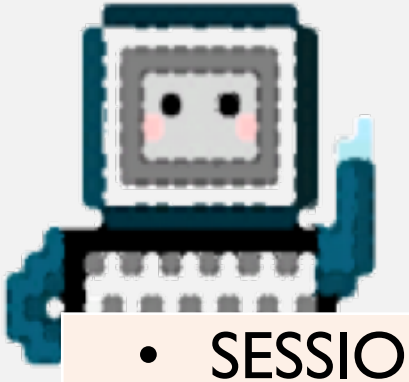
THE UNIVERSITY of NEW MEXICO

AOLME CURRICULUM

SESSION 1



LEVEL 1

- SESSION 1: ***Basic of Raspberry PI and Linux-****(motivational overview of projects-images, ls, cd, to find previously made files)*
- SESSION 2: ***Introduction to Python*** *(print, for, if)*
- SESSION 3: ***Algorithms*** *(for loops-arithmetic progressions, if statements-ranges, inequalities)*
- SESSION 4: ***The Coordinate Plane and Black & White Images in Python***
- SESSION 5: ***Binary and Hexadecimal number systems***
- SESSION 6: ***Images and Their Components (histograms)***
- SESSION 7: ***Creation of Images and Video***
- FINAL PROJECT: VIDEO

BASICS OF RASPBERRY PI AND LINUX

OBJECTIVES:

1. Explore, identify, and name computers components across systems (PC and Raspberry).
2. Describe how information flows in a computer system.
3. Utilize basic Linux commands to navigate filesystems in a Raspberry Pi.
4. Practice assembling components and cables of a computer system.

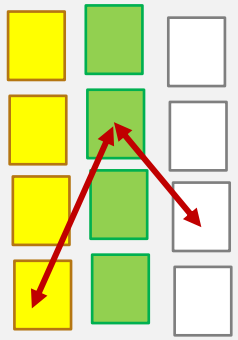
SELECTED ACTIVITIES

1. Components of a computer and the raspberry Pi
2. Assemblage of the Raspberry Pi components and internal data flow in Computers
3. Navigation of directories and basic commands in Linux

1.1. Components of a Computer & the Raspberry Pi

1. **Think & Talk:** What do you know about computers? What do you think a Personal Computer (PC) is? What's a Raspberry Pi? What are the components or parts of a computer?

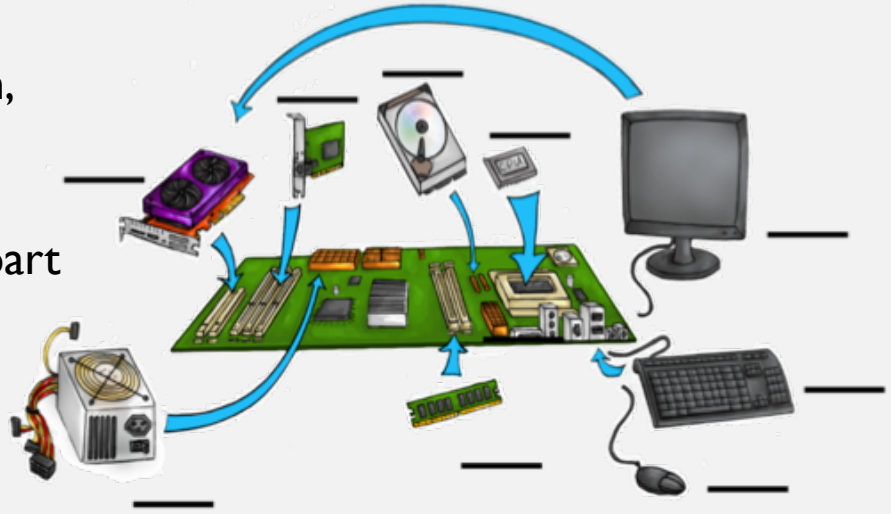
2. **ID the parts**: In your team, shuffle the white cards and take turns randomly selecting a card. As a card is selected, try both: (a) point to and find that part on an old real-life computer, and (b) name each component or part.



What would be another way to play the game?

3. **Play:** (a) Make card columns by color and match them. *Note:* green cards = component names; yellow cards = descriptions, & white cards = visuals.
(b) Turn upside down and mix up all cards and play memory. *To play:* take turns flipping over a card of each color at a time, if they all match, keep them; if not, turn cards back upside down. Wins who finds > matches.

4. **Link systems:** With your team, take turns identifying and matching each part of a computer system with a Raspberry Pi system.



1.1. Components of a Computer & the Raspberry Pi

Resources for the Activity

1. Activity Card
2. 3 decks of cards (white, yellow, green) with names, definition, visual of computer parts
3. Raspberry Pi
4. Old real-life computer
5. Student journal

Recommended steps for the Activity

1. Have students have an informal conversation about computers that can lead to recalling the names of the parts of a computer
2. Use a real computer to ID those parts
3. Before playing the memory game, make sure students (mostly on their own) accurately connect the names, visuals, and descriptions of the parts.
4. Have students practice these links by playing memory. Make it less about a competition, and focus on understanding. Check if words in cards make sense.
5. Make it fun! Have students make decisions on playing the game.
6. Have students lead the making connections across computer systems. Use the Raspberry Pi!!

Activity 1 Goal: Explore, identify, and name computers components across systems (PC and Raspberry).

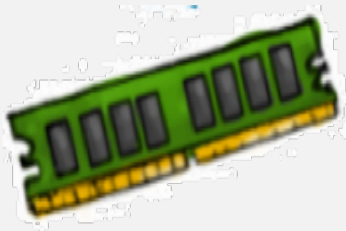
Components of a Computer

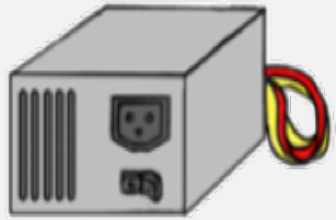
RAM Random Access Memory	**Hard drive**	**GPU** Graphics Processing Unit	**PC** **Camera**	**Power Supply for Personal Computer (PC)**	**Ethernet Port**
Portable Power Supply	**Secure Digital (SD) Memory Card**	**Motherboard**	**Ethernet card for Personal Computer (PC)**	**CPU** **Central Processing Unit**	**Raspberry Pi Camera**

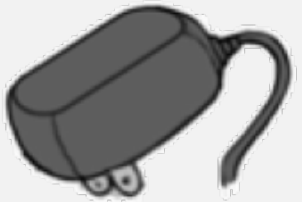
Components of a Computer

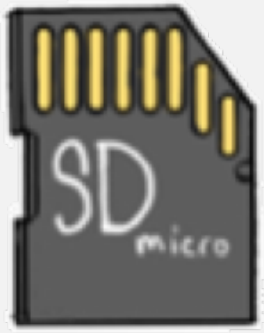
It is used to supply power to small computers (e.g., Raspberry Pi) or a mobile phone.	It is used to store all programs and data that will be processed by CPU. When the computer is turned off, the memory is lost.
It is used to store data securely. The data is not lost when the device is turned off.	Stores program files and data. Everything stays here even if the computer is turned off. This is used as permanent storage for the data.
It is used to connect the CPU to the memory, the power, and all other computer components together.	It is used to process data fast. It reads its data from the RAM and writes the results to the RAM when done.
It is used to connect a Personal Computer (PC) to the internet.	It connects to the computer externally. It is used by the computer to take pictures.
This is the brain of the computer. It tells everyone else what to do. It also performs mathematical operations	It supplies power to the different Personal Computer (PC) components.
It connects to the Raspberry Pi computer. It is then used to take pictures.	This is a connector. You can plug a cable to it so as to connect to a cable model to access the internet.

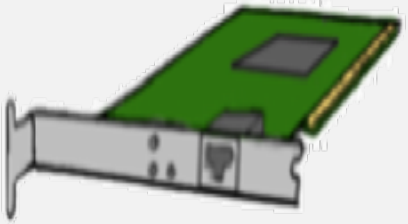
Components of a Computer

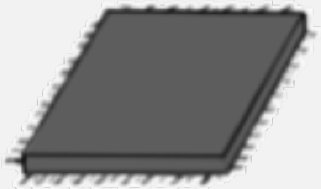


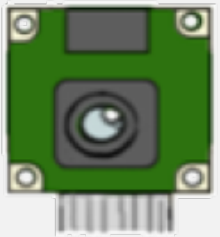






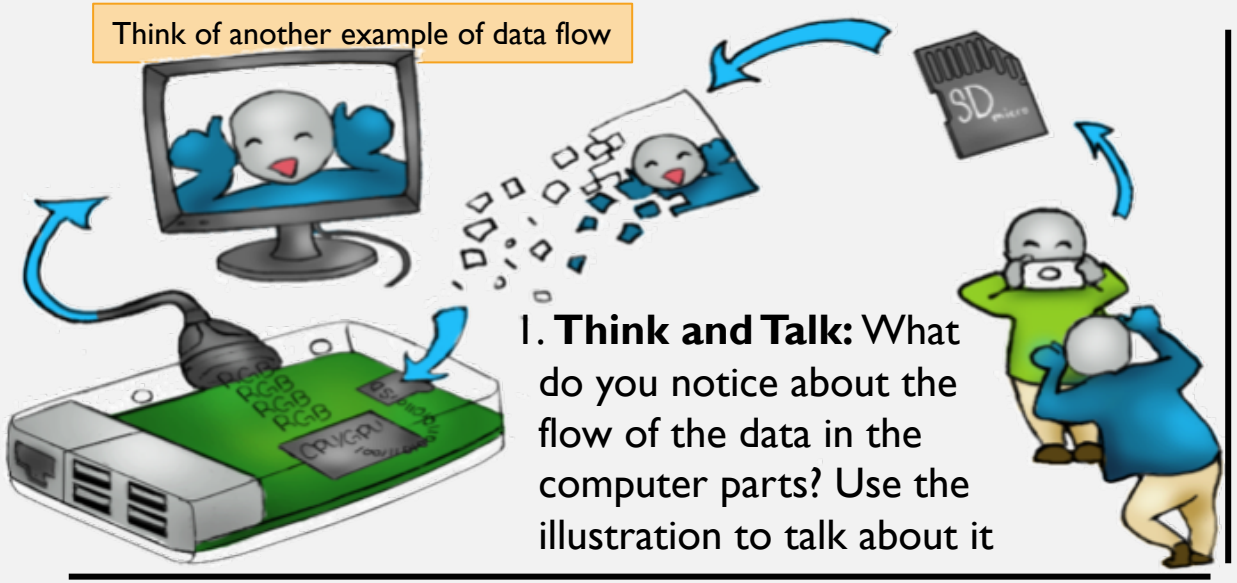






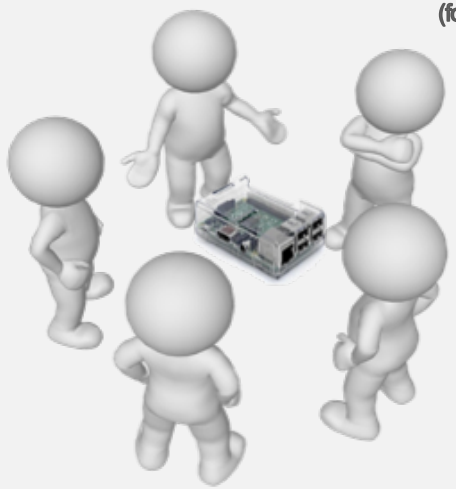
1.2. Computers Assemblage and Data Flow

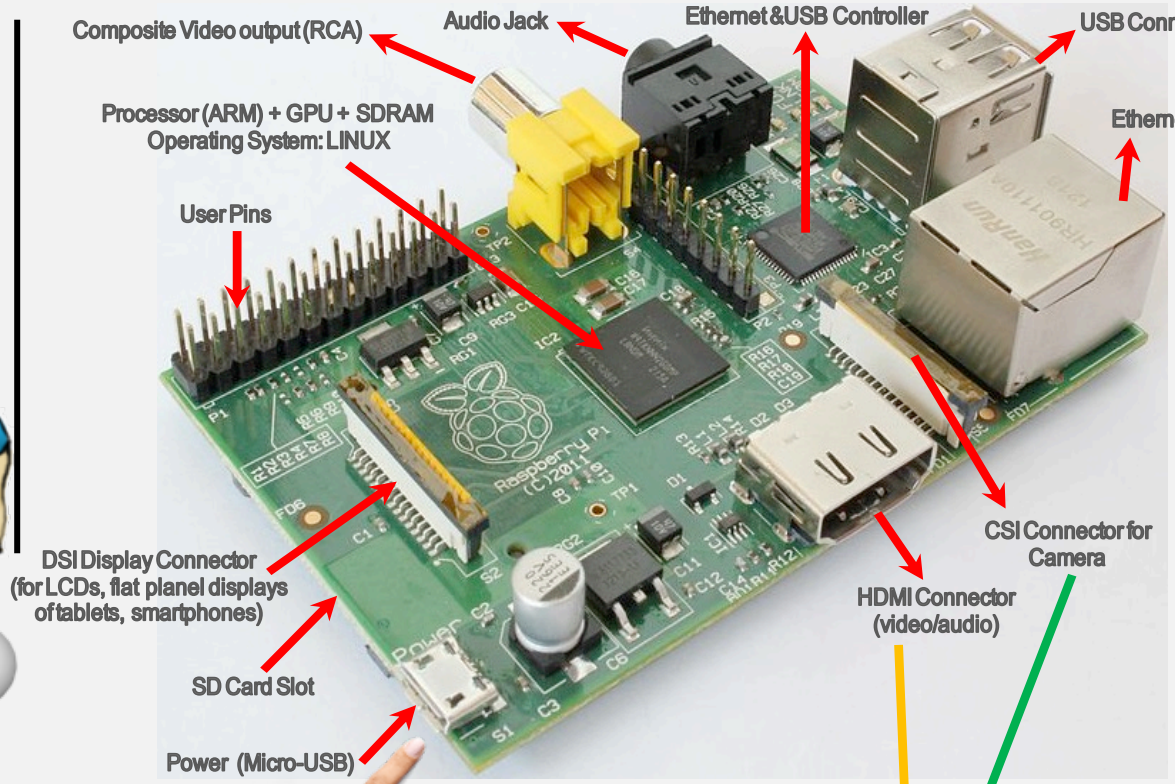
Think of another example of data flow

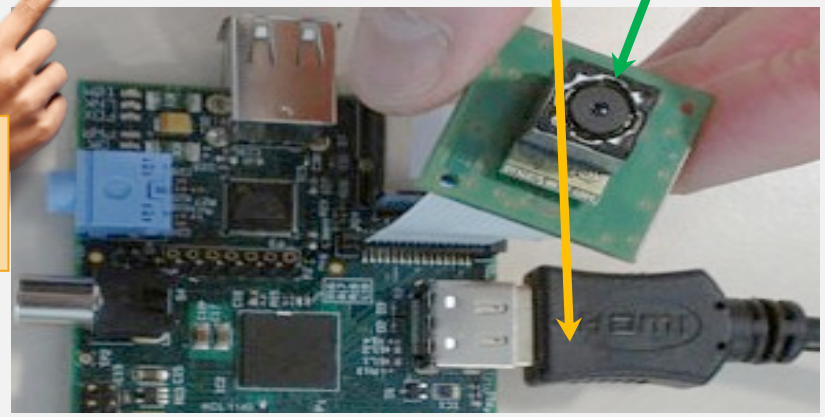


1. **Think and Talk:** What do you notice about the flow of the data in the computer parts? Use the illustration to talk about it

2. **Think, Talk, & Do:** Work collaboratively in your team to put together the Raspberry Pi computer. As you do, use the terms you've learned.
   -What is you favorite part? Why?
   -What component is linked to the HDMI connector?







REMEMBER! Connect the power last.

1.2. Computers Assemblage and Data Flow

Resources for the Activity

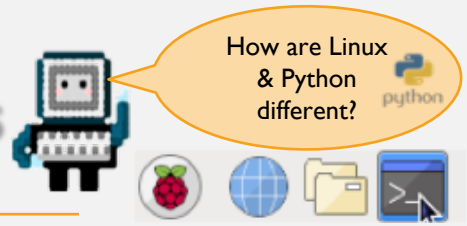
1. Activity Card
2. Raspberry Pi kit per group
3. Power strip

Recommended steps for the Activity

1. Have students describe the illustration of taking pictures as an example of data flow and create a story-like about the data flow. Elaborate on data flow ideas by having them further think about their own experiences at school using data on a computer
2. Motivate students to use the names of the components of the computer as they talk. Model that type of talk to them as the team puts the computer system together.
3. Make sure all students participate in the assemblage and ask them to describe using related vocabulary on what they are doing or how they did connect those parts.
4. Have students describe their own experiences assembling computers at home or school
5. Ask for any questions they might have and encourage team members to respond

Activity 2 Goals: (a) Describe how information flows in a computer system. (b) Practice assembling components and cables of a computer system.

1.3. Linux: Directory Navigation & Basic Commands



1. **Explore:** To navigate the directory of files on our computer or **filesystem,** we use the Graphical User Interface or GUI, which uses small icons or visuals on the desktop that tell the computer what to do.

To open the directory, use the GUI File Manager by double clicking on the folder icon. The **taskbar** appears on the left-top side of your monitor. *How familiar are you with navigating the computer this way? Open and close 2-3 files.*

2. Another way to navigate directories is through the Linux Terminal. Open it by double clicking on its icon: To start, type `ls -al` in the **command line** (pi@raspberrypi:~$) and you'll see:

```
pi@raspberrypi:~/Documents $ ls -al
total 28
drwxr-xr-x  7 pi pi 4096 Dec 20 12:29 .
drwxr-xr-x 23 pi pi 4096 Dec 20 12:29 ..
drwxr-xr-x  3 pi pi 4096 Dec 20 12:29 AOLME
drwxr-xr-x 11 pi pi 4096 May 27  2016 BlueJ Projects
drwxr-xr-x  5 pi pi 4096 May 27  2016 Greenfoot Projects
drwxr-xr-x  2 pi pi 4096 May 27  2016 Scratch Projects
```

The first letter "d" tells it's a directory. If it were "-", then it'd be a file. The blue text is the file or directory name. `/` refers to the root directory, `.` refers to the current directory, and `..` refers to the previous directory.

What else do you see?

3. **Work:** There are many more commands. Try them out, take turns.

Command	Description	Examples
`pwd`	Print Working Directory. Prints the current directory name.	`>pwd` `/home/pi`
`ls`	Lists the files and directories in the current directory.	`>ls` `pi readme.txt`

`ls -al`	Prints detailed information for each local file and directory. See detailed example.	`>ls`
		`drwx ... pi`
		`-drwx ... readme.txt`

`cd name`	Change Directory to name.
	
	`/` refers to the root directory.
	`.` refers to the current directory.
	`..` refers to the previous directory.
		To make "/" the current directory:
		`>cd /`
		`>pwd`
		`/`
		To go back one:
		`>pwd`
		`/home/pi`
		`>cd ..`
		`>pwd`
		`/home`

In your own words, what's a command?

4. **Create:** Directories are marked under /. For example, `/home` is a one-level directory, `/home/pi` is a two-level directory. Command: `mkdir name` creates and names a directory, and `rmdir name` removes it. With your team create 3 directories: `/home/pi/mario1`, `/home/pi/mario2`, and `/home/pi/mario3`. Then, erase them all.

What will these commands **do**?

```
>mkdir mario
>cd mario
>pwd
 /home/pi/mario
```

```
>mkdir mario2
>ls -al
 drwx .. mario2
>rmdir mario2
>ls -al
```

How many directory levels are marked below?
`/pi/AOLME/Session 4/Square`

Write: What Linux commands should you remember? How can you tell the directory levels?

1.3. Linux: Directory Navigation & Basic Commands

Resources for the Activity

1. Activity Card
2. Raspberry Pi kit
3. Student journal

Recommended steps for the Activity

1. Have students think about how they usually navigate computers and use that to think about this session
2. Motivate students to take turns typing in commands, so that all of them have similar participation.
3. Let students pay attention to what is happening when commands are typed it, and ask students who are not typing to describe what is happening and why. If the group wants, create own names for directories.
4. Have students debrief what they learned at the end of the session and write in their journal at least 3 thoughts
5. Promote collaboration by listening to and helping each other. An error is just a step to get better.

Activity 3 Goal: Utilize basic Linux commands to navigate filesystems in a Raspberry Pi.