an open space, such as the gym or a large classroom if youth will be throwing balls around the room.

Why look at network topologies? Network topologies are the architecture of networks and display the way a network is organized. When the youth design their own networks, it is important that they have a sense of how networks are connected. Different layouts provide different affordances and drawbacks.

Network topology refers to the arrangement or layout of a network: How are the computers connected to each other? There are different ways in which a network can be set up, and that layout affects the ways in which one computer communicates with another. Computer scientists often rely on graphical representations of the networks to analyze how information flows or to troubleshoot network failure. This graphical tool comes from graph theory—a way of representing systems with nodes and links (see Unit 2 for connections).

Network Topologies

Network Topology	Description	Graph
Linear or Bus	Nodes form a pipeline. Computer A is connected to B and B is connected to C, and so forth.	
Ring	Every node has exactly two branches connected to it. It is similar to the line topology, if the end nodes connect to each other and form a ring.	 
Star	Nodes are organized in a ring with one node in the center of it. Each node in the ring is connected to the center node only.	 
Tree	Nodes are arranged as a tree.	 
Partial Mesh	There are at least two nodes with two or more paths between them. Often, links emerge randomly, so this type of network doesn't have the symmetry that the other topologies have.	 
Fully Connected Mesh	Every node is connected to every other node in the network.	 

Resources

- Network Topologies in Wikipedia: http://en.wikipedia.org/wiki/Network_topology
- Network Tutorial: Topology http://members.tripod.com/barhoush_2/topology.htm
- Graph Theory animations: http://www.cs.sunysb.edu/~skiena/combinatorica/animations/
- Map of Cyberspace: http://personalpages.manchester.ac.uk/staff/m.dodge/cybergeography/atlas/atlas.html

- Playing Graph Theory Games: http://www.ccs3.lanl.gov/mega-math/workbk/graph/grgsm.html

Warm-Up

Time: 10 minutes

Purpose: Reintroduce youth to graph theory.
Set up online social network space and local server access.

Materials:
- Overhead projector
- Examples of Graphs activity sheet

To Do

1. On an overhead projector, show the youth the Examples of Graphs activity sheet and ask them if they remember learning about these in Unit 2 (or if they have ever seen one if they weren't in ICT4me at the time).
   - They may remember looking at the subway maps or flight paths.
   - They may remember playing with planarity.net or the "traveling salesman" game.
2. Have the youth who have seen these representations talk about what they remember, pointing out the important features of graphs:
   - Nodes
   - Links or edges
   - Distance is counted differently on these representations. We use the term hop or jump to refer to the distance between one node and another – regardless of how visually distant they may seem.
3. Ask them if they see a connection between this form of representation and networks.
   - Some youth may suggest that they could be helpful in looking at computer networks, where each node is a computer and each link/edge is a wire.
   - If the youth can't think of how they may be useful, tell them that you are going to explore those connections this week.
4. You can also explain: "Graphs are very powerful tools for creating mathematical models of a wide variety of situations. Graph theory has been instrumental for analyzing and solving problems in areas as diverse as computer network design, urban planning, and molecular biology. Graph theory has been used to find the best way to route and schedule airplanes and invent a secret code that no one can crack." (http://www.ccs3.lanl.gov/mega-math/workbk/graph/graph.html)

Challenge

Time: 1 hour

Purpose: Explore different kinds of graph theory problems, and possible solutions.

Materials:

- Markers, colored pencils
- The Colorful Houses of Tourist Town activity sheet
- The Colorful Sidewalks of Tourist Town activity sheet
- Mail Carrier's Tour activity sheet
- The Painter of Lines in the Street activity sheet

To Do

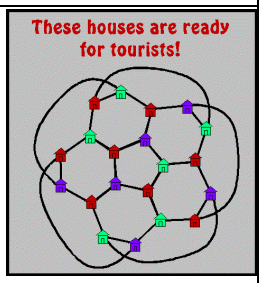
1. Explain that they are going to be working on some problems that require using the tools of graphs (from the "Warm-Up"). In these problems they will have to navigate the nodes (vertices) and the edges (links) of the graphs to figure out the answers. The constraints on the games (the rules they need to follow) are similar to the ones that computer scientists see every day when dealing with networks. Other fields also take advantage of these tools, and we'll explore some examples.
2. Have the youth work in groups of 2 or 3 on the following activities.
3. Each team can work on a different problem. When they are done with one, they can switch to another problem. There is no order to the problems, and they all have a little note about how they are similar and different.
4. Debrief each of the activities with the youth. It may work best if you have a discussion after each activity – highlighting several solutions and asking the youth to explain their answers.
5. Help the youth solve the problems strategically. First, let them play around. As they are solving or having trouble solving the problems, ask them to note (with a number) their starting positions for each new attempt. This will help them eliminate starting places or colors schemes that aren't useful, and it will tell them what they haven't tried before. They can also use arrows for determining paths (direction of movement on a graph).

1. The Colorful Houses of Tourist Town

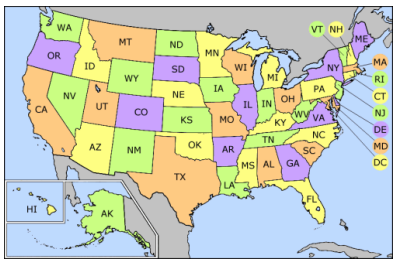
In Tourist Town there is something interesting to see in every house, and the people who live there want the tourists to visit them all. The City Council has decided to buy just enough paint to repaint all of the houses. If tourists leave a house that they have just visited and look next door and see a house that is the same color, they might think that it is just like the house that they just left and not visit it. So the City Council wants to repaint the houses so that no neighboring houses are the same color. What is the least number of colors the City Council needs to buy?

This problem is related to "The Colorful Sidewalks of Tourist Town," (below), but they are not quite the same, as you will see if you do them on the same graphs.

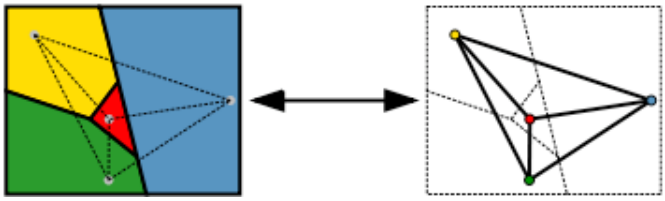
Answer:



*The key to this problem is finding the minimum number of colors needed to paint the houses. In this case, we only need **3 colors**. This diagram represents one possible solution. Youth may find others. It will be interesting to note the strategies they used. If they used more than 3 colors, challenge them to take away one color to see if they can still do it. Do the same for youth who have 3 colors - they will realize that using 2 colors is not possible. The solution is evident on it's own - because one can visually tell the adjacent houses have a different color.*



Both the coloring houses and the sidewalk-coloring problems are similar to the problem people who make maps encounter. What is the minimal number of colors needed to color the U.S. map so that no adjacent states have the same color? As seen on this map, the answer is 4. These two problems are related - think of the states as the nodes in the houses problem above. Here's the connection between the two. Each state or space can be marked with a node as in the image below. The edges indicate which spaces are adjacent.



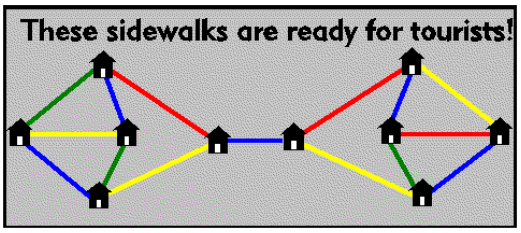
2. The Colorful Sidewalks of Tourist Town

Since all the grownups got to paint their houses, the City Council decided that the children should be able to paint the sidewalks in bright and interesting colors. They don't want the tourists to ever get bored by walking down two streets in a row with sidewalks the same color. What is the **least number of colors** the City Council needs to buy? Experiment by drawing graphs and coloring their "sidewalks".

This problem is related to "The Colorful Houses of Tourist Town," but they are not quite the same, as you will see if you do them on the same graphs.

Answer:

*The answer is **4 colors**, given the graph to the right. You can have youth switch graphs and try the problem about houses on this graph and the problem about sidewalks on the graph for the houses problem to see how the answers are different. In the case of the sidewalks, the youth are coloring the edges. In the case of the houses, they are coloring the nodes.*



3. Mail Carrier's Tour

Imagine that the graph is the map of a neighborhood. The edges are streets and at every vertex is a house. The mail carrier doesn't want to walk down any more streets than necessary to pick up and deliver mail to all of the houses. What is the best route to take? Where should they put a drop box for the truck to leave all the mail that needs to be delivered in the neighborhood?

This problem seems very much like "The Painter of Lines in the Street." Try both games on the same graph and see what you think.

Answer:

Here are two solutions to the problem about the mail carrier. The drop box can be placed at any point, because the mail carrier will start and end in that spot. This is called a Hamiltonian cycle. The property of a Hamiltonian cycle is that it visists every vertex or node exactly once.

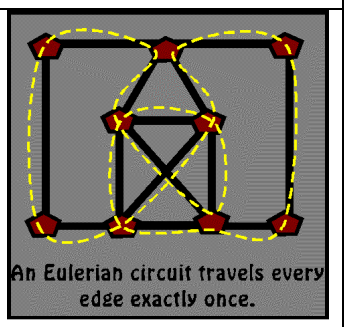
This activity relates to networks because it enables exploration of paths through each of the nodes. For example, think about how to get everyone in an office or school to sign an electronic petition without having duplicate copies of the message go around.

This problem is similar to the pilot's – Ms. Willingham's – problem in Unit 2. The similarity is that each node must be visited once and the path should return to the beginning. It is different because we aren't looking for the optimal path.

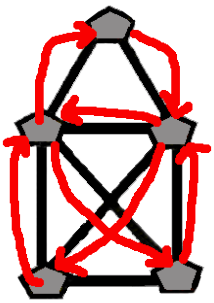
4. The Painter of Lines in the Street

The person who paints the lines in the streets works hard and doesn't want to have to spend time and energy lugging painting equipment when it is not necessary. What is the best route to take for painting the streets so that all the streets get painted, and the only time that the painter is on a street is when he or she is painting it? Can the painter end up where he or she started?

This problem seems very much like "Mail Carrier's Tour," (above). Try both problems on the same graph and see what you think.



Answer:



Here are the possible solutions to the painter's problem. Again, the solution is self-evident in the drawing. When the youth try out different strategies they will know whether they solved the puzzle or not. Have them notice what node or link they start with in each strategy - building their problem solving skills. Let them play around a little, then suggest they write try a systematic approach, writing down where they start and in which direction they go. They can do this using numbers in the nodes and arrows for the path.

Notice that this problem calls for traveling the edges/links exactly once, but it says nothing about visiting the nodes. In the second problem - the smaller graph - the starting place is key. Notice that the solution shows a starting place in one of the "odd" nodes - the node that has three (an odd number) edges. All but two nodes in this graph have even links.

This problem is similar to Nina's Travel's problem in Unit 2. The number of edges per node (whether odd or even) make a difference to the solution.

Main Activity

Time: 50 minutes

Purpose: Explore the basic types of network topologies and some of their properties.

Materials:

- Thick yarn (to represent the edges/cables)
- Masking tape (to hold down yarn)
- Post-It notes or index cards
- Pencils, pens, markers
- Koosh balls or objects that can be tossed
- Chart paper
- Network Topologies 1 activity sheet
- Network Topologies 2 activity sheet

To Do

1. Tell youth they are going to learn about different types of network designs (or layouts or configurations), to learn what advantages and disadvantages different designs have. Explain that they will call them "network topologies," like computer scientists do.
2. Give youth the network topologies and ask them to describe to you from the drawing how they think each network works. Ask them to calculate how many hops (or jumps/links) it takes to go from Node A to Node F in each of the topologies.

Line	5 hops (only)
Ring	1 or 5 hops
Star	1 hop (only)
Tree	4 hops (only)
Partial mesh	3, 4 or 5 hops
Full mesh	1, 2, 3, 4, or 5 hops

3. Explain that they are going to attempt some of these networks for different problems.
4. Divide the youth into two teams, with about 7-10 students per team. Explain that you are going to give them several situations to solve using a network. Their job is to figure out which network topology could get the job done best.
5. Hand out yarn, balls/notes, markers, and masking tape.
   - Yarn symbolizes the cables or edges (from graph theory) between computers.
   - The notes and Koosh balls represent the objects being shared in the network (viruses, information, gifts, people). Depending on the problem, one or all the youth will have to write down something on the notes.
   - The youth will stand in for the nodes or computers.

6. Remind them that there are no right answers here, and that they should try to explore all the networks on the activity sheet. You can play each scenario twice, so that each team can try a different configuration. The scenarios are:
   - Spread a Virus.

     One student sends out a virus to one or more youth (depending on the configuration of their network). Each recipient replicates the virus—writes out a new note card—and sends out the replica, keeping the original virus.
   - Enact a Gift Exchange.

     Each youth starts off with one gift (they can write "From: 'their name,'" and the word "gift" on each card.) They have to pass the gift to another person so that at the end of the exchange, everyone has a gift from someone other than themselves.
   - Get a Recommendation (For a Movie).

     One student starts off the exchange by sending out a request for a recommendation (On the note, write: can anyone recommend (a new movie for Friday night)?). There can be multiple copies of the request, depending on the configuration of the network. Not all members of the network have to participate in the exchange, but the first person should receive several recommendations on the note(s) they sent out.
   - Organize the School Bus Pickup.

     Each youth starts off with a note with their name on it. Then, the first youth puts their name in a basket (or other container) and passes it around the network, collecting all the notes. This is similar to the mail carrier problem in the "Challenge," but there is no rule that the bus has to return to the starting place. The youth will see how some networks are more efficient than others for this type of problem, like the linear, ring, and the fully or partially connected meshes. The other configurations (star, tree) require backtracking to nodes already visited in order to retrieve the remaining notes.
7. Expect that different teams will organize in different patterns and that some of the patterns may be unusual or not from the book. Highlight some of the advantages and disadvantages in each model.
8. Make sure you explore all the topologies through this exercise. What kinds of problems are best solved using linear topologies? (Example: school pickup.) Which problems are solved more efficiently using the star or tree model? (Example: virus spread.). The youth can give you different answers. Make sure that when they explain why they would do one configuration over the other, they are sharing their knowledge of how the configurations work.
9. If lack of space is a consideration, do these exercises on paper. Instead of having youth form one of the topologies, they can use the Topologies activity sheet to enact some of the problems. They should work in pairs or small teams. Make sure they discuss the path of the objects.

Discussion/Reflection

Time: 20 minutes

Purpose: Discuss the advantages and disadvantages of different network topologies and how they may help to solve particular problems.

Materials: None.

To Do

1. Ask youth to describe any differences and/or similarities between the different topologies.
2. Example: In linear and ring topologies the computers only connect with two other computers; the two mesh topologies are similar in that there are multiple paths available from one computer to another; star and tree topologies are similar because there is one central node that connects to many others.
3. Ask them what would happen if one of the nodes were broken? What about the links/edges?
    - Linear & Ring—end nodes would not affect the network, the middle nodes will break the network in half. If any link/edge broke, then one or more computers would be left disconnected.
    - Star & Tree—if the center node breaks, the whole network falls. If any of the links goes, then only the two adjacent computers would be disconnected.
    - Mesh—depending on which node and which link, the network configuration can find another route to connect all nodes.
4. Ask them what connections they see between all these activities in Week 3.
5. Let them give several answers. They may see connections you don't see and we didn't foresee.
6. Explain that graph theory—which they have been using all week—is a math tool for understanding networks—all kinds of networks: people, geographical, computer and information networks. Computer scientists use graphs to solve network problems. To find out when a network fails, they need to know what kind of topology is used to see if they can figure out the problem easily. They will also have to explore both node failures and link failures—and that's why some time was spent learning about different constraints (the mail carrier problem, or the coloring houses problem).
7. What part of the design process did we work on this week?
8. What did we learn that can help us design our classroom of the future?

Week 4: Site Visit or ICT Visitors

Summary

Schedule

Warm-Up	Prepare for site visit.	20 min
Main Activity	Site visit or ICT Professional Visit	1 hour 30 min (or more)
Discussion/Reflection	What was learned on the site visit?	10 min
Total Time		2 hr (or more)

Essential Questions

- Why would you want to use a network?
- How do computer networks and the computers they connect impact your life?

Design Process Concepts Involved

- Research it.
- Use it.

Glossary

- **Field notes.** Scientists record field notes during or after their observation of a specific event they are studying. These notes are usually very descriptive so other scientists who read the notes can easily recall details or information about the event.

Materials

- 2 Gathering Bags (recycled bags), for ***Gatherers***
- 4 Clipboards, for Interviewers & Gatherers
- 2 Digital Recorders (optional), for Interviewers
- 2 Digital cameras that have filming capacity and 2G SD cards, one for each Photographer
- 2 Sets of Colored pencils, for ***Sketch Artists***
- Internet access
- 2 Vellum spiral bound drawing books (or other bound sketch book i.e. sketch/artist pads of paper that are 11”x8.5”), to use as “Innovation Notebooks” for Sketch Artists
- 8 (2 of each role) Field Trip Planner “Role Sheets” for “Gatherer, Interviewer, Photographer & Sketch Artist”
- Optional: LCD projector projecting “Role Sheets” for volunteers to read from. If not then all youth should have a copy of all 4 “Role Sheets” to be informed and/or so volunteers can support youth in these roles.

Getting Ready

Overview

Field Trips will be very important for this unit. There are a lot of organizations working on cutting edge technologies that use wireless networks. There are fewer devices being made that don't already, in one way or another, connect to individual's PANs.

Background

During this week, youth will prepare for and go on a field trip. Other ICT4me Units have a slightly different field trip curriculum. The main difference is that Unit 4 needs extra time for preparing the Networked Classroom of the Future project. Unit 4's Site Visit or ICT Visitor curriculum does not have a Session B; this extra time can be used for youth to finish the Networked Classroom of the Future project. The site visit curriculum written for other units are meant to be "bookended" sessions, so it will take extra time. Facilitators can make choices about how to organize the field trip prep, site visit, and reflection based on the other field trip sessions written in the curriculum. The most important aspects of a site visit are that youth are intentionally engaged during the trip, meet ICT Professionals, and process what they learned.

When you arrange the site visit, make sure that the ICT professionals understand the students' interest in **networked technologies with potential uses in the classrooms**. Below is a list of companies and devices that may inspire youth in their designs. Please take some time to research companies in your organization's area.

Livescribe, Inc.
7677 Oakport St. 12th Floor
Oakland, CA 94621
Audio Pen and Smart Paper: http://livescribe.com/

LeapFrog Main Office – Emeryville
6401 Hollis Street, Suite 100
Emeryville, CA 94608-1071
http://www.leapfrog.com

Preparation

1. Make field trip plans. See the ICT Field Trip Packet for details.
2. Make sure it's okay for youth to take pictures at the organization you plan to visit. Learn what is permissible and where they won't be able to take photos.
3. Learn about the organization your youth will visit. Provide pointers appropriate URLs and resources for the Challenge section.

4. If possible, brief ICT professionals about the career-related questions that youth will be asking them. Provide them a list of questions youth may be asking and themes/points to aim to cover during the visit.
5. Make sure that the youth have been assigned defined roles of Gatherer, Interviewer, Photographer and Sketch Artist. Two youth per role, totaling 8 youth on the trip. See Activity Pages for details.
6. Have 2 digital cameras.
7. Make sure you collect the digital cameras and the Innovation Notebooks/clipboards, drawings and interview Q & A directly AFTER the field trip.
8. Prior to the Challenge activity, go to:
    - http://www.engineergirl.org/Engineers.aspx and prepare a list of profiles and their URLs in a Word document for youth to explore. These links should be careers related to what they might see on the field trip. Put the list on students' computers.
    - The website for the organization that you are visiting. You should find the organization's websites before hand and bookmark them on students' computers, or write the URLs on the board or in a Word document.

Warm-Up

Time: 20 minutes

Purpose: Prepare for site visit.

Materials:

- 2 Gathering Bags (recycled bags), for ***Gatherers***
- 4 Clipboards, for ***Interviewers & Gatherers***
- 2 Digital Recorders (optional), for ***Interviewers***
- 2 Digital cameras that have filming capacity and 2G SD cards, one for each ***Photographer***
- 2 Sets of Colored pencils, for ***Sketch Artists***
- Internet access
- 2 Vellum spiral bound drawing books (or other bound sketch book i.e. sketch/artist pads of paper that are 11"x8.5"), to use as "Innovation Notebooks" for ***Sketch Artists***
- 8 (2 of each role) Field Trip Planner "Role Sheets" for "Gatherer, Interviewer, Photographer & Sketch Artist"
- Optional: LCD projector projecting "Role Sheets" for volunteers to read from. If not then all youth should have a copy of all 4 "Role Sheets" to be informed and/or so volunteers can support youth in these roles.

To Do:

1. Ask youth to look at the website of the organization that will be visited. Have them look at some of the demos of the new technologies (audio pens for Livescribe and Leapfrog, for example).
2. Have youth brainstorm a list of questions they would like to ask at the site visit. Remind them about their design task (a classroom of the future) to guide/organize their thinking.
3. Tell youth that part of their goal for this field trip is to learn about women in ICT careers and that to help us create a record of what we saw and learned, we will have roles to play while on the trip. Quickly list the roles to the youth (you will go over these roles in greater detail later on):
   - Gatherer
   - Interviewer
   - Photographer
   - Sketch Artist

4. Youth should interview and interact with 4 or 5 professionals. They should gather the following information through questions about the professionals that they meet:
   - Job title
   - What they do
   - What they like about their job
   - Their life outside of work
   - Their hobbies and interests (current and during middle school, high school, college)
   - Their educational background
   - Their career path
5. Ask them to gather information or mementos (e.g., business card, brochures, key URLs) on their field trip, so they can create an ICT Professional Snapshot (see Activity Page "ICT Professional Snapshot Template". These ICT Professional Snapshots can be digital if resources and time allow.
6. Define roles and tasks by handing out or projecting specific "Role Sheets". Ask youth to volunteer to read a "Role Sheet." Be sure to ask youth open-ended questions to check for understanding and clarify what this role is asking.
7. It is important to print out "Role Sheets" for youth in color, to foster excitement and to meet students' different learning styles.
8. Discuss the concept of taking "field notes" and why they may be important with any of these roles.
9. In your own words remind youth of the essential questions of the unit. Have them brainstorm questions they have related to these topics to add to the "Interviewer Role Sheet."
10. Nominate, pre-assign, or ask for volunteers to fill at least two students for each role. For the first field trip it is suggested to "volunteer" youth you have noticed as having strong leadership skills
11. Discuss with youth who do not have an assigned/volunteered role how they can best support their peers who are in specific roles.

Main Activity

Time: 1 hours 30 minutes (or more)

Purpose: Go on a site visit, or have an ICT Professional visit your program.

Materials:
- Computers with Internet access
- Notebooks

To Do:

1. Go on a site visit to an organization developing new tools for classrooms, such as Livescribe and Leapfrog. This visit is an essential component of the unit. Make sure that youth have adequate time to interact with technology and new products. It is recommended to visit sites that develop tools which include network technology.
2. Make sure the youth are asking questions of the ICT professionals regarding the elements and types of networks involved in using these tools.

Reflection

Time: 10 minutes

Purpose: Consider what was learned on the site visit.

Materials
- ICT Professional Snapshot Template

To Do

1. After the site visit, ask youth to explain what they learned, and whom they met.
2. Youth can use the ICT Professional Snapshot Template to describe the professionals they met.
3. What part of the design process was accomplished this week? (Research it, use it.)
4. What did you see or use that can help you design your networked classroom of the future? (Answers will vary, but expect them to arrive at the idea that they experienced some state of the art technologies that could be used in their classrooms of the future.)

Week 5: Making an Interactive Whiteboard

Summary

Schedule

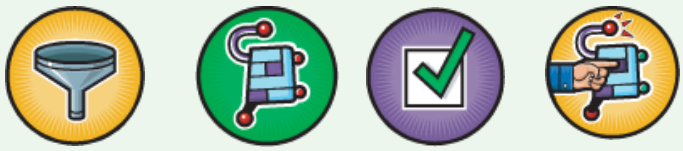
Warm-Up	Show video of Johnny Lee's interactive whiteboard.	10 min
Challenge	Build the Wii-board.	60 min
Main Activity	Use Wii-board.	60 min
Discussion/Reflection	What part of the design process was done?	10 min
Total Time		**2 hr 20 min**

Essential Questions:

- Why would you want to use a network?
- How do computer networks and the computers they connect impact your life?

Design Process Concepts Involved

- Research it.
- Build it.
- Test it.
- Use it.



Glossary

- **Interactive Whiteboard** – an interactive computer display that uses a computer and an LCD projector. Smartboards are a brand of interactive whiteboards used in schools and offices; they cost about $5,000. During this week, youth will create a less expensive version.
- **Infrared (IR) light.** Infrared light is not visible to the human eye. The Wii remote has a camera that captures Infrared light. When the Infrared LED is light, the Wii remote camera will transmit its position to the computer software via Bluetooth.

- **Bluetooth** **Wireless** - the industry standard for connecting PANs via a secure, radio frequency. It connects all devices that are within a 30 feet radius to each other. In this project, the computer's software will communicate with the Wii remote via Bluetooth.
- **LED** stands for light-emitting diode. LEDs are very small but powerful light "bulbs." LED colors vary depending on the semi-conductor materials used. During this week's activity, youth will be replacing a red, green or blue LED with an Infrared LED. Infrared LEDs do not emit visible light. To check whether your Infrared LED is working properly, view it through a digital or cell phone camera.
- **Troubleshooting** - a form of problem solving. It is the systematic search for the source of a problem so that it can be solved. Troubleshooting is often a process of elimination - eliminating potential causes of a problem.

Materials

- LCD projector
- Computer (Bluetooth-enabled. Most Mac OS X computers have Bluetooth)
- Wii remote whiteboard software (For PCs: http://johnnylee.net/projects/wii/; and for Macs: http://www.uweschmidt.org/Wiimote-whiteboard)
- Wii wireless remote control ($40)
- 1-3 Infrared Pens, from http://www.wiiteachers.com/
- Steps in making a Wii interactive whiteboard activity sheet

Getting Ready

Overview

In these two sessions, youth will create an interactive whiteboard by networking a computer, LCD projector, a Wii remote and an infrared pen. They will also have an opportunity to use the interactive whiteboard during the Main Activity and in the following weeks.

Background

Both building and using the interactive whiteboard are part of the activities. In putting together the hardware for the interactive whiteboard, the youth learn about the hardware, software and architecture of a network. They will create a network that uses infrared, Bluetooth and wired connections. Plus, they will feel very accomplished when they make something like this work.

In using the interactive whiteboard, they will get a chance to see an example of yet another tool that requires a network. Some of the websites they visit in the Main Activity highlight the usefulness of an interactive whiteboard for the classroom: for collaborating (note taking and drawing tool, for example) and for sharing experiences (by watching video, looking at pictures, or playing a game together). The interactive whiteboard activity is intended to inspire youth about possible networks and applications when they are designing their classroom of the future.

You MUST build the interactive whiteboard yourself before leading the youth in this activity. Make sure you are familiar with all the components and the potential problems that may arise in the process of building one.

Please note: you do not have to buy the Wii – just the wireless Wii remote control.

You should buy the infrared pens from http://www.wiiteachers.com/. They are about $20 and the seller created them in response to Johnny Lee's whiteboard project. This is a great site—you can get a whole kit from them although we don't require all the components they suggest.

Order the pens at least three weeks in advance to allow for delivery. Test the pens using a cell phone or camera view to see if it works by holding the infrared pen up to a camera and view it through the lens/viewer while pressing the pen's button. If the pen works you should see a light through the viewer. The infrared light will not be visible to the bare eye.

Optional:

You may want to build your own infrared pen. If you need additional information regarding the infrared pens, Google “how to build an infrared pen” and you will find multiple suggestions in the form of images, YouTube videos, and schematics.

Warm-Up

Time: 10 minutes

Purpose: Show video of Johnny Lee's interactive whiteboard.

Materials

- LCD projector
- Computer with Internet access
  Bookmark to:
  http://johnnylee.net/projects/wii/

To Do

1. To warm up, ask youth to explain what an interactive whiteboard is (also referred to as a Smartboard). Ask if they've seen one at school or elsewhere.
2. Show the video of Johnny Lee's interactive whiteboard (the video is called "Low-Cost Multi-point Interactive Whiteboards Using the Wiimote", on the Johnny Lee website).
3. Explain to the youth that they are going to build an infrared pen (if applicable) and the interactive whiteboard during today's session.
4. Show the youth on the Design Process chart that they are going to research it (video), build it (Wii-remote control whiteboard, aka the Wii-board network), test it (see if infrared pen and network are working), and use it (look at some cool websites).
5. Ask youth to predict how this activity relates to the overall theme of the unit (networks) and to their design activity (classroom of the future).

Challenge

Time: 60 minutes

Purpose: Create & test network for interactive whiteboard.

Become familiar and use the interactive whiteboard.

Materials

- 1 Computer per team
- 1 or 2 LCD projectors
- 1 or 2 wireless Wii remote controls
- 1 – 3 infrared pens (purchased from http://www.wiiteachers.com/)
- Wii-board activity sheet
- Wii remote whiteboard software downloaded and installed in all the computers (For PCs: http://johnnylee.net/projects/wii/; and for Macs: http://www.uweschmidt.org/wiimote-whiteboard).

To Do

1. Make sure all equipment is ready to be assembled (i.e., things are available but not networked). You will be calling on several teams of youth to set up the interactive whiteboard. If you only have time for one or two teams, reassure the rest of the youth that they will have plenty of opportunities to set up in future weeks as well.
2. Have the teams of youth not setting up the Wii-board draw and write down "troubleshooting" notes while the other teams work through the process.
3. Help the first team of youth set up the hardware, but **let them do the work**.
   - As they set up the hardware, ask them why they are putting things in particular locations; for example: "Where is the Wii remote? Why is the Wiimote 'looking' at the wall or screen area?"
   - Ask them to tell you what kind of connections are happening (where is the Bluetooth, what is connected via Bluetooth, what is connected via cables, what is connected via infrared? How do they know?).
   - Use this as an opportunity to help them learn how to troubleshoot. From the Johnny Lee video they should have an idea of the network they are creating, but there are many possible breaking points. Each connection (projector-computer; computer-Wii remote; infrared pen-computer) will offer opportunities to practice troubleshooting. Make sure the youth are the ones doing the troubleshooting, but support them with questions such as: "What's not working? How do you know? What do you think could be the problem? How could we find out what the problem is?"
4. If you haven't already, ask youth to download and install software for Wiimote-whiteboard from: http://www.uweschmidt.org/Wiimote-whiteboard (this is the Mac compatible program).
5. Have youth launch the WiimoteWhiteboard program (for instructions, click on the Help menu and select WiimoteWhiteboard Help).

6. Try out Google Earth with the new Wii-board. Ask youth who didn't have a chance to set up this time to try it out.
7. If you have enough time, ask the youth to disassemble and have another team set up the Wii-mote again.

Main Activity

Time: 60 minutes

Purpose: Become familiar and use the interactive whiteboard.

Materials
- Wii-board (computer, LCD projector, IR pen, Wii remote)

To Do

1. Download and install software for activity:
   - http://earth.google.com/
   - http://www.phunland.com/wiki/Download
   - http://phet.colorado.edu/en/simulation/moving-man
2. Have a new team rebuild the Wii-board
3. Each team should "play" with one or more of the fun software sites. Make sure that teams get to see different applications for the mini-network they created:
   - Connecting to the Internet to see cool (educational) web pages
     - Mapping software: Microsoft Virtual Earth (For PCs only), Google Earth
     - Interactive Museum in Uruguay: http://muva.elpais.com.uy/
   - Connecting to the Internet to talk or communicate with other people
   - Collaborating on a task (drawing, game, simulation)
     - Note taking: One Note
     - Physics simulation software: Phet
     - Painting programs: Alias Sketchbook Pro
     - Math activities: http://illuminations.nctm.org/Games-Puzzles.aspx
     - For graph theory, useful in making network topologies: http://illuminations.nctm.org/ActivityDetail.aspx?ID=20
     - Planarity game: http://www.planarity.net/
     - Human Anatomy: http://www.innerbody.com/htm/body.html
   - Watching a video or looking at photos together
     - Virtual Tourism
     - Media Browsing: CoolIris
4. Ask youth to write down in their design notebooks ideas about how they can incorporate a Wii-board into their classrooms of the future.

Discussion/Reflection

Time:	10 minutes
Purpose:	For youth to reflect on what part of the design process was done today, and what troubleshoots did they encounter?
Materials	None

To Do:

1. Ask youth what troubleshoots did they encounter while setting up the Interactive Whiteboard?
2. Discuss what youth found successful and challenging about troubleshooting?
3. Ask youth what part of the design process they used this week. (Research it, build it, test it, use it.)
4. What did they learn this week that will help them in designing their classroom of the future? (They created a network with three different connections (infrared, Bluetooth, wires), and used a network to look at some educational applications, which could be cool in their classroom of the future.)

Week 6: First Week of Design

Summary

Schedule

Warm-Up	Assemble and use the Wii-board to explore classroom friendly tools.	30 min
Challenge	Review Difference Among Types of Networks.	30 min
Main Activity	Introduce the design requirements.	
	Brainstorm and sketch a networked classroom of the future, including one device.	70 min
Discussion/Reflection		10 min
Total Time		**2 hr 20 min**

Essential Questions

- Why would you want to use a network?
- How do computer networks and the computers they connect impact your life?

Design Process Concepts Involved

- Define it.
- Brainstorm.
- Sketch it.

Glossary

- **Personal Area Network or Peer-to-peer network.** A small network made up of a person or family's personal digital assistants (PDAs), mobile phones, computers, printers, digital cameras and video game consoles. The network can be connected through wired and wirelessly. Each device has equal status and control. Bluetooth and Infrared are ways to connect PANs wirelessly.
- **Prototype**. An example that has most of the features of what will be built based on a design. A prototype is not the final form but gives an example of what the final product will look like and do.

- **User Feedback.** The process of gathering helpful suggestions and observations regarding a product from the user of the product. The intention is to improve the product, not test the user. It is an opportunity for the designers to get perspective on their designs; to see if the design makes sense to a person not involved in the design itself.

Materials

- Wii-board hardware (LCD projector, computer, IR pen)
- Computers with Internet access
- Chart paper
- Post-it notes
- Colored pens
- Design Requirements sheets
- Brainstorm activity page
- DataGotchi activity pages

Getting Ready

Overview

For the next five weeks, youth will be designing "networked classroom of the future" in teams of 2 or 3. Each week has a Session A (Warm up and Challenge) and a Session B (Main Activity and Discussion/Reflection). In Session A, youth will explore a few new technologies to inspire their designs using the Wii-board they created. Groups will also review similarities and differences among three networks (PAN, Internet and cell phone networks), and brainstorm their networked classroom of the future.

In Session B, youth will be introduced to the design requirements and develop their designs. If possible, allow teams to use the Wii-board for collaborating on their designs.

In the following weeks if youth can't finish brainstorming, sketching, interviewing and building within the time constraints of the intended sessions, activities can be stretched across several sessions. Moreover, the Unit is written for the Networked Classroom of the Future project to take 5 weeks, yet the project can be stretched for at least one extra session. Facilitators can also extend the unit as long as their program term will allow. Facilitators can stretch the design, interview, feedback, and prototype building sessions of the project across several sessions. To do this facilitators should gauge how many extra sessions that will fit within the time constraints of their affiliate's program term.

Remember, simplicity is the key. How can youth design networks that make classrooms easier to use, or actions in a classroom simpler? How can wireless technology make this happen?

Background

Design Requirements. Youth begin their designs this week. As you review the Design Requirements sheet, make sure you explain that there is a real client for their designs. Explain to youth that their designs for a networked classroom of the future will interest technology professionals and school representatives attending FTN and can possibly be used one day. You should try your best to recruit teachers and administrators as clients for user interviews and as participants in FTN. If teachers and administrators are not available you can ask youth to conduct user interviews on other students and adults who are familiar with classroom settings.

It is important youth understand that they are designing an entire network for the classroom of the future. This network should include designing several devices. Network prototypes should include simple representations of these devices. However user scenarios and the demonstration of the network only have to feature one of the network devices in detail. Youth can focus on showcasing more than one device if they have time, but due to time constraints youth are not required to focus on more than one of their network's devices.

Remind youth of their skills and time constraints by preparing a Design Requirements Tools and Time Constraints chart (you can save and use again for other sessions). Use the Tools and Time Constraints outlined below to create the chart.

Tools you have for this job:

- A Wii-board to help you design collaboratively
- Computers with Internet access & printer
- Chart paper, colored pens and markers
- Construction materials: cardboard, scissors, tape, pipe cleaner, straws, twine/string, and wires.

Time constraints:

- Your preparation time is limited to 5 weeks.
- You will have 3 weeks to design and integrate feedback.
- You will have 2 weeks to prepare and present your final product.

Brainstorming. You can scaffold brainstorming time by leading a group brainstorm. It may be helpful to have an example brainstorm displayed in a central area of the room. This example should list a lot of ideas—with some ideas crossed out and some ideas circled, and some sketches that relate to the ideas. Youth can start brainstorming with sketches and writing down ideas in their design notebook. Groups should have group brainstorms on large pieces of chart paper.

As part of the Design Requirements, groups will develop User Scenarios. It is important for designs to come to life in descriptions where users can see the device in action, see the DataGotchi pages as an example. User Scenarios can either be represented in a written skit, or groups can create comic book-like sketches to represent the scenario. Some youth could enjoy drawing rather than writing their user scenarios. Show youth the DataGotchi pages as an example of how they can use comic book type illustrations for creating user scenarios. Note that the DataGotchi pages also incorporate "screen shots" of what the device's screen looks like when it's in use. It's important for youth to show users how their device's screen will look like when it's in action.

Network Technologies. To get more ideas for applications that may inspire the youth in their designs, visit http://www.globis.ethz.ch/research/paper/applications. You can also search for new classroom gadgets and technologies and bookmark pages on students' computers, or write the URLs on the board. To find information on how to set up and use the Speech-recognition software on a Mac computer, visit http://lifehacker.com/software/speech-recognition/hack-attack-make-your-macs-speech-recognition-work-for-you-215764.php. You may want to set up speech recognition on one computer to demonstrate with youth. If you have time, you can have youth add some of the suggestions from this site to their Macs. If your affiliate uses PC computers, have youth try setting up the Text-to-Speech capabilities. For more information on how to set up Text-to-Speech on a PC visit, http://support.microsoft.com/kb/306902.

Note that as technology changes facilitators can explore new resources to model and create network devices. At the time of writing this curriculum, App Inventor, a new visual programming software that helps create applications for network devices was in its early development stages. We know tools like this will be more widely available soon. To keep up to date with current technology, affiliates should research new networking technologies and try to incorporate them into the Networked Classroom of the Future project. New technologies can be used as examples for youth to gain ideas, or can also be used for youth to create their final projects with. For example, with software such as App Inventor, it may be possible for youth to create working applications on network devices such as iPad-like tablets or cell phones.

It is important to understand the differences between three of the most widely-used networks today. Peer-to-peer, the Internet, and cell phone networks. The three networks have important similarities and differences. All send fixed bits of information in the form of "packets" from one device to another. Beyond that, the networks operate differently. **Peer-to-peer** networks do not use servers. **The Internet** relies on a network of servers and established "roadways" to send information. **Cell phones** work only when they are in range of towers that can relay messages from one phone to another. To use the Internet, one needs a way to connect to the network of servers; to make a call on a cell phone, a person needs to be in range of a tower, and so does the person receiving the call. These facts are important in considering what kind of network is best for a particular design or product. For example, if the application is only going to be used in one location, like on a desktop computer, the Internet may be a good network to choose. But if you want people to be able to use the application and talk to anyone else wherever they may be, the cell phone-type network may be a better option. Make sure youth understand and can explain what type of network they are creating and how their network devices should link.

Warm-Up

Time: 30 minutes

Purpose: Assemble and use the Wii-board and explore classroom friendly tools.

Materials
- Wii-board hardware (LCD projector, computer, IR pen)
- Design Requirements sheet

To Do

1. Ask a team of youth to set up the Wii-board on arriving. Pick a team that did not have the opportunity to try the assembly of this small network the previous week.
2. Your goal in this session is to expose the youth to new technologies to help them think outside of the box.
   - Have teams explore some of the following sites to get ideas of more collaboration tools that might be inspirational to their designs:
     - PaperShow
     - http://www.papershow.com/us/
     - Interchange of ideas, interactive whiteboard http://youtube.com/watch?v=aSyELuC3n2Q
     - You can also provide your list of new classroom gadgets and technologies.
3. Have all youth try out the Text-to-Speech and Speech-recognition on their computers. See the Background section above to set up the application for PC and Mac computers. This exploration does not require using the Wii-board, but some youth may want to try it out on a larger screen.

Challenge

Time: 30 minutes

Purpose: Review and generate a list of the differences among peer-to-peer networks, the Internet, and cell phone networks.

Materials

- Chart paper and pens
- Types of Networks sheets

To Do

1. Explain that in this activity, you will review the differences between three networks:
   - PAN or Peer-to-peer networks, in which computers that are in close proximity to one another communicate directly.
   - Two WAN networks:
     - Internet—a "network of networks."
     - Cell phone networks, which enable real-time one-to-one (and sometimes multiparty) communication among any of its members.
2. Facilitate a whole group discussion or assign youth to three teams (one per type of network) to generate responses for the empty cells on the Types of Networks activity sheet. The goal of this activity is to prepare youth for the design task ahead.

Answer Key for Types of Networks sheet

	PAN	Internet	Cell Phone Network
What kinds of devices can use this network?	Handhelds, PDAs, cell phone, computers	Handhelds, PDAs, cell phone, computers	Cell phones
How are the devices connected to each other?	Bluetooth and infrared	Wireless and wires	Cells (geographic area in which a signal from a cell phone can be received) that each have base stations with radio equipment for receiving and transmitting calls
What can you do with this type of network?	Send a note or file directly to someone else, print a document, transfer contacts and other information from one device to another	Access the Web, send email, chat – etc. everything you can do on the Internet.	Talk, send text messages

Main Activity

Time: 70 minutes

Purpose: Introduce the design requirements and prototyping.

Materials

- Wii-board
- Chart paper
- Pens
- Computers with Internet access
- Design Requirements sheet
- Design Requirements Tools and Time Constraints chart
- Design Process chart
- DataGotchi Pages

To Do

1. Form teams of 2 or 3 youth. Choose groups beforehand. Consider how group dynamics will provide a productive group environment. Pick youth that will work well together for the rest of Unit.
2. Give each group several sheets of chart paper or large sheets of blank paper.

3. Review the Design Requirements sheet with the youth. Walk through the requirements for this job. Explain that they will present their designs at Family Tech Night to school and district personnel. Groups should put forth their best efforts and take their designs seriously no matter who is in the audience.
4. Go over the Design Requirements Tools and Time Constraints (posted on chart paper that you can save and use again for other sessions).
5. Using the Wii-board, or writing notes on a chart paper/regular board, discuss the following questions together.
   - What are the needs of the classroom of the future?
   - Who are the users?
   - What kinds of tools or devices will they need?
6. Make sure youth understand that they are designing a network for a classroom of the future, including the devices that will be part of this network. Guide them towards defining the design process problem collaboratively. You should write down what youth are saying so that they can refer to these ideas. Explain that when they go off to brainstorm and sketch their designs, they can use these ideas or come up with more along the way.
7. Have youth brainstorm their network designs, referring them to the Brainstorm and the Design Requirements sheets. Let them know that they can use the Web for ideas. Tell youth that at least one person should be a note-taker and youth should respect one another's ideas.
8. If groups seem stuck:
   - Remind the group that simplicity is the key, how can they make things easier or simpler? How can they use wireless technology to do that?
   - Have them answer the question: What actions do you want people to do?
   - Give some examples, such as:
     - Suppose your focus is on math, you may want to use or design a math calculator visualization tool that makes 3D graphics represent the math problem.
     - Teacher and student desks that are smart tables where homework, lesson examples, and projects can all be in digital form and sent to others in the network.

Note: You may want to scaffold brainstorming time by giving a specific timeframe, such as 20 minutes to brainstorm, 20 minutes to draw sketches, 20 minutes to create a map.

9. Explain that students can create several sketches that look different and circle the parts of each sketch that they like the most. Also explain that groups can divide the work among their members, so some youth are working on sketches and others are creating the map.
   - You can show youth the DataGotchi activity pages to example what screen shots and user scenarios in illustration form looks like.

10. If youth cannot finish their brainstorm and sketches in one session, you can use some time in the next session for finishing.

Discussion/Reflection

Time:	10 minutes
Purpose:	Help youth identify what they know and don't know about the users and social networks that might be interested in their application.
Materials	None

To Do

1. Ask youth:
   - Name the steps in the design process that you accomplished this week.
   - What helped you design a device for a networked classroom of the future?

Week 7: Second Week of Design

Interviews & Peer Feedback (Performance Task)

Summary

Schedule

Warm-Up	Continue to develop designs.	25 min
Challenge	Conduct user interviews.	45 min
Main Activity	Present designs. Provide feedback.	60 min
Discussion/Reflection	Reflect on steps of design process.	10 min
Total Time		**2 hr 20 min**

Essential Questions

- Why would you want to use a network?
- How do computer networks and the computers they connect impact your life?

Design Process Concepts Involved

- Sketch it.
- Develop designs.

Glossary:

- **Feedback.** The process of sharing helpful suggestions and observations regarding a product or group performance. The intention is to improve the product or performance, and is not intended as an attack on a person. It is an opportunity for the designers to get perspective on their designs; to see if the design makes sense to a person not involved in the design itself.

Materials

- Chart paper
- Markers and pens
- Computers with Internet access
- Design Notebooks
- Networked Classroom of the Future - Design Requirements sheet (from week 6)
- DataGotchi Pages (from week 6)
- Feedback Forms

Getting Ready

Overview

During week 7, you will have an opportunity to conduct a formative assessment on what the youth understand of the unit. In the Warm-up, the youth continue designing their devices for a networked classroom of the future. The Challenge is dedicated to youth conducting User Interviews. In the Main Activity, they will present drafts of their designs to their peers. Groups will provide feedback to other teams. You will be able to determine from the students' presentations and the type of feedback they provide to teach other how well the youth understand networks.

Background

User Interviews and Feedback. In the *Challenge* youth will conduct user interviews. They will integrate their user and peer feedback into their designs in another session. You will need to guide students in interviewing techniques; see the User Interview and Feedback activity sheets. You can demonstrate to youth what a successful interview would look like. You may need to ask youth to use in-school time to conduct interviews with teachers, or if your program is located on a school site you may ask teachers if they can participate in user interviews. If teachers or administrators cannot be interviewed, youth may interview students. Note that you may want to invite the teachers and students who were interviewed to ensure their attendance at Family Tech Night (FTN).

In the *Main Activity* you will have a list of questions that will help you gather information on what youth do and do not understand about networks. This is the performance task. Ask the performance task questions to groups or individuals at anytime during this session. Good times to ask the performance task questions are after group presentations, and after youth have provided feedback. Use notes about what you learned in the presentations to give youth oral or written feedback to correct misconceptions, fill in missing information, or review concepts covered in the first sessions of this unit. If you choose to have the youth respond to these questions in written form, you may gain more permanent evidence and can respond more thoughtfully to their needs in the following session.

Performance Tasks are designed to enable you to assess students' understanding of the core ideas in the unit. In particular, are they getting closer to understanding the two Essential Questions:

- Why would you want to use a network?
- How do computer networks and the computers they connect impact your life?

Warm-Up

Time: 25 minutes

Purpose: Youth continue to develop their networks.

Materials

- Chart paper
- Pens
- Computers with Internet access
- Design Requirements sheet
- Design Notebooks and design

To Do

1. Youth continue working in teams to develop their networked classroom of the future.
2. Remind youth to check their design requirements. And check to see that youth are following the design requirements.
3. Tell youth that by the end of the Warm-Up their groups should have maps of their networks and sketches of a device nearly completed.
4. If groups state that their designs are finished check to see if they have fulfilled all design requirements. At this stage groups should still have some design requirements they need to complete.

Challenge

Time: 45 minutes

Purpose: Conduct user interviews for network and device.

Materials

- Wii-board
- Chart paper
- Pens
- Computers with Internet access
- Design Requirements sheet
- Design Requirements Tools and Time Constraints chart
- Design Process chart
- DataGotchi pages
- Brainstorm sheet
- User Feedback interview

To Do

1. Show groups the DataGotchi Activity sheets. Have volunteers read each section aloud. Ask youth the following questions:
   - What is the network?
   - What is the device?
   - How are people in the classroom using the device?
2. Give groups 5 minutes to create a short 1-2 minute user scenario for their networked classroom of the future. Tell youth that they can use the Guiding Questions on their Brainstorm sheet to structure the user scenario. Explain to youth that they will use their scenarios to explain their network and its devices to potential users.
3. Give youth 5 minutes to review their User Interview & Feedback sheet. Explain that they will conduct user interviews with people who would use their network and its devices. Make sure youth understand that they need to interview a user to make sure that their network and devices meet users' needs. Explain that they will use the phrases provided on the sheet to conduct the interview. As they ask questions, they should make notes about the user's feedback on the sheet.
   - Note: You can show youth what a successful interview would look like by conducting a short user interview with some volunteers.
4. Give youth 10 minutes to practice their interview techniques on one another. They can interview in partner pairs or as individuals.
5. Have youth conduct their interviews. Interviews shouldn't last more than 15 minutes. They can conduct their interviews on someone that is not in their design group if their network is meant for a student. If their device is meant for a teacher, have youth ask permission to visit a teacher or ask them to conduct the interview during a free moment during the school day.

Note: Remind youth to approach their teacher for an interview during a free moment, like lunch, break, or in between classes, not in the middle of a class lesson.

6. If youth do not have the opportunity to conduct their user interviews have them continue creating their user scenarios. Remind them that they want to demonstrate how users might interact with the device(s) across the classroom's network(s). The youth will use this scenario as part of a demonstration (demo) they will give during Family Tech Night.

Main Activity

Time: 60 minutes

Purpose: Youth share the designs they've developed

Materials

- Groups' device designs
- Design Notebooks
- Computers with Internet access

To Do

1. Tell them that they are going to be receiving feedback from their peers. Emphasize that they are not presenting their final design, but simply a draft.
2. Give teams a few minutes to prepare 5-minute (or less) presentations of their designs (in draft form). Remind them that they can use their user scenarios to present their networked classroom of the futures and its devices.
3. Have youth present their designs. You may wish to do this as a whole group or in smaller groups. In the presentations, each team of designers should:
   - Explain their network map and device sketches.
   - Share the user scenarios they developed.
   - Add any information that will help other youth understand their designs.
4. Use the following questions to probe the students' understanding of their designs and the way networks function. (No need to ask all of the questions for each group):
   - What type of networks does your networked classroom of the future use?
   - What happens if one of the networks is not working?
   - What parts of your network can stop functioning and the network still works?
   - What elements of the network are essential and would break the network if they were not functioning?
   - Who are the users?
   - What are the steps a user or users must take to use the system?
   - How would the networks in this classroom impact your life?
5. Have youth use the Peer Feedback Form after each presentation (give about 2-5 minutes for the youth to fill out the forms). Make sure everyone receives feedback. You can choose to have youth give verbal feedback where groups will have to keep track of the feedback they receive on their own. Or have each youth in session write out a feedback sheet for each presentation.
6. Have youth use the Design Requirements sheet as a checklist for the feedback.

Discussion/Reflection

Time: 10 minutes

Purpose: Youth give each other feedback on meeting the design requirements.

Materials
- Paper
- Pens

To Do

1. Ask youth to name the steps in the design process that they accomplished this week.
2. Ask youth to report on what feedback helped them design a device for a networked classroom of the future?
3. What did you like about user interviews?
4. What was challenging about user interviews?
5. Ask youth to give "glows" and one "grow" they noticed about their group's network. "Glows" are appreciations of aspects they liked or thought were designed well and "grows" are constructive criticisms of aspects that can be improved upon.

Week 8: ICT Visitor & Prototype Building

Summary

Schedule

Warm-Up	Finalizing device design.	20 min
Challenge	Work with ICT visitor or continue finalizing device design.	60 min
Main Activity	Create physical prototype of device.	50 min
Discussion/Reflection	Discuss Essential Questions.	10 min
Total Time		**2 hr 20 min**

Essential Questions

- Why would you want to use a network?
- How do computer networks and the computers they connect impact your life?

Design Process Concepts Involved

- Develop Designs.

Glossary

- No glossary items this week.

Materials

- Chart paper
- Markers and pens
- Computers with Internet access
- Document camera
- Design Notebooks
  - Networked Classroom of the Future - Design Requirements sheet (from week 6)
  - Completed Feedback Forms (from week 7)
  - Physical prototype building materials:
    - Cardboard boxes of all shapes and sizes (interesting shapes and sizes, or pieces of cardboard)
    - Construction paper, variety of colors
    - Tape
    - Staples
    - String
    - Pipe cleaner
    - Flexible wire
    - Blunt-tipped wire cutters

Getting Ready

Overview

This is the first week of building. The warm-up is for incorporating feedback, and finishing sketches and user scenarios. During the challenge an ICT visitor may visit to discuss students' designs and incorporate user feedback. Facilitators can modify the activity to achieve the same purposes but without an ICT visitor's help. The Main Activity is set aside for creating the physical prototype of the network and its devices. In the Reflection, youth discuss the Essential Questions of the unit.

Background

During this week, you will have an opportunity to address the misconceptions and learning gaps you observed in the Performance Task in week 7. See the Networks and Connections activity sheet that summarizes the concepts. As you talk to each team, give hints, suggestions, and ask questions to help them improve their designs, and improve their understanding of networks. The warm-up is optional, if youth have already completed their designs and sketches, have them move on to creating their physical prototype.

This is a good opportunity to invite an ICT professional to help youth polish their designs before they finish. Professionals interested in improving education, who work in educational technology, or are experts in collaboration, are good candidates for the visit.

In the physical prototype, groups will construct 3D models of how their network works. Groups need to indicate what kind of network they created (PAN, LAN, or WAN) and how their devices works within this network. To represent the different network connections one could use different colored string or wires, tape a sign or something else (for example draw a Bluetooth symbol, or use braces that have no wire for "wireless"). Remember simplicity is key! Facilitators should create a simple example of a network to display—like a cell phone tower network or the Internet. Facilitators should build this example during preparation time. You can decide whether you give youth hints on representing the network. Encourage youth to use their imaginations. Groups shouldn't be too preoccupied on how individual devices look. The important part is how youth represent their network connections. For inspiration see School 2.0 at http://www.ibo.org/ibworld/may09/school2.cfm. But remember, School 2.0 is a more complex example of what youth should create, emphasize on keeping representations simple.

Note that many groups, like IDEO (a design and consulting firm, www.ideo.com), and Stanford Design School (http://dschool.stanford.edu) create cardboard prototypes of things to brainstorm, get a feel for their designs, and show how people could use the device or product.

Warm-Up

Time: 20 minutes

Purpose: Finish designs.

Materials

- Computers with Internet access
- Design Notebooks
- Networked Classroom of the Future - Design Requirements sheet (from week 6)
- Completed Feedback Forms (from week 7)

To Do

1. Remind youth that this is the last week of design and that they will need to complete their work by the end of the session.
2. Have youth finish their device design sketches and map of the network.
3. Have groups look over their user and peer feedback forms. Have each group choose what feedback they will incorporate into their designs.

Challenge

Time: 60 minutes

Purpose: Review user and peer feedback.

Finish designs.

Receive advice from ICT professional.

Materials

- Computers with Internet access
- Design Notebooks
- Networked Classroom of the Future—Design Requirements sheet (from week 6)
- Completed Feedback Forms (from week 7)

To Do

1. Remind youth that this is the last week of design and that they will need to complete their designs by the end of the week.
2. Introduce the ICT professional to the youth.
3. Have youth give a quick introduction of their networked classroom of the future and its devices to the ICT Professional. Youth can use their user scenarios and sketches to explain their network.
4. Ask the ICT professional if they can give specific feedback on group's networks. They can either fill out a User Feedback form or provide verbal feedback.

Note: the facilitator and group should take notes if the ICT Professional is giving verbal feedback.

5. Ask the ICT professional to help youth decide what aspects of their user and peer feedback they should incorporate into their designs.
6. ICT professionals can also help groups decide or decline on aspects of their design for building their physical prototype. Declining a feature would happen if a specific requires more time than they have. This is a good time to discuss limits. Often designers and other professionals need to make choices about their designs based on how much time and money they have for the design task.
7. Have groups finalize their designs with building their physical prototypes in mind.

Main Activity

Time: 60 minutes

Purpose: Create a physical prototype for their device.

Materials

- Computers with Internet access
- Design Notebooks
- Networked Classroom of the Future - Design Requirements sheet (from week 6)
- Physical prototype building materials:
  - Cardboard boxes of all shapes and sizes (interesting shapes and sizes, or pieces of cardboard)
  - Construction paper, variety of colors
  - Tape
  - Staples
  - String
  - Pipe cleaner
  - Flexible wire
  - Blunt-tipped wire cutters

To Do

1. Have youth get into their design groups. Ask youth questions about how their network will be represented. Will they use string, text bubbles, or signs to indicate the parts of the device that are connected to the network?
2. Have groups use whatever materials they think are necessary to build their physical prototypes. Make sure there are enough essential items for each group to have, such as glue, scissors, tape, string.
3. If groups are having a slow time building or using team work, suggest that they divide their network into parts. Each team member works on one part and then they can bring all the parts together when they are completed.

Discussion/Reflection

Time: 10 minutes

Purpose: Youth discuss the essential questions for the unit

Materials
- Design requirements
- Design process poster

To Do

1. Ask youth to reflect on the unit.
2. Discuss the following questions:
   - Why would you want to use a network?
   - How do computer networks and the computers they connect impact your life?

Week 9: Second Week of Prototype Building

Summary

Schedule

Challenge	Continue to build network prototype .	1 hour 10 min
Main Activity	Develop demonstrations.	60 min
Discussion/Reflection	Reflect on steps of design process.	10 min
Total Time		2 hour 20 min

Essential Questions

- Why would you want to use a network?
- How do computer networks and the computers they connect impact your life?

Design Process Concepts Involved

- Sketch it.
- Create prototype.

Glossary

- **Demonstration.** Typically shortened to “demo,” a demonstration is the act of exhibiting the use of a device, machine, or showing an example of a process, to possible users or buyers.

Materials

- Chart paper
- Markers and pens
- Computers with Internet access
- Document camera
- Design Notebooks
  - Networked Classroom of the Future—Design Requirements sheet (from week 6)
  - Completed Feedback Forms (from week 7)
  - Physical prototype building materials:
    - Cardboard boxes of all shapes and sizes (interesting shapes and sizes, or pieces of cardboard)
    - Construction paper, variety of colors
    - Tape
    - Staples
    - String
    - Pipe cleaner
    - Flexible wire
    - Blunt-tipped wire cutters

Getting Ready

Overview

During week 9, youth continue building their physical prototypes and create demonstrations (demos) for their network and devices. In the *Challenge* groups will continue building the physical prototypes of their devices. In the *Main Activity*, groups will use their user scenarios to create a demonstration of their network. You will be able to determine from the demonstrations how well youth understand networks.

Background

Use the following questions to probe the students' understanding of their designs and the way networks function. Ask the following questions informally as groups are building their prototype (no need to ask all of the questions for each group):

1. How will you show what type of network(s) your classroom of the future use?
2. Will you show what happens if one of the networks is not working?
3. Will you show what parts of your network can stop functioning and the network still works?
4. How will you show what elements of the network are essential and would break the network if they were not functioning?
5. Who are the users?
6. What are the steps a user or users must take to use the system?
7. How would the networks in this classroom impact your life?

In the *Main Activity,* Youth will develop demonstrations that should be used during Family Tech Night. Remind youth that they have already created many parts of the demonstration by creating user scenarios and sketches. They should piece together their demonstration using their user scenarios, sketches, and the map of their network. For example, you could give the youth an example of a demonstration using a regular table and acting as though it were a smart board by displaying pictures, homework, and a wire connected to a string to another smart table. See the Demonstration Guidelines Activity Page. You can use the DataGotchi pages as an example of what a "screen shot" looks like. Screen shots are images of what the device screen will look while it is in use. Illustrations of the DataGotchi screen show youth that screen shots are pictures of what their device's screen will look like when it is in action.

Challenge

Time: 1 hour 10 minutes

Purpose: Youth continue to create physical prototypes of their device.

Materials

- Computers with Internet access
- Design Notebooks and designs
- Physical prototype building materials:
  - Cardboard boxes of all shapes and sizes(interesting shapes and sizes, or pieces of cardboard)
  - Construction paper, variety of colors
  - Tape
  - Staples
  - String
  - Pipe cleaner
  - Flexible wire
  - Blunt-tipped wire cutters

To Do

1. Youth continue working in teams to build their physical prototype of their networked classroom of the future, including devices. Check to see that youth are following the design requirements.
2. If groups are having a slow time building their prototype or difficulty using team work, suggest that they divide their network into parts that each team member can work on and then bring all the parts together when they are completed.

Main Activity

Time: 60 minutes

Purpose: Youth create a network demonstration .

Materials

- Groups' device design sketches
- Map of Network
- User Scenarios
- Design Notebooks
- Computers with Internet access
- Demonstration Guidelines
- DataGotchi Pages (from week 6)

To Do

1. Explain to youth that they will be creating a demonstration of their network for the classroom of the future and its devices. They will use this demonstration to present their devices at Family Tech Night.
2. Have youth review the requirements for a demonstration. You can either write the requirements on a piece of chart paper (and save it for later) or pass out copies. You may want to explain what "screen shot" means by using an example of what it looks like on the DataGotchi pages.
3. Have youth use their user scenarios, design sketches, and map of network as props for their demonstration. Give the youth an example of a demonstration.
4. If there is enough time, have youth practice their demonstrations with you or another group. You and others can give verbal feedback, but ask the presenting group to keep track of the feedback they receive by writing down notes for their own network and/or device's improvement.

Discussion/Reflection

Time: 10 minutes

Purpose: Youth give each other feedback on meeting the design requirements and creating a demo.

Materials

- Paper
- Pens

To Do

1. Ask youth to name steps in the design process they accomplished this week.
2. Ask youth what they found challenging about creating a demonstration.
3. Ask youth to report what they did to help them develop a demonstration for their device?

Weeks 10 & 11: Family Tech Night (FTN)

Summary

Schedule

Warm Up	**Brainstorming a plan for FTN (Family Tech Night)** Youth brainstorm projects and examples they want to share.	20 min
Challenge	**Creating a plan for FTN**	80 min
Discussion/Reflection	**Youth discuss enduring understandings and reflect on what they've learned.**	20 min
Main Activity	**FTN Presentations** Youth and leaders host FTN, which may extend into the evening to accommodate adults' schedules.	2 hr
Total Time		**4 hr**

Getting Ready

Overview: This is a chance for the youth to showcase to their family, peers, staff, and school community the work that they completed during the unit.

Background: Refer back to the unit's lessons. Family Tech Night gives youth a chance to revisit lessons completed throughout the unit and use the information they learned when presenting their projects to people coming to Family Tech Night.

Tips

Gather students' projects to give you an idea of what is complete and what needs to be finished from the unit in order to display them for FTN.

Make sure the youth take a leadership role in the planning and the night itself. (Example: Have youth lead a short lesson with their guests and families.)

Make the night creative, interactive and fun for the youth.

Secure a space for FTN that will accommodate the displays and guests.

Make sure you plan for the use of technology, including checking that the Internet access and computers are working. Also have a backup low-tech version in case the technology does not work or is slow.

Note that you may want to contact the teachers and students who were involved in designing groups' projects, to ensure their attendance at Family Tech Night.

For Unit 4, note that presenting their designs will be more compelling if the youth incorporate and discuss how easily they created an interactive whiteboard for less than $50.

Examples for Unit 4. Bluetooth, Wii White Board, Network Demonstrations, and stations comparing network technologies are some of the best to show.

Idea 1. Since the Networked Classroom of the Future is the largest project, it can be a main project shown. Each station can be represented by a design group, where each group manages a table with a different activity from the unit while also having a 3-fold science board display their Networked Classroom of the Future project. Every group can have a 3-minute "demo break" or the demos could be done one at a time on a stage-like area near their stations. Demo breaks are shorter than the demos that they created so that each station can have enough time to also show their activity. Demo breaks mainly convey how different types of users are using this network. Other projects or activities are displayed on a table so youth know that all work during ICT4me is important. See sample layouts 1.

Idea 2. All projects from Unit 4 can be displayed at different stations off to the side of the room. Youth can give their network demonstrations on a center stage. Assign youth to each station and ask them to be prepared to discuss the project and their use of the design process.

In addition to any choice: Let the youth show off the new skills they learned by setting up and using the Wii White Board, or conducting a product demonstration with parents and friends (see layout 2).

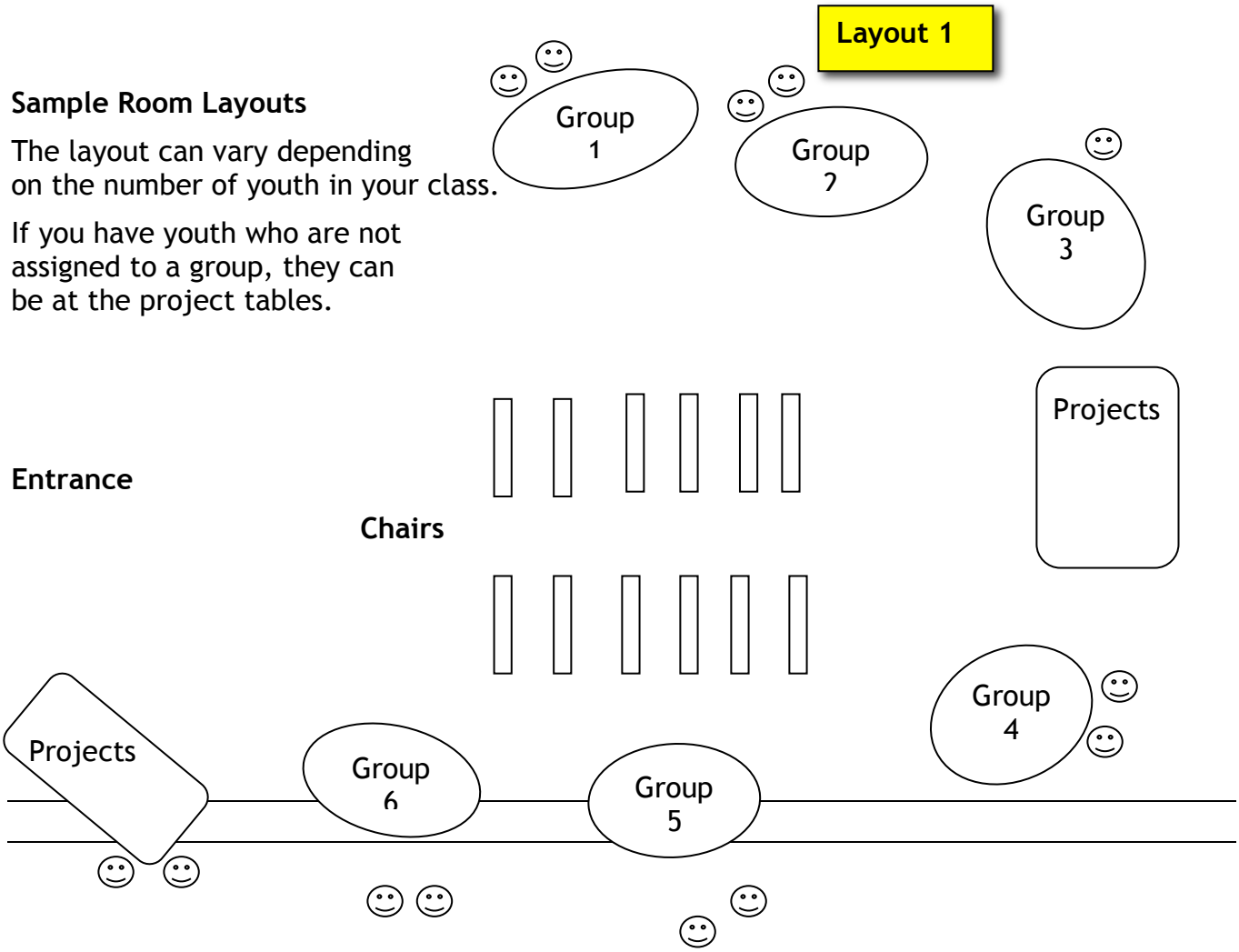
Materials

- Work youth completed during the unit
- Markers
- Display boards
- Dry-erase board
- Rulers
- Pencils
- Scissors
- Tape
- Note cards
- Paper (white/color)
- Posters
- Computers
- Cameras
- Extension cords
- Food
- Eating Utensils
- Plates

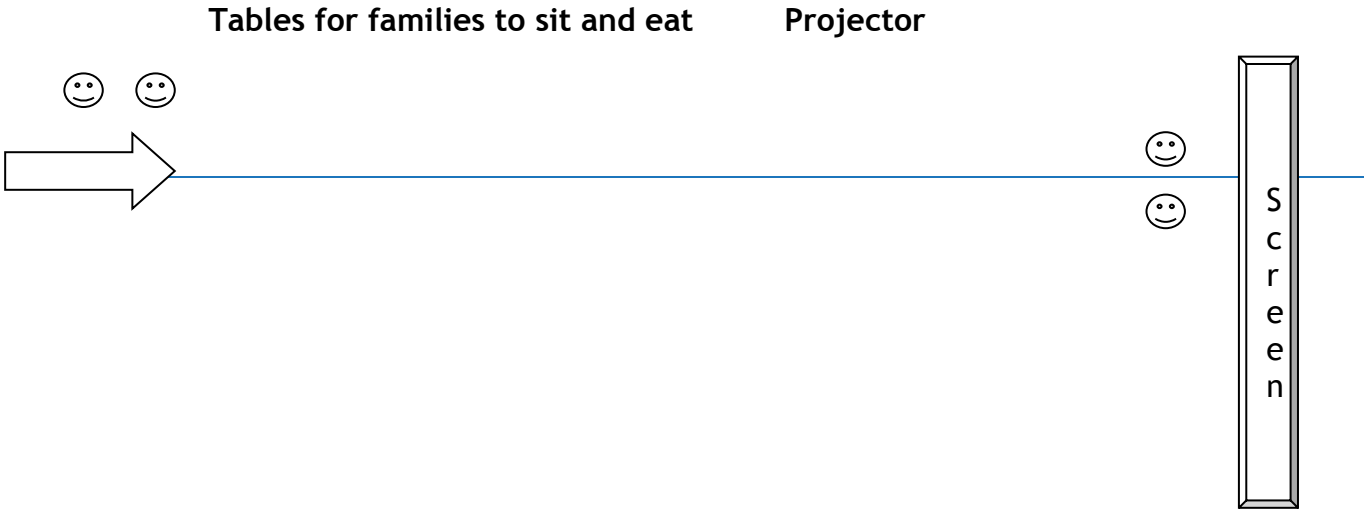
Sample Room Layouts

The layout can vary depending on the number of youth in your class.

If you have youth who are not assigned to a group, they can be at the project tables.



Entrance



Brainstorming a Plan for FTN

Time: 20 minutes

Purpose: Youth will b**rainstorm** projects that will be presented to parents/guardians/school staff on Family Tech Night.

Materials

- Large paper and markers
- Dry-erase board and markers

To Do

1. Before meeting with the youth, staff should have an idea of what projects they want to show.
2. Have youth come together in a large circle to brainstorm. A student or facilitator can be the scribe.
3. Have youth think of the projects they want to show. Write down each one and tally how many times each one is stated
4. After a list is created, youth will then choose what they want to work on in small groups. Make sure that each youth has a task to complete.
5. You can also focus on one project to show and use this time to brainstorm tasks that will be assigned to youth. Make sure to emphasize to the youth that they will show this project to their family so they know the level of work you are expecting.

Tips

- Keep in mind that you are facilitating the brainstorming session and you should already have some options youth can choose from.
- Although only one project maybe highlighted during the night (for example, Unit 4's Networked Classroom of the Future project), it is important for youth to know that all ICT4me work is important. All work should be displayed on side tables, or posted on walls, or on 3-sided presentation boards (science fair boards).
- Ask ICT4me staff to visit those stations that have fewer visitors.
- Remember to have food that the community you serve will enjoy.

Creating a Plan for FTN

Time: 80 minutes

Purpose: For youth to make and create their displays to show off their projects for Family Tech Night.

Materials

- Markers
- Paper (white/color)
- Note cards
- Scissors
- Pencils
- Display boards

To Do

1. Once a list of roles is created, share the list of roles with youth.
2. Assign roles to youth.
3. Youth get in groups to determine what their stations will look like and how they will communicate knowledge of their project.
4. Facilitators should work with youth to ensure that their presentations use appropriate language, are well organized, and that their projects reflect the learning from the unit.
5. Allow time for youth to practice their presentations.

Discussion/Reflection

Time: 20 minutes

Purpose: Youth reflect on what they've learned in the unit.

Materials

- Presentations and project materials that will be used at FTN.

To Do

1. Have youth gather in a circle and reflect on what they've learned during the unit.
2. Remind youth of the essential questions and ask them to respond to these questions now that they are at the end of the unit. The students' answers to these questions should be reflected in their presentations at FTN.

Essential questions for Unit 4

- Why would you want to use a network?
- How do computer networks and the computers they connect impact your life?

FTN Presentations

Time: 2 or more hours

Purpose: Youth present what they've learned and designed.

Materials
- Presentations and project materials
- Computers with Internet access
- Food – It's a celebration!

To Do

1. Set up the stations as planned. Make sure each youth has a role and responsibility.
2. Provide food. It's a good idea to have tables for eating separate from the technology.
3. Back up plan if technology is not working. For example, for Unit 4 you may want to have pictures of the youth using the Wii-board on a PowerPoint if the Wii-Board does not work. Have copies of the PowerPoint on a pen drive or multiple computers.
4. Encourage visitors to circulate. For example, you may want to create an information gathering game that encourages visitors to go to every station and ask the youth questions.
5. Have fun!

Activity Pages

Week 1

- Station 1: Telephone Components
- Station 1: Telephone Directions & Questions
- Station 2: Cellular Telephone Components
- Station 2: Cellular Phone Questions & Directions
- Station 3: Telephone Network
- Station 3: Telephone Intercom Questions & Directions
- Station 4: PDA Components
- Station 4: PDA Questions & Directions

Week 2

- PAN, LAN, WAN
- Example of a WAN
- Ning example, Bluetooth and Infrared Instructions

Week 3

- Examples of Graphs
- The Colorful Houses of Tourist Town
- The Colorful Sidewalks of Tourist Town
- Mail Carrier's Tour
- The Painter of Lines in the Street
- Network Topologies 1
- Network Topologies 2

Week 4

List page titles

Week 5

Steps in making a Wii interactive whiteboard

Week 6

- Types of Networks
- Classroom of the Future Design Requirements
- Brainstorm Guide
- DataGotchi Pages

Week 7

- User Feedback & Interview Form
- Peer Feedback Form

Week 8

- Networks and Connections

Week 9

Demonstration Guidelines

Week 1

Activity pages

- Station 1: Telephone Components
- Station 1: Telephone Directions & Questions
- Station 2: Cellular Telephone Components
- Station 2: Cellular Telephone Questions & Directions
- Station 3: Telephone Network
- Station 3: Telephone Intercom Questions & Directions
- Station 4: PDA Components
- Station 4: PDA Questions & Directions

Station 1: Telephone Components

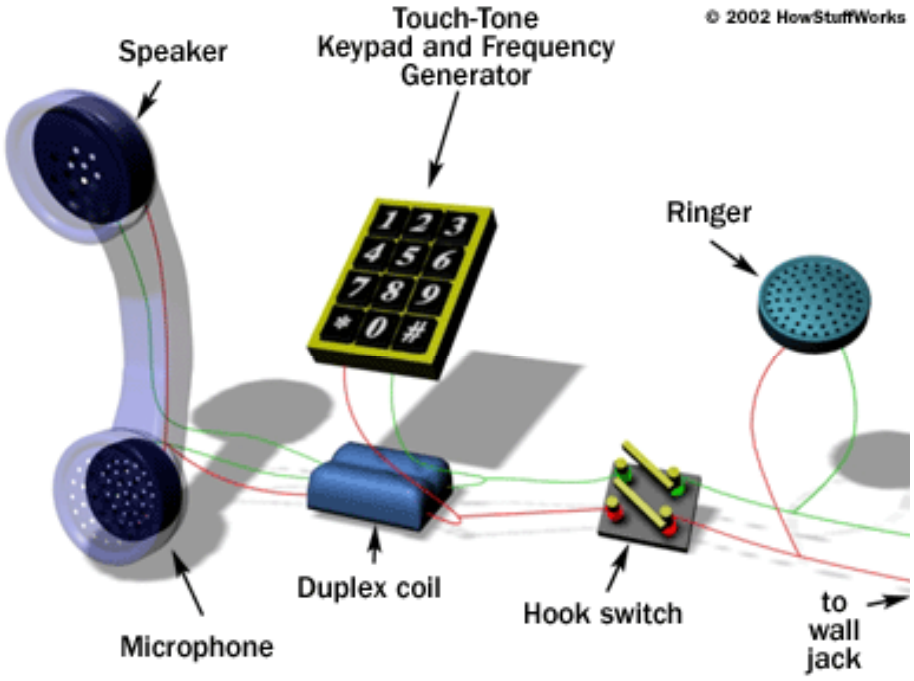


Image source: *http://electronics.howstuffworks.com/telephone2.htm*

Hook Switch - a switch that connects and disconnects the phone from the network

Ringer- a speaker and a circuit that generates a pleasant ringing tone when someone is calling

Microphone- a device that has a diaphragm that is vibrated by sound waves (your voice), which it turns into an electric signal

Speaker- a device that turns electric signals into sound waves

Duplex Coil – a device that prevents the sound of your voice from reaching your ear so you don't hear your voice in the speaker when you talk

Touchtone Pad and Frequency Generator- a keypad the produces different tones based on the key being pressed

Station 1: Telephone Directions & Questions

1. Take apart the telephone and identify each part noted in the diagram.
2. Explain to somebody in your team how this telephone works.
3. Put the phone back together and sketch what you found.
4. Imagine that you are using this phone to call your friend. How does this phone connect to your friend's phone? Hint: You may want to look at a simulation online of how your phones connect. Make a sketch of the network.

Station 2: Cellular Phone Components

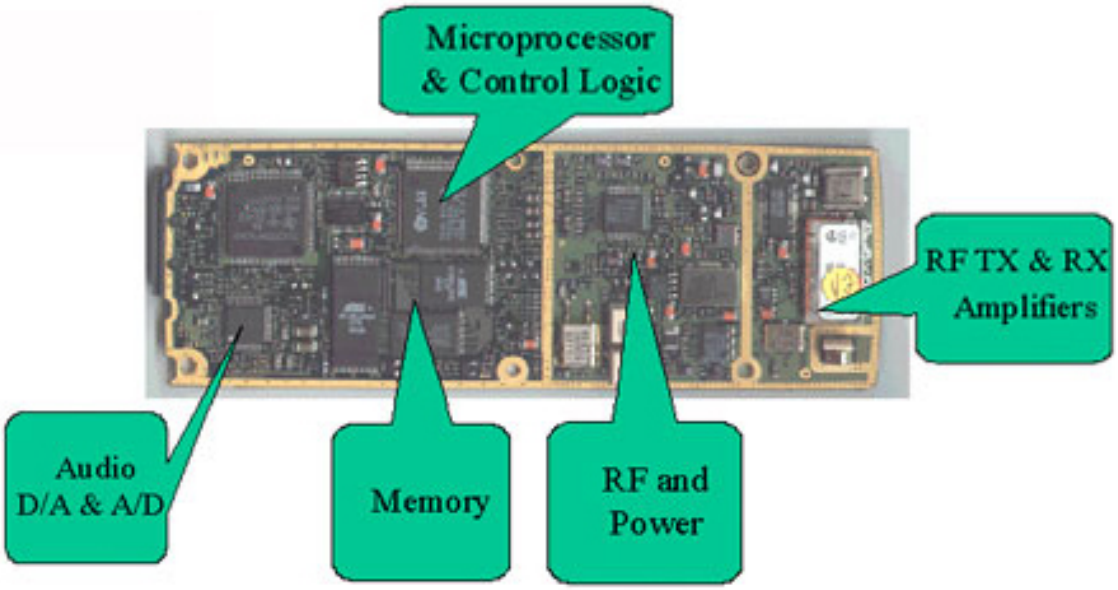


Image source: *http://electronics.howstuffworks.com/inside-cell-phone.htm*

The parts of a cell phone:

- A microscopic microphone
- A speaker
- An LCD or plasma display
- A keyboard
- An antenna
- A battery
- A circuit board containing the guts of the phone

In this picture several of the internal components are identified.

The microprocessor and memory handle all of the housekeeping chores for the keyboard and display deal with command and control signaling with the base station and also coordinate the rest of the functions on the board.

The RF (Radio Frequency) and power section handle power management and recharging and also deal with the hundreds of FM channels.

Finally the radio frequency amplifiers handle signals in and out of the antenna.

What is amazing is that all of that functionality - which only 30 years ago would have filled the entire floor of an office building - now fits into a package that sits comfortably in the palm of your hand!

Station 2: Cellular Phone Questions & Directions

1. Take apart the cell phone and identify each part in the diagram.
2. How does this phone differ from the diagram?
3. Can you explain how this telephone works?
4. Put the cell back together and sketch what you found.
5. Imagine that you are using this phone to call your friend on their cell phone. How do the phones connect? What if their phone is not a cell phone? Make a sketch of the network that includes cell phones and landline based phones.

Station 3: Telephone (Intercom) Network

A telephone a simple device, but the connection between you and the phone company is even simpler. In fact, you can easily create your own intercom system using two telephones, a 9-volt battery (or some other simple power supply) and a 300-ohm resistor that you can get at a hardware store. You can wire it like this:

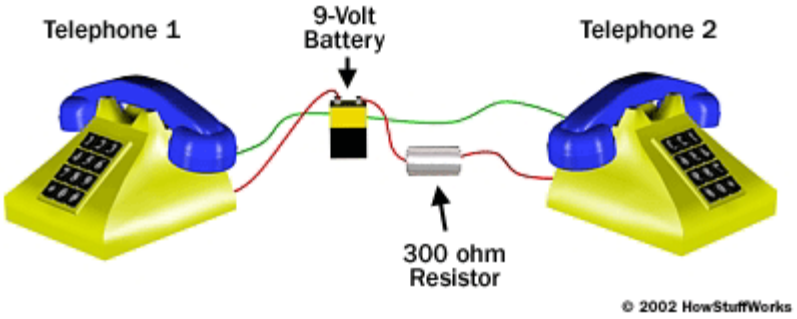


Image source: *http://communication.howstuffworks.com/telephone4.htm*

Note: Most resistors look like wires the size of paper clips; this graphic does not reflect actual size.

Your connection to the phone company consists of two copper wires too! The only thing your little intercom cannot do is ring the phone to tell the person at the other end to pick up. The "ring" signal is a 90-volt AC wave at 20 hertz (Hz).

Hand Generated!

You know the hand cranks on those old-fashioned telephones? They were used to generate the ring-signal AC wave and sound the bell at the other end!

The easiest way to wire a private intercom like this is to go to a hardware or discount store and buy a 100-foot phone cord. Cut it, strip the wires and hook in the battery and resistor as shown. (Most cheap phone cords contain only two wires, but if the one you buy happens to have four, then use the center two.) When two people pick up the phones together, they can talk to each other just fine. This sort of arrangement will work at distances of up to several miles apart.

Station 3: Telephone Intercom Questions & Directions

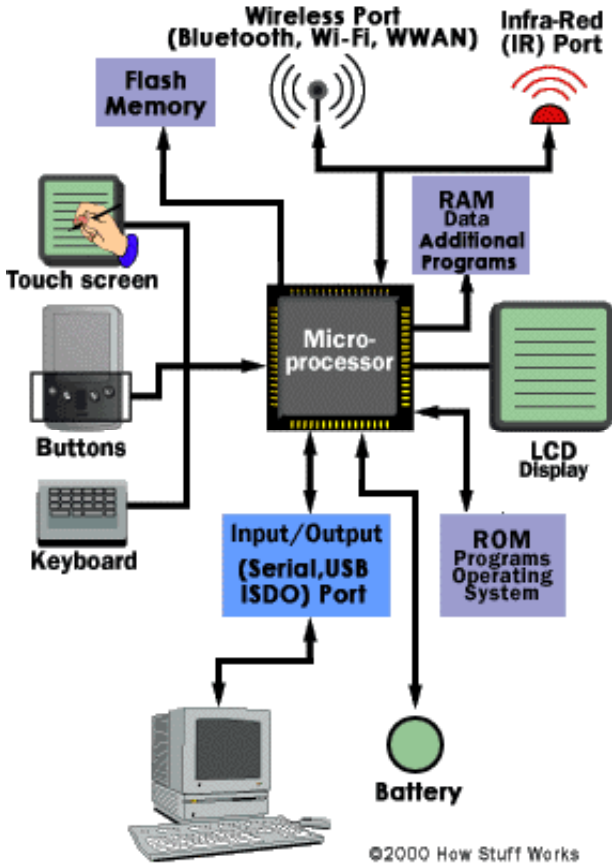
1. Use the diagram to set up the intercom network.
2. What makes it possible to hear the person on the other end of the phone?
3. This connection is similar to the way phones once worked, when there were switchboards and human operators. As you know, things have gotten much more computerized.
4. Continue to work on your sketches. Include all the computer-oriented networks that you know about—like the Internet!

Station 4: Personal Digital Assistant (PDA)

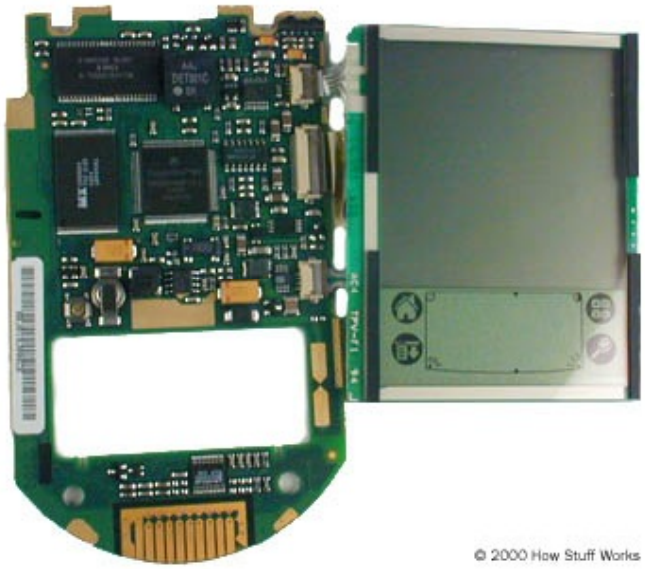
Like standard desktop and laptop computers, PDAs are powered by microprocessors. The microprocessor is the brain of the PDA, and it coordinates all of the PDA's functions.

Note the ways that the PDA can join a network: Bluetooth, Wireless Wi-Fi, and Infrared.

The parts that can make up a PDA



Here is an inside view of a PDA. The circuit board folds away from the screen. In the middle of the circuit board is the microprocessor.



Images source: *http://electronics.howstuffworks.com/pda2.htm*.

Station 4: PDA Questions & Directions

DO NOT TAKE ANY OF THE PDAS APART.

1. Look at the diagram of and read the information about the PDA.
2. What are the different ways that this PDA can communicate with other PDAs?
3. Use a PDA to create a note and beam it to another PDA.
4. Can you explain how the PDA works?
5. Make a sketch of the network that includes the PDA and all the different ways it can communicate with other devices.

Week 2

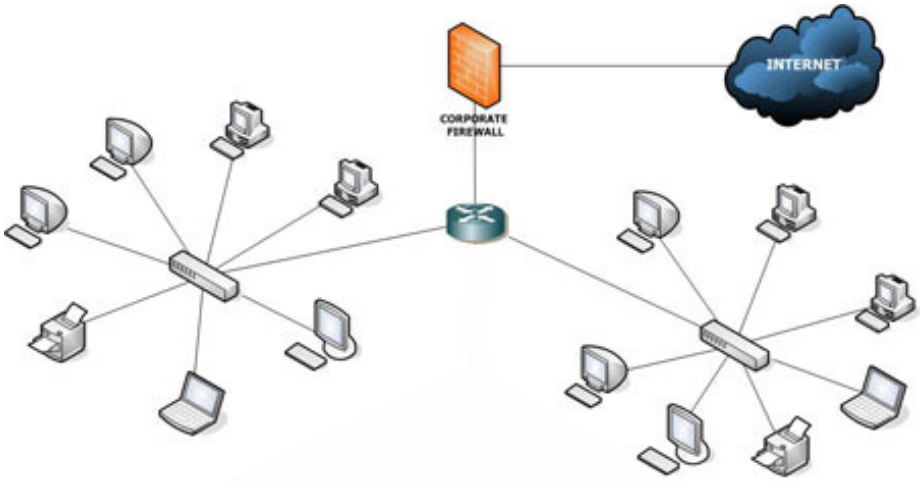
Activity Pages

- PAN, LAN, WAN
- Example of a WAN
- Ning Example, Bluetooth and Infrared Instructions

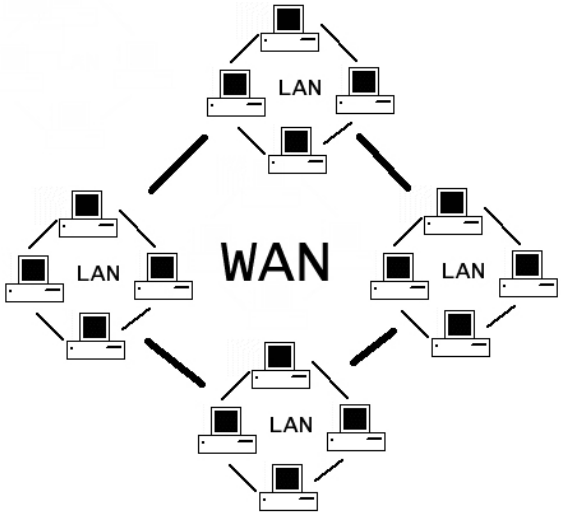
PAN, LAN, WAN

PAN

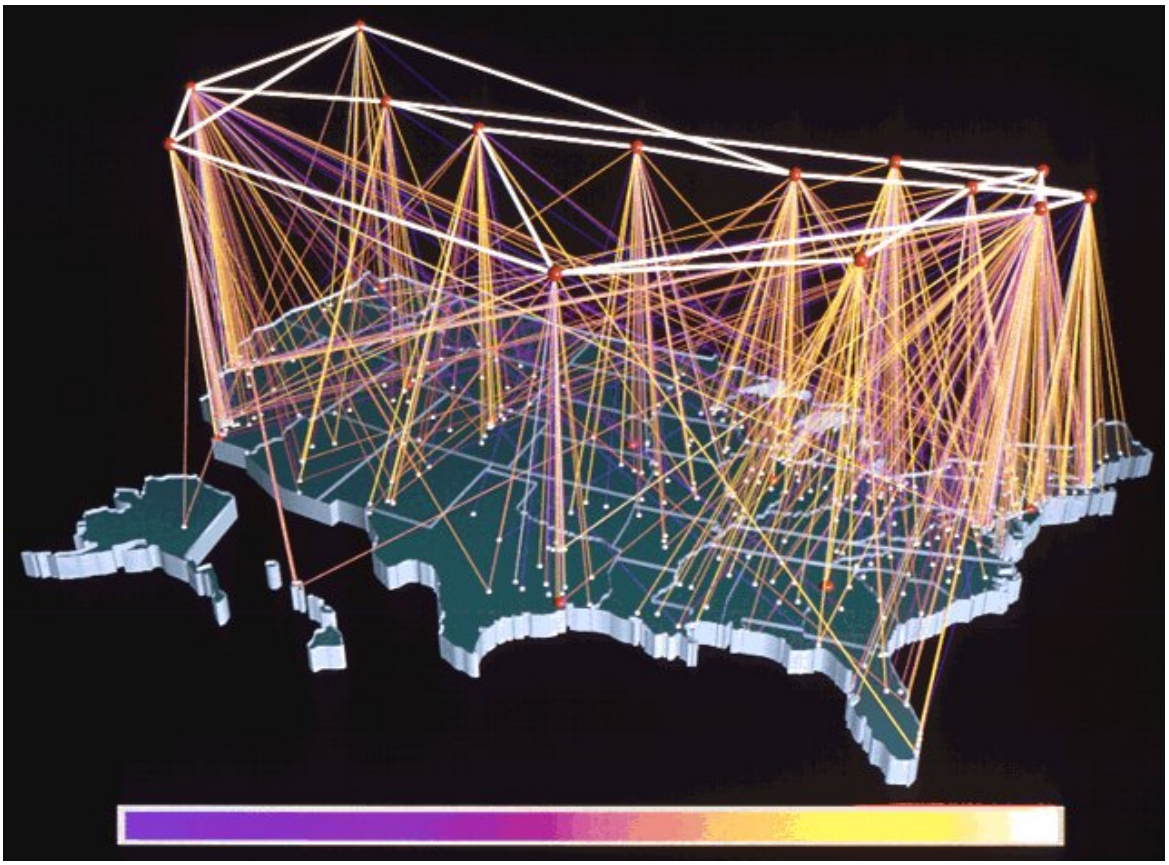
LAN



WAN



An Example of a WAN: the National Science Foundation Network



This is one of many images created by the Visualization Study of the NSFNET, by Donna Cox and Robert Patterson from the NCSA in 1992. Source: An Atlas of Cyberspaces: http://personalpages.manchester.ac.uk/staff/m.dodge/cybergeography/atlas/geographic.html. Last visited Feb. 27, 2008 2:35pm

Ning Example, Bluetooth and Infrared Instructions

Ning Example File Upload

- Go to the Start menu and find Internet Explorer.
- Type in the URL for the online space
- Once you have your assigned login, use it and a password to log into the ICT4me Ning group.
- Go the Group your facilitator created.
- Look at the "Sharing Files" discussion forum.
- Create or choose a document on your computer or handheld
- Upload it under the "Reply to This" box, by clicking the link "Upload Files".

Bluetooth and Infrared (Beaming)

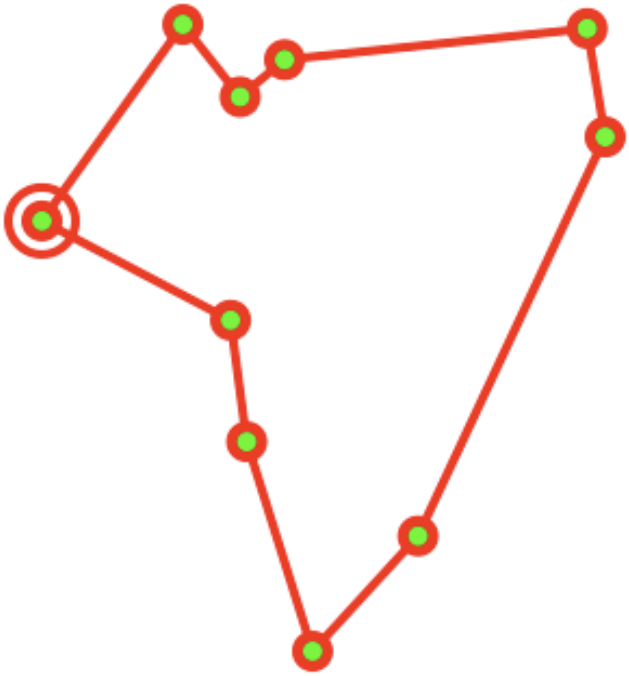
- Turn on Bluetooth – look for it in the network menu.
- Then go to Notes under Start menu (you may then need to go to Programs if Notes isn't listed under Start menu).
- Create a note. Then, click OK.
- Hold onto the note you created; a menu with Bluetooth as an option will appear.
- Choose the device number you want to send to. (Note: all handhelds are numbered on the outside based on the ID number they are programmed with.)
- The same thing is true for infrared: create a note, click OK, hold onto the note you created, then select Beam.
- You won't choose a device number but must have your handheld pointed at another handheld.

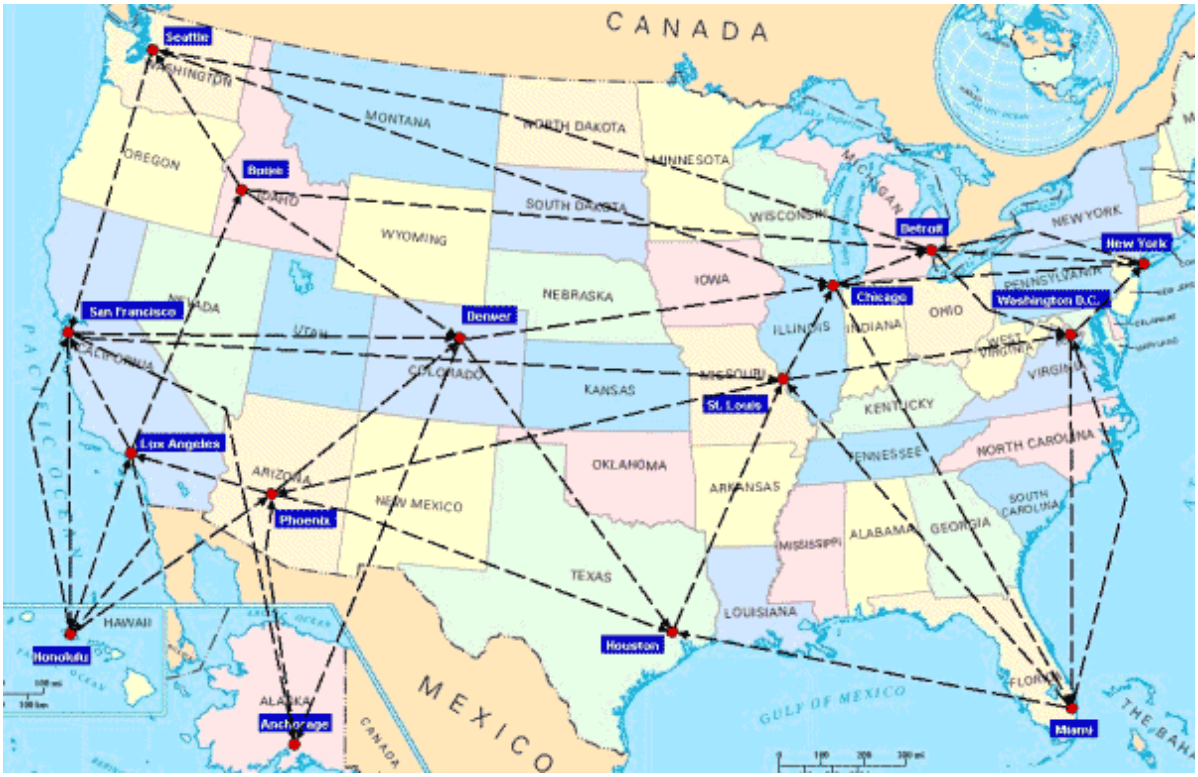
Week 3

Activity Pages

- Examples of Graphs
- The Colorful Houses of Tourist Town
- The Colorful Sidewalks of Tourist Town
- Mail Carrier's Tour
- The Painter of Lines in the Street
- Network Topologies 1
- Network Topologies 2

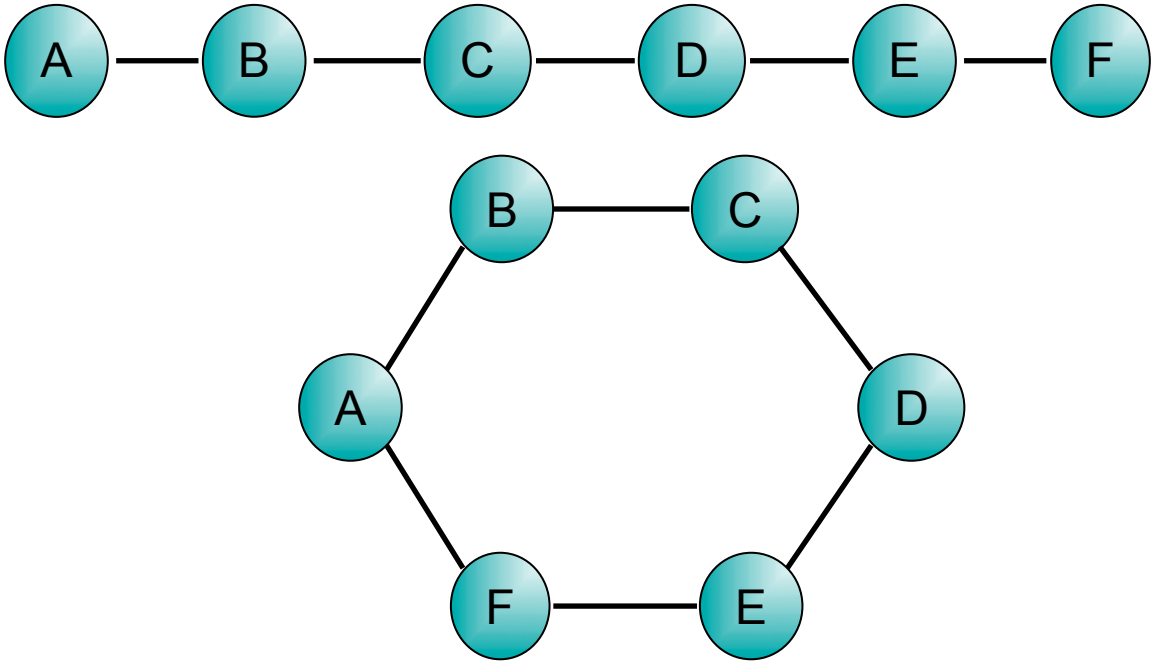
Examples of Graphs

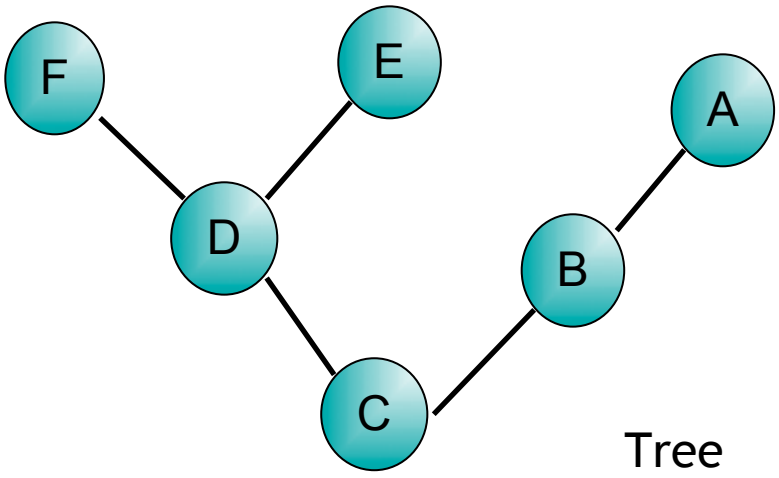




Network Topologies 1

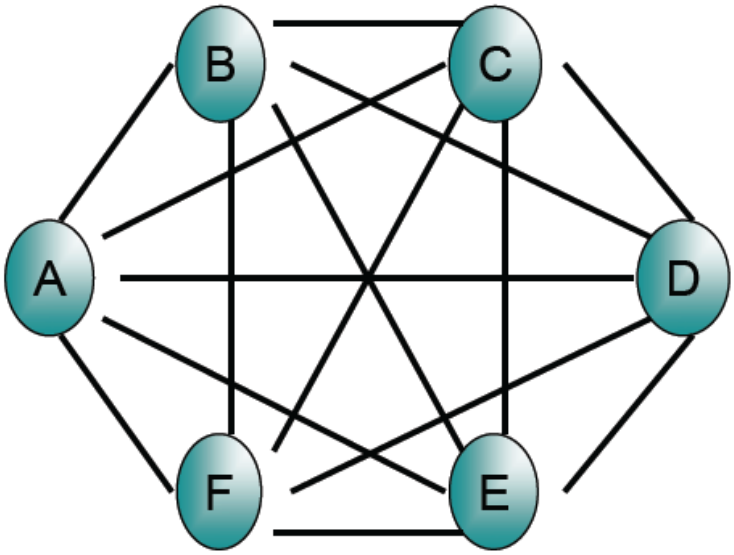
Linear or Bus



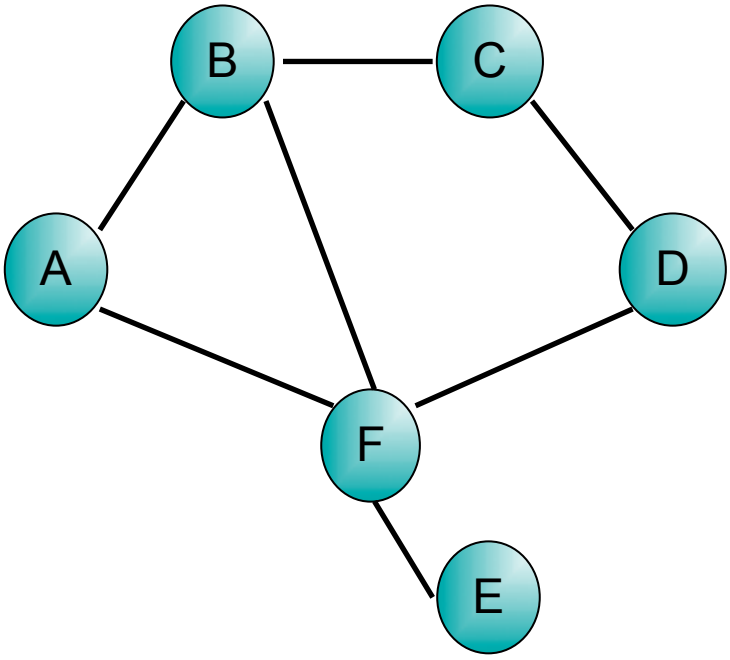


Tree

Network Topologies 2



Fully Connected Mesh

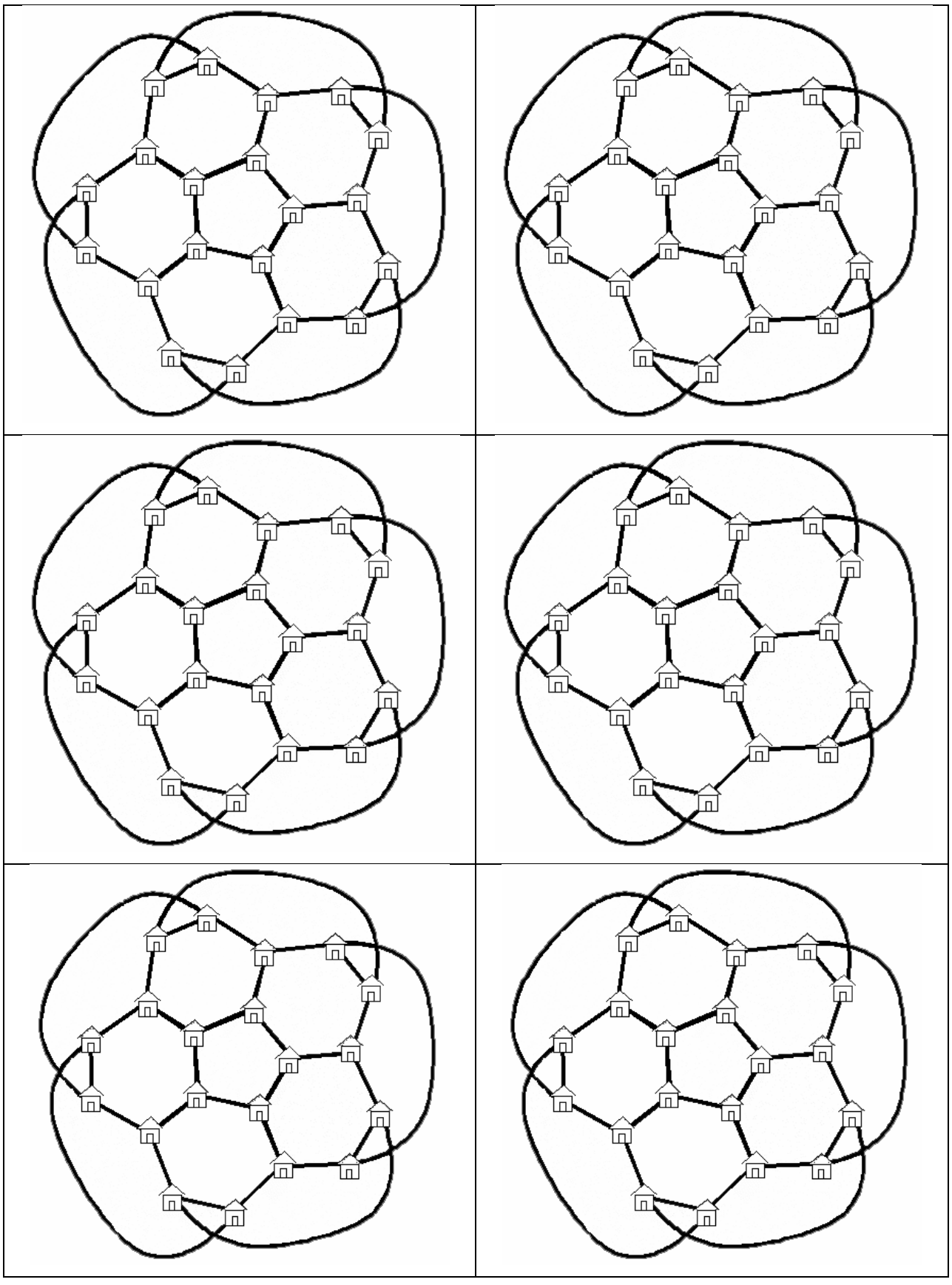


Partially Connected Mesh

The Colorful Houses of Tourist Town

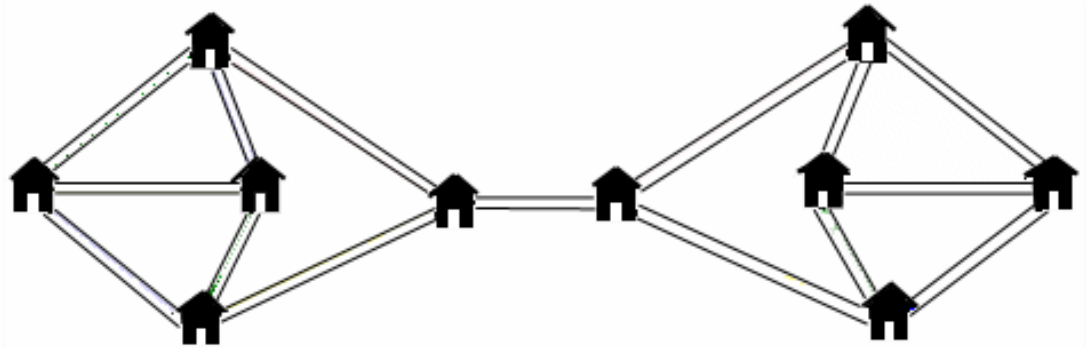
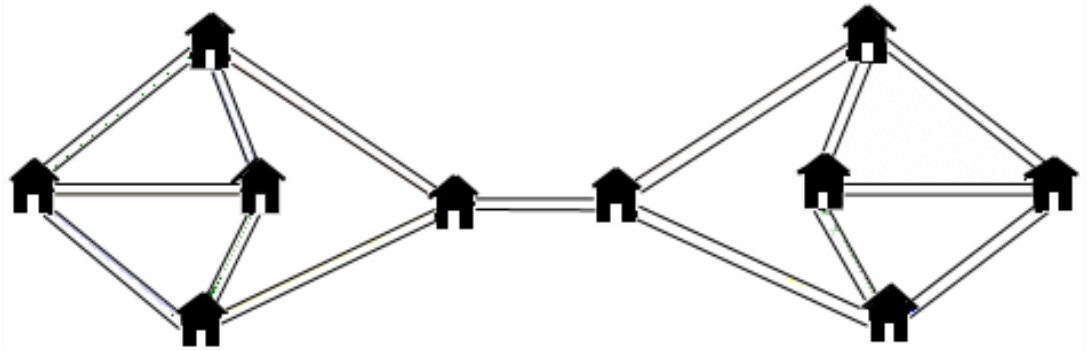
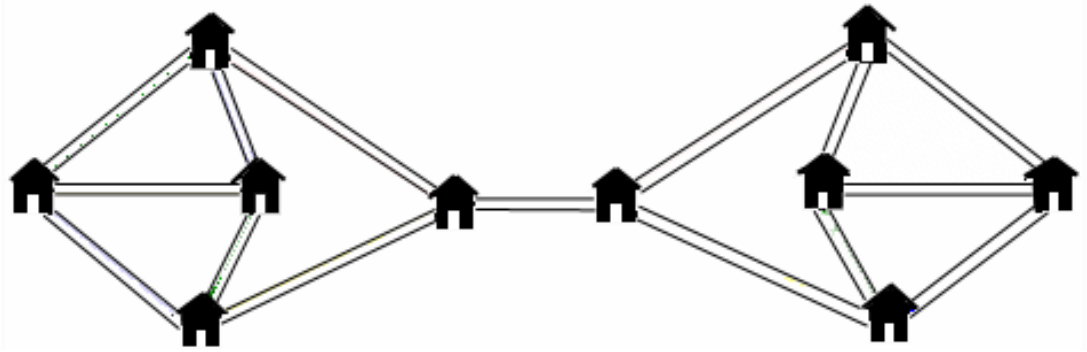
In Tourist Town there is something interesting to see in every house, and the people who live there want the tourists to visit them all. The City Council has decided to buy *just enough* paint to repaint all of the houses. If tourists leave a house that they have just visited and look next door and see a house that is the same color, they might think that it is just like the house that they just left and not visit it. So the City Council wants to repaint the houses so that no neighboring houses are the same color. What is **the least number of colors** the City Council needs to buy?

This problem is related to "The Colorful Sidewalks of Tourist Town," (below), but they are not quite the same, as you will see if you do them on the same graphs. These in turn are related to map coloring.



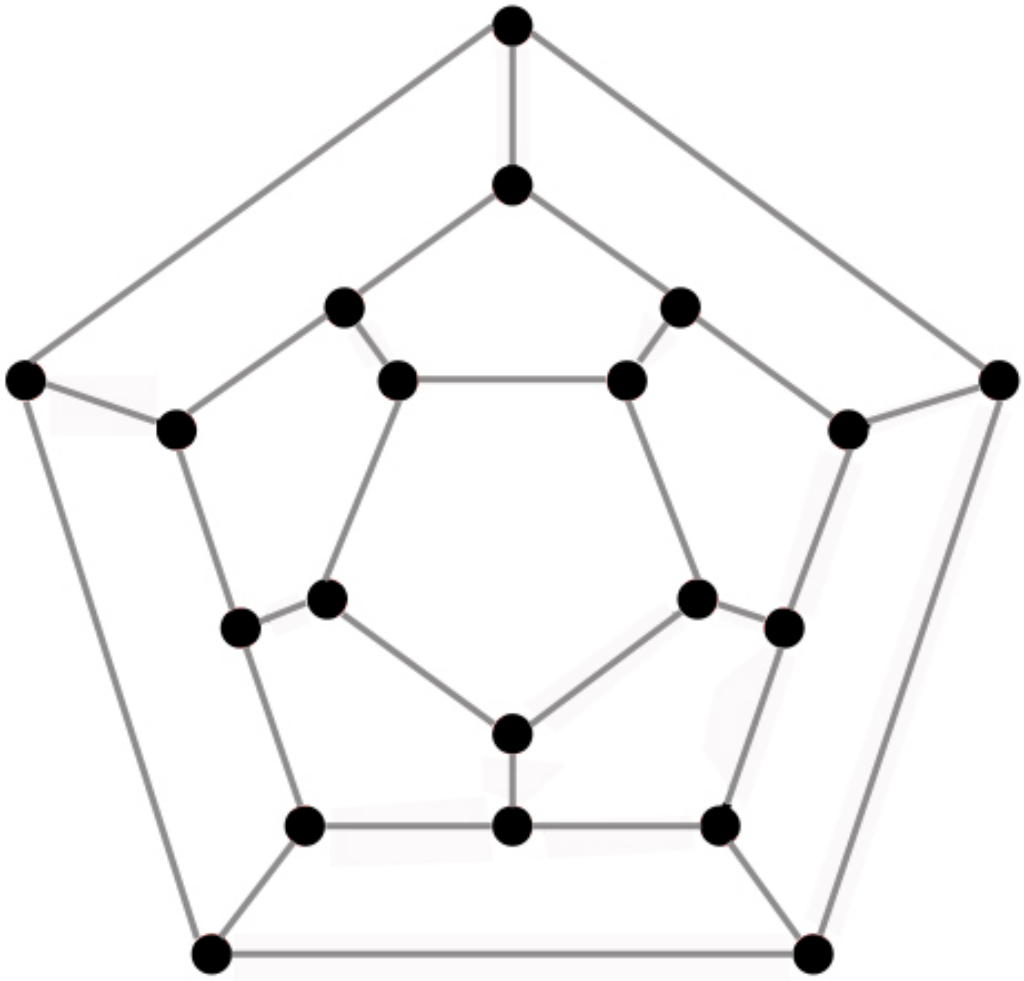
The Colorful Sidewalks of Tourist Town

Since all the grownups got to paint their houses, the City Council decided that the children should be able to paint the sidewalks in bright and interesting colors. They don't want the tourists to ever get bored by walking down two streets in a row whose sidewalks are the same color. What is the **least number of colors** the City Council needs to buy? Experiment a few times by drawing graphs and coloring their "sidewalks."

1	
2	
3	

Mail Carrier's Tour

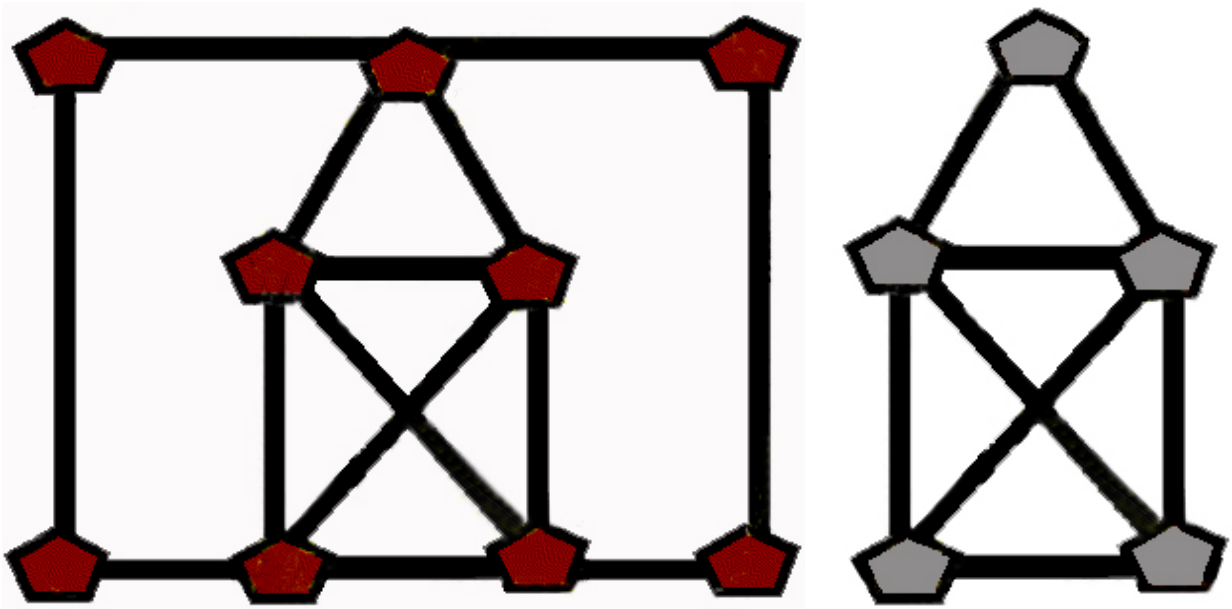
Imagine that the graph is the map of a neighborhood. The edges are streets and at every vertex is a house. The mail carrier doesn't want to walk down any more streets than necessary to pick up and deliver mail to all of the houses. What is the best route to take? Where should they put a drop box for the truck to leave all the mail that needs to be delivered in the neighborhood?



The Painter of Lines in the Street

The person who paints the lines in the streets works hard and doesn't want to have to spend time and energy lugging painting equipment when it is not necessary. What is the best route to take for painting the streets so that all the streets get painted, and the only time that the painter is on a street is when he or she is painting it? Can the painter end up where he or she started?

Try your solution on these two graphs.



Week 4

Activity Pages

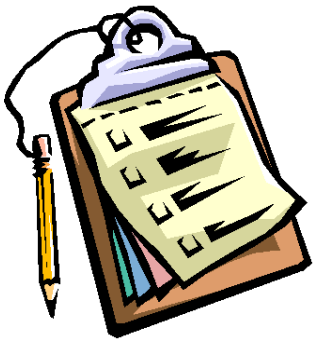
- Gatherer Role Sheet
- Interviewer Role Sheet
- Photographer Role Sheet
- Sketch Artist Role Sheet
- ICT Professional Snapshot Template

Gatherer Role Sheet

Your role is to work with your partner to collect "field data" from the place you are visiting tomorrow on your field trip and fill your bag! Open your eyes wider than they have ever been before! Look where others may not be looking. See yourself as a true investigator that has just arrived on the scene!

Things to consider for your investigation and "Gatherer Bag" of goodies:

1. Brochures
2. Business cards
3. Leaflets
4. One pagers for visitors
5. Samples, giveaways, or goodies!
6. Logo of the business or site
7. A leaf, small rock, some small natural memento from the walk up to or around the site
8. Write down any quotes, clues, key phrases or mottos that the business says a lot. Or slogans the organization believes in like Girls Inc's motto, "Strong, Smart & Bold"
9. Help direct your "Photographer" partners to scenes, processes, objects and people to consider photographing and filming.

Interviewer Role Sheet

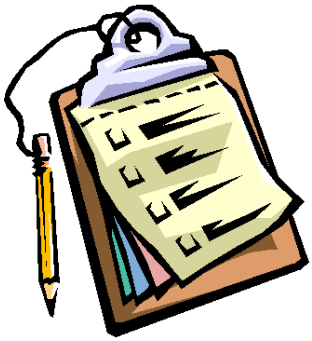
Your role is to work with your partner to collect information by interviewing the "ICT Professionals" hosting at your field trip with the suggested questions below. You don't have to use all of the questions. Practice with your partner asking questions before the trip to get comfortable with introducing yourself, eye contact and thanking the person in which you are asking questions. Have fun with it! This is your chance to become a journalist and reporter! Imagine yourself in the bright lights on location on the evening news!

Questions to consider asking as an interviewer with your clipboard. Plan what questions you will ask and which ones your partner will ask or one partner asks while another writes and uses the digital recorder:

1. What is your official job title?
2. How do you see women having an impact in this field?
3. How would you describe what you do here?
4. What do you like the least about your job?
5. What do you like about the most about your job?
6. Please describe your life outside of work.
7. What hobbies and interests did you have growing up related to this job? (current and during middle school, high school, college)
8. What is your educational background?
9. Please describe your career path and what lead you here today.
10.

These are questions to ask of your fellow ICT4me youth that are on this trip and you and for you and your partner to answer as well:

1. What is something new you learned today?
2. What did you learn today that was different than what you before coming on this trip, a myth that was exposed today?
3. What do you want to know more about?
4. What should people know who did not go on this field trip?



Photographer Role Sheet

Your role is to work with your partner to capture pictures of your field trip experience. This is your shot of being a real camerawoman on the scene! You get to be the eyes of the day and shoot with your perspective and find images maybe others will not see. Consider the background, is what you are seeing through the lens tell the story of what you want to share? You have a very important role.

Please focus on aspects of the organization you are visiting and the professionals you are meeting on the trip—and not taking extra photos of youth posing that will wear down the batteries.

Plan with your partner who will take pictures of certain things so you don't do double work and have too many photos of the same things. What to look for:

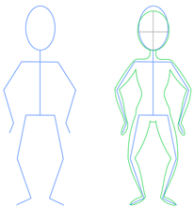
1. Buildings
2. Equipment/Tools of the trade
3. Posters, Charts, Equations, etc.
4. The location/site
5. ICT Professionals who say it's ok to take their pictures
6. People at work (if they say it's ok)
7. Other ICT4me youth learning, trying out tools, talking about what they like on trip, etc

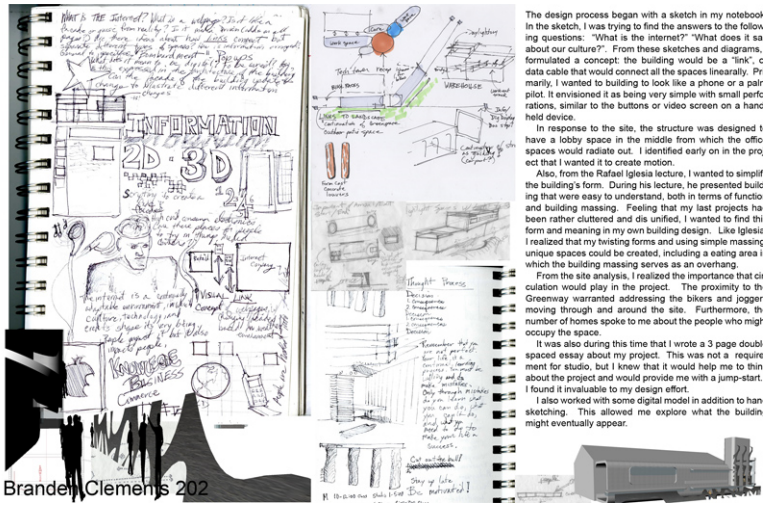
Sketch Artist Role Sheet

Your role is to work with your partner to sketch cool things you are witnessing on your field trip! This is your start as a "live artist" just like the courtroom sketch artists that show the scene because cameras are not allowed! You get to capture in small sketches what others may not see! Remember sketches do not always have to be pictures it can be words on a board, one detailed part of a machine, a sign posted on site, someone's name tag, someone's hand using equipment…"stretch" or should I say "sketch" your mind!

Plan with your partner who will sketch images of certain things so you don't do double work and have not enough original work of the experience. What to look for photos:

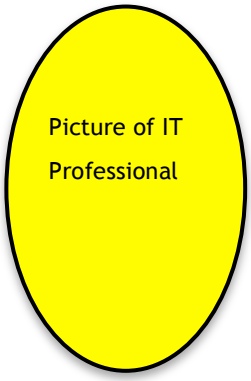
1. Buildings
2. Equipment/Tools of the trade
3. Posters, Charts, Equations, etc.
4. The location/site
5. Processes that you see people doing to get their work done. Can you make the process a flow chart?
6. Remember to be creative! A page of 5-10 small sketches that you can color in with colored pencils/markers at lunch time, on the bus or finish during the next ICT4me session is perfect planning!





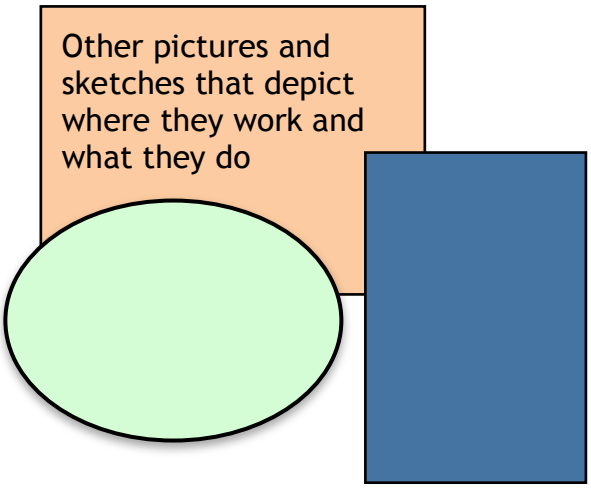
ICT Professional Snapshot Template

This is an example of how you can organize the information and images you gathered to create an "ICT Professional Snapshot." The snapshot is meant to give other people a good idea about what you learned in a visually interesting way, like a poster or trading card. Use your creativity and have fun!



Name

Job title
What they do
URL for their bio



Why is their job important?
Explain how their work helps other people.

About [Name of ICT Professional]
What they like about their job
Their life outside of work
Their hobbies and interests

What do they create?
Describe product or service
URL for their products/organization

Education & Experience
Their educational background
Their career path

Week 5

Activity Pages

- Steps in Making a Wii Interactive Whiteboard.

Steps in Making a Wii Interactive Whiteboard

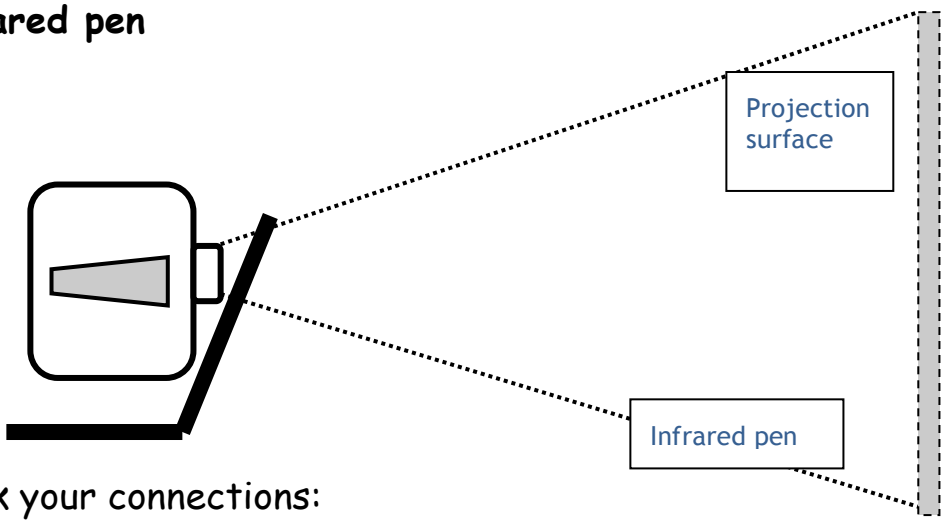
1. Set up your hardware. (Make sure anything that might need to be plugged in to a power supply is.)

a. Computer

b. LCD projector

c. **Wii remote.** It should be on top of the LCD projector, with the infrared eye looking at the screen or wall area.

d. Infrared pen



2. Check your connections:

a. Connect your projector to the computer (with a wire). Does the projection display what is on your computer screen?

b. Connect your Wii remote to your computer (via Bluetooth). Does your computer recognize the Bluetooth signature of your Wii remote?

c. Connect your infrared pen to the network (via infrared light). Launch the WiimoteWhiteboard software, and calibrate your infrared pen and screen. Does the computer respond to your infrared pen? (If yes, then your infrared network is working, if not …)

d. Check other connections (Wii remote connection: is it pointed in the right direction, can it see the infrared pen?

Week 6

Activity Pages

- Types of Networks
- Classroom of the Future Design Requirements
- Brainstorm Guide
- DataGotchi Pages

Types of Networks

	PAN	Internet	Cell Phone Network
What kinds of devices can use this network?			
How are the devices connected to each other?			
What can you do with this type of network?			

Networked Classroom of the Future

Design Requirements

- A map of the networked classroom. Show the connections between devices in the classroom, connections to other networks, the service provider, and users involved.
- A sketch of one device in your networked classroom. Include how this device connects with other devices in the network, or to a larger network such as the Internet. Have your sketch explain these connections with a "screen shot" (these are pictures of what the device's screen will look like when using it).
- Two user scenarios describing: How will users benefit by using the device in a network? Who will they network with? Show at least one person not in the classroom connected through your network (e.g., a parent, an expert, students in Nicaragua). This can be written or explained in pictures like a comic book.
- A physical prototype of the networked classroom and its devices.

Knowledge you have for this job:

- Network components (e.g., hardware such as a computer, a cell phone, or a Wii remote)
- Connections types (e.g., wired, wireless)
- Sizes of networks (e.g., PAN, LAN, WAN)
- Different network layouts (e.g., star, bus, mesh)
- Reasons to use network(s)
- Experience in a classroom that could use some upgrades

Brainstorm Guide

1. The first step in designing your networked classroom of the future is to brainstorm ideas. Brainstorming is an exercise in pure creativity.

2. As you come up with ideas, share them with the group. Listen to what others are saying – it can help you come up with new ideas, too. Generate LOTS of ideas. You can choose the best ones later.

3. When you are done brainstorming, write down the team's idea for your design. Making a sketch of your design may be helpful to capture your team's ideas.

4. Be sure to answer the following guiding questions:
   - Who are the users?
   - How will they use the networks and classroom tools in your design?
   - What other people outside of the classroom will they be connecting with?
   - What are the components of the networks in your design? How do these components connect to each other and to larger networks?
   - How can you explain your device and how it works in a short 1-2 minute skit?

Week 7

Activity Pages

- User Feedback & Interview Form
- Peer Feedback Form

User Feedback & Interview Form

Use this form to guide your interview and capture feedback from users on your network map and sketch.

User: _____

Date: _____

Start the interview by:

1. Say a two-sentence overview of what your networked classroom of the future is like for its users. You might say:

1. "Teachers in my networked classroom of the future can…"
2. "Students in my networked classroom of the future can…"

2. Then let your user know that you need their help, say:

"Please take a look at my network map and the sketch of one of the devices on the network. I need your feedback to improve my designs."

Ask these interview questions, and write down the feedback underneath:

3. Please take a look at the map of the network. Describe to me what you think is happening from looking at the map.

4. [If the user doesn't understand the network, tell them how the network is supposed to work, and ask:] "From my map and sketches, how could I make this part clearer?"

User Feedback & Interview Form (Continued)

5. Now let's take a look at the sketches of a device. Describe to me what you think is happening from looking at the sketch.

6. [If the user doesn't understand the network, tell them how the network is supposed to work, and ask:] "From my map and sketches, how could I make this part clearer?"

7. Do you have any suggestions for how I can improve my networked classroom of the future? What can I add or remove?

8. Do you have any other suggestions or comments for me?

Peer Feedback Form

When filling out this form, please make sure your comments are helpful to the other designers. Explain your reasons for each comment and suggestion.

Design reviewed: _____

1. Is the map of the classroom and networks clear? If not, explain what can be done to improve it.

2. Did the user scenarios make sense? Are they represented in the sketch(es)?

3. Did the user scenario help you understand the sketch?

4. How can the designers improve their design of a networked classroom of the future? What can they add or remove? (Give concrete answers)

Week 8

Activity Pages

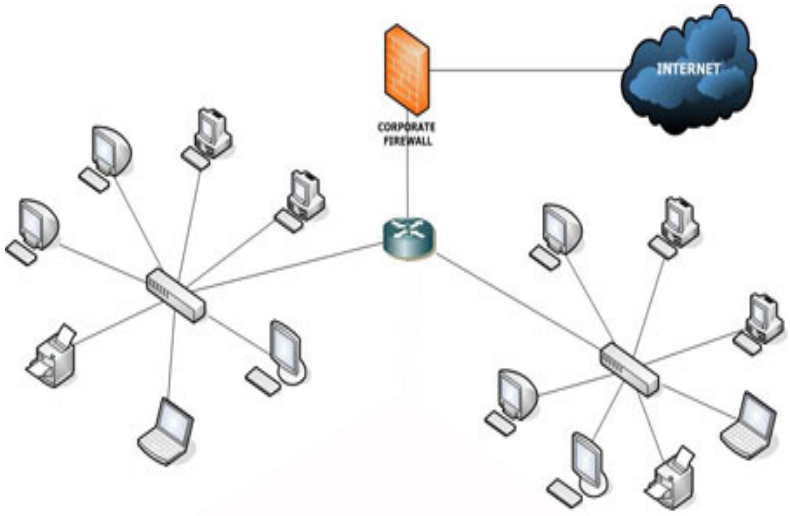
- Networks and Connections

Networks and Connections

PAN (Personal Area Network)

Examples of PAN: Bluetooth devices connected to one another. TV remote control sending infrared messages to the TV.

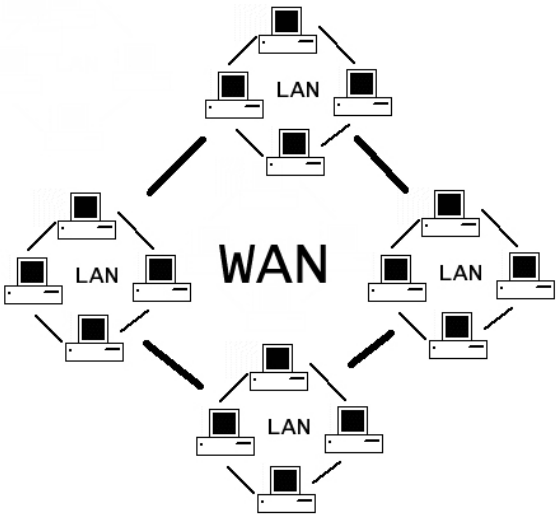
LAN (Local Area Network)



Examples of LAN: Several networks, connected to one another through a server. Such as classroom networks connected to a school server.

WAN (Wide Area Network)

Examples of WAN: Several LANs connected to each other through servers. The largest example is the Internet aka World Wide Web.



Week 9

Activity Pages

- Demonstration Guidelines

Demonstration Guidelines

A demonstration should be informative while also entertaining. Your networked classroom of the future demonstration should include the following:

- A walk-through description of the network and its devices (point out each part of the network and how different devices may work together).
- Describe a user scenario, including who can use the network and what devices are used. Specifically highlight one device.
- "Screen shot" pictures of what the device looks like when it's in action (see the screen shot illustrations on the DataGotchi pages).