Introduction to Arduino & PureData

Baabu Aravind V S
baabuaravind@gmail.com

Why We Are Here Today ???

- To learn some new stuffs which gives out-of-box user experience
  - **Arduino** – What is it ???
    http://arduino.cc/
  - **PureData** – What is it ???
    http://puredata.info/

Is that it cool ? Come on let's have a look

https://www.youtube.com/watch?v=DqQlO811Ino

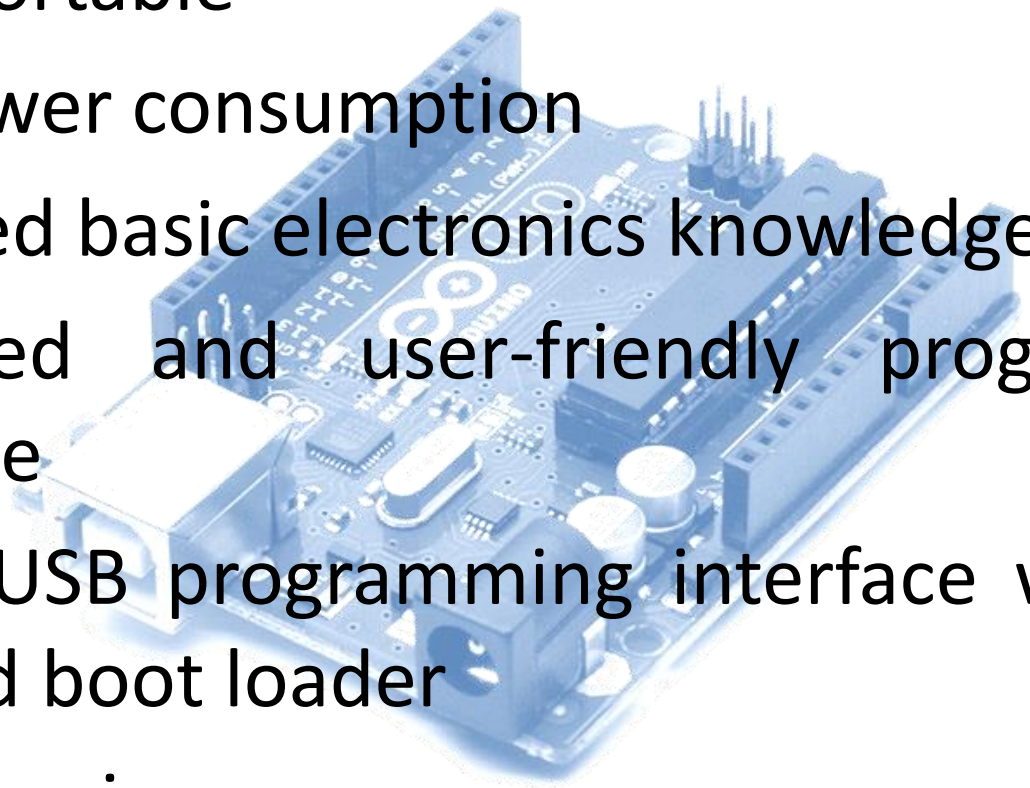
Arduino

- It’s a open source physical computing platform
- It’s an electronic prototyping environment to create interactive projects
- Hardware and Software is easy to use
- Arduino software IDE is a cross platform

Why Arduino ?

- It is open source, both in terms of Hardware and Software
- It can communicate with a computer via serial connection over USB
- It can be powered from USB or standalone DC power.
- It is cheap, nearly 1300 INR , the hardware can be built from components or a prefab board can be purchased for approx 900 INR

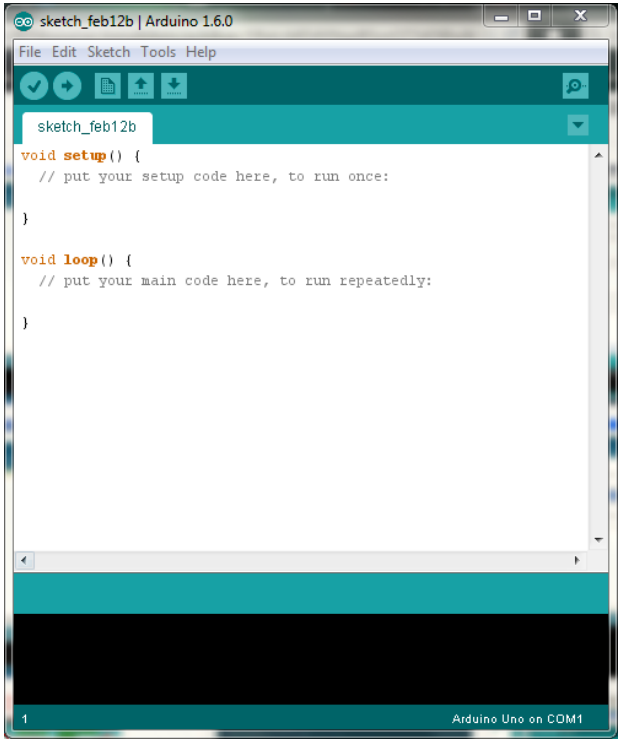
Advantages



- Easily portable
- Low power consumption
- Just need basic electronics knowledge
- Simplified and user-friendly programming language
- Native USB programming interface with pre-installed boot loader
- Free Libraries

Arduino Software IDE

Integrated Development Environment

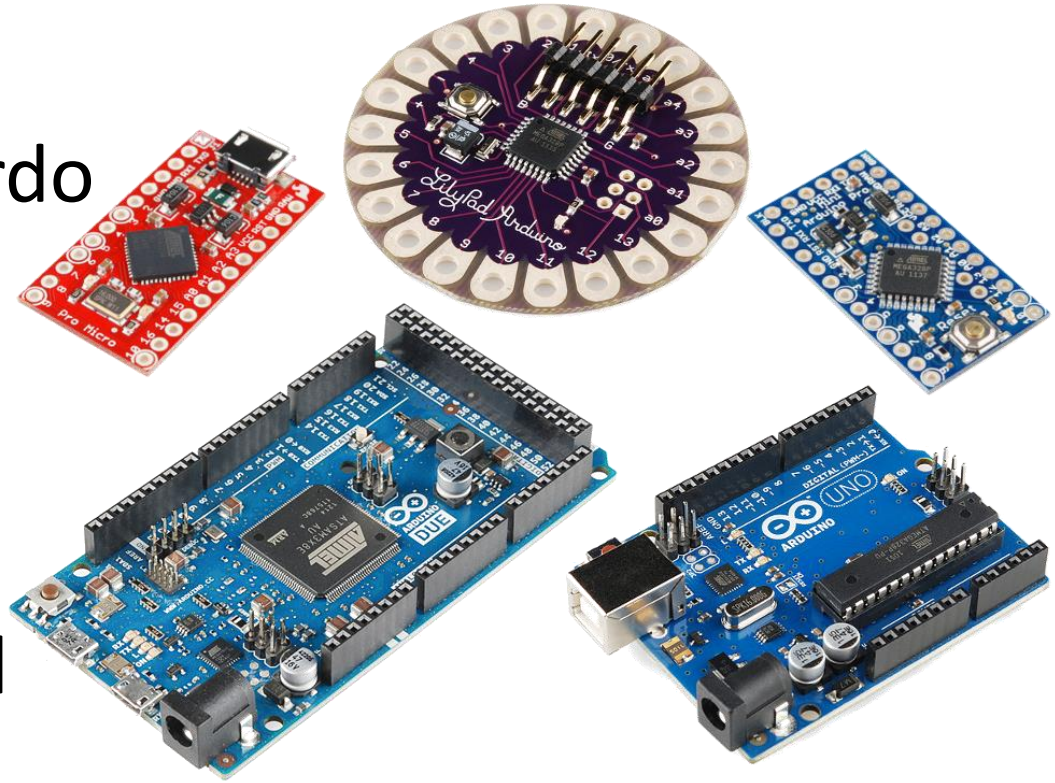


Live demo of IDE

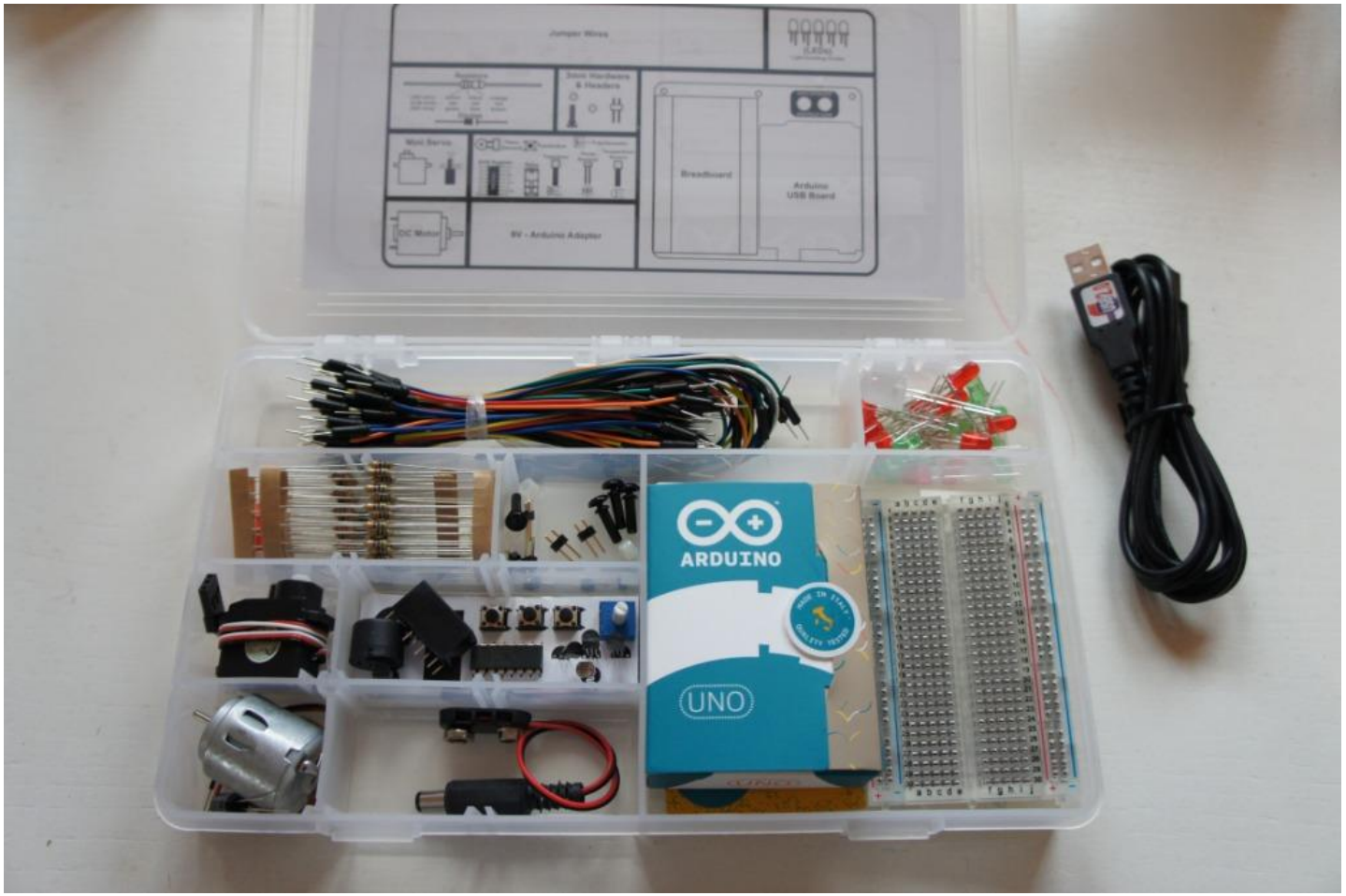
the language itself is based in C.

Most popular Arduino Boards

- Arduino Uno
- Arduino Leonardo
- Arduino Mega
- Arduino Due
- Arduino Micro
- Arduino LilyPad
- Arduino Yun



Arduino Kit Box



Arduino Kit Box

 Duemilanove Board	 DC Power Supply	 Breadboard	 USB Cable	 Piezo Sounder
 10 x Clear RED 5mm LED's	 10 x Clear Blue 5mm LED's	 10 x Clear Green 5mm LED's	 5 x 1N4001 Diodes	 3-Way Terminal Block
 10 x Yellow Diffused 5mm LED's	 10 x Green Diffused 5mm LED's	 10 x RED Diffused 5mm LED's	 5 x Tactile Switches	 4K7 Potentiometer
 Light Dependent Resistor	 8x8 Mini LED Dot Matrix Display	 LM35DT Temperature Sensor	 TIP-120 NPN Transistor	 DC Motor
 10 x 100R Resistors	 10 x 150R Resistors	 10 x 240R Resistors	 10 x 470R Resistors	 10 x 1KR Resistors
 10 x 1K5R Resistors	 10 x 1MR Resistors	 2 x 74HC595 Shift Register IC's	 2 x 16-Pin IC Socket	 Jumper Wire Kit
 Component Case	 Earthshine Design Starter Kit Manual			

Supported Languages

C	RUBY
FLASH	PYTHON
PROCESSING	PHP
PD	MATLAB
MAX/MSP	SQUEAK (SMALL TALK)

Where to learn

https://learn.adafruit.com/category/learn-arduino

http://playground.arduino.cc/

Applications of Arduino

- Home Automations
- Sensor prototyping
- Robotics
- Wifi, Ethernet, Bluetooth, GSM

Another video on what we can do with Arduino

https://www.youtube.com/watch?v=dX37LFv8jWY

Interesting projects you can find it here

http://www.instructables.com/tag/type-id/category-technology/channel-arduino/

What is PureData ???

- PD is a visual programming language for electronic music
- To create music now-a-days people uses digital computer software to make changes
- Technically its called as DSP
  - **D**evi **S**ri **P**rasad – absolutely not
  - **D**egree **S**topping **P**aper – Nope

Exactly "**Digital Signal Processing**"

DSP

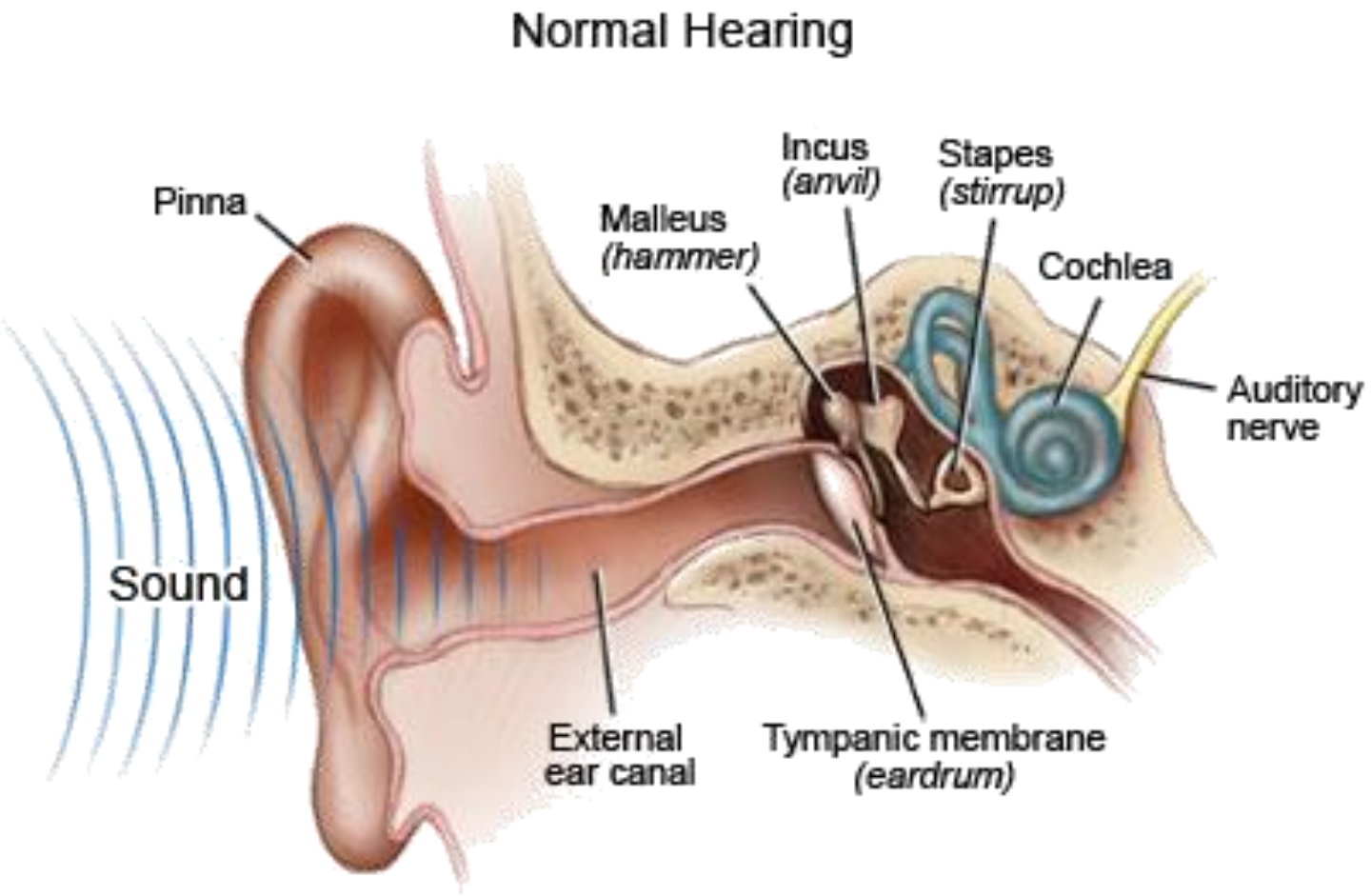
The subject hated by most of the student

- **Digital** – information is represented by digits
  - » ***Work only with numbers***
- **Signal** – tech. term for special mode of computer operation
  - » ***Deals with sounds***
- **Processing** – ***functions executed by computers***

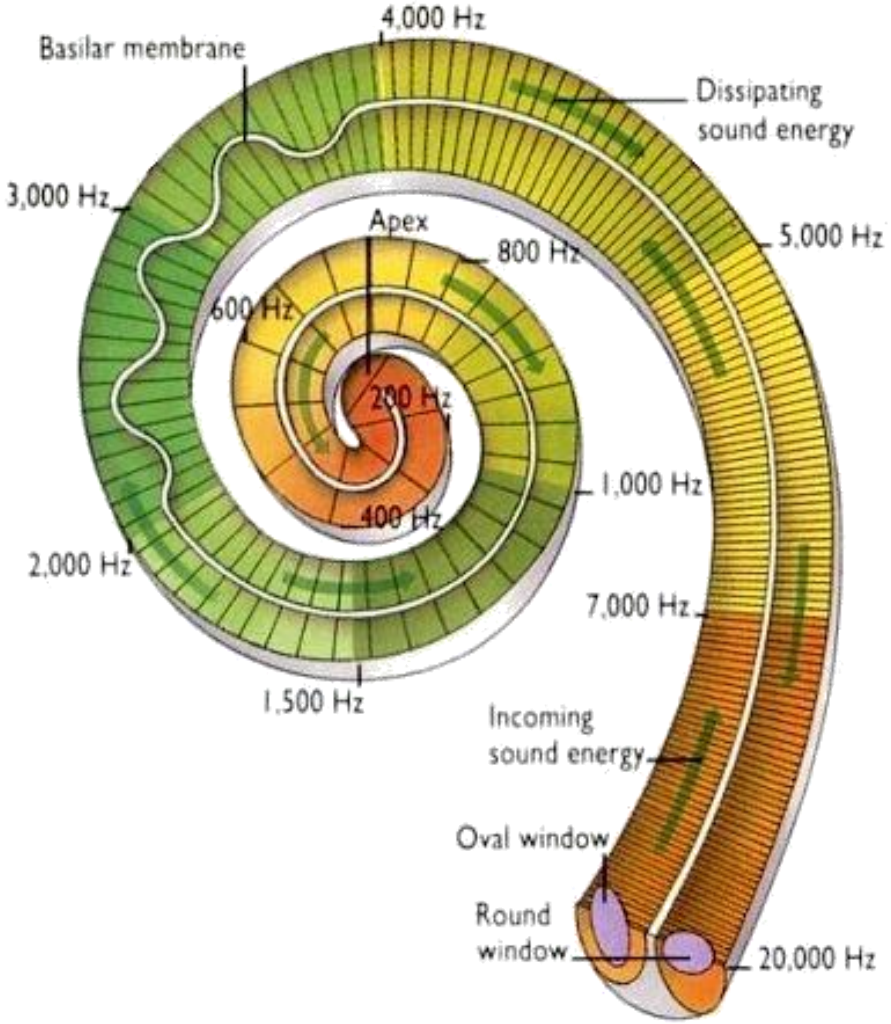
Why PD ?

- It is an open source
- Easy to create software graphically, without writing lines of code
- PD is real time graphical programming environment
- Its cross platform, works well on Windows, Linux as well as in Mac.

Human Hearing Range



Human Hearing Range



Its Play Time

- Ideal : 20Hz to 20kHz
- Protect your ears
- What Happens ?
  - If you found a sound that you can hear
  - But not your teachers or parents

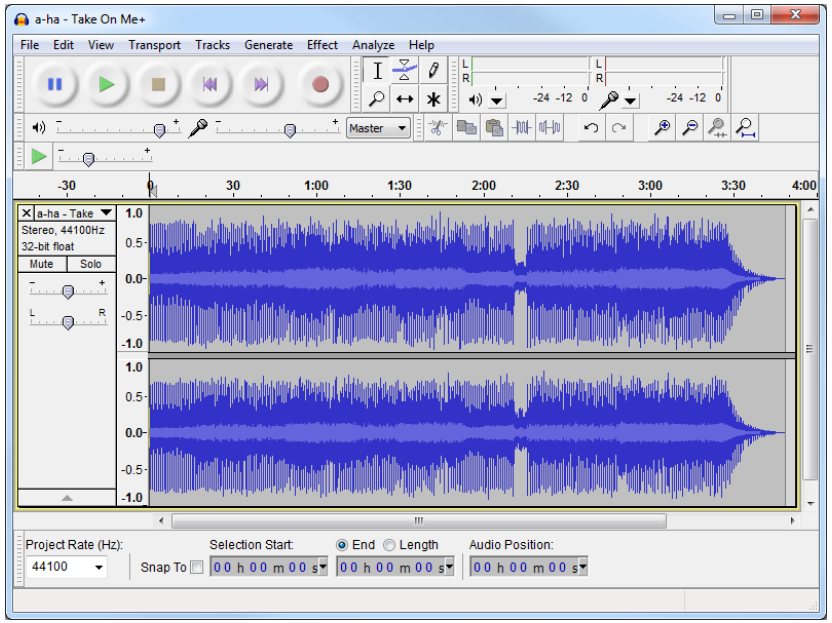
Its really cool….!!! Right

http://www.freemosquitoringtones.org/

Audacity

- It’s a free open source cross platform tool for recording and editing tools

http://audacity.sourceforge.net/



It’s a basic example of MIDI – musical instrument digital interface

Simple demo of audacity

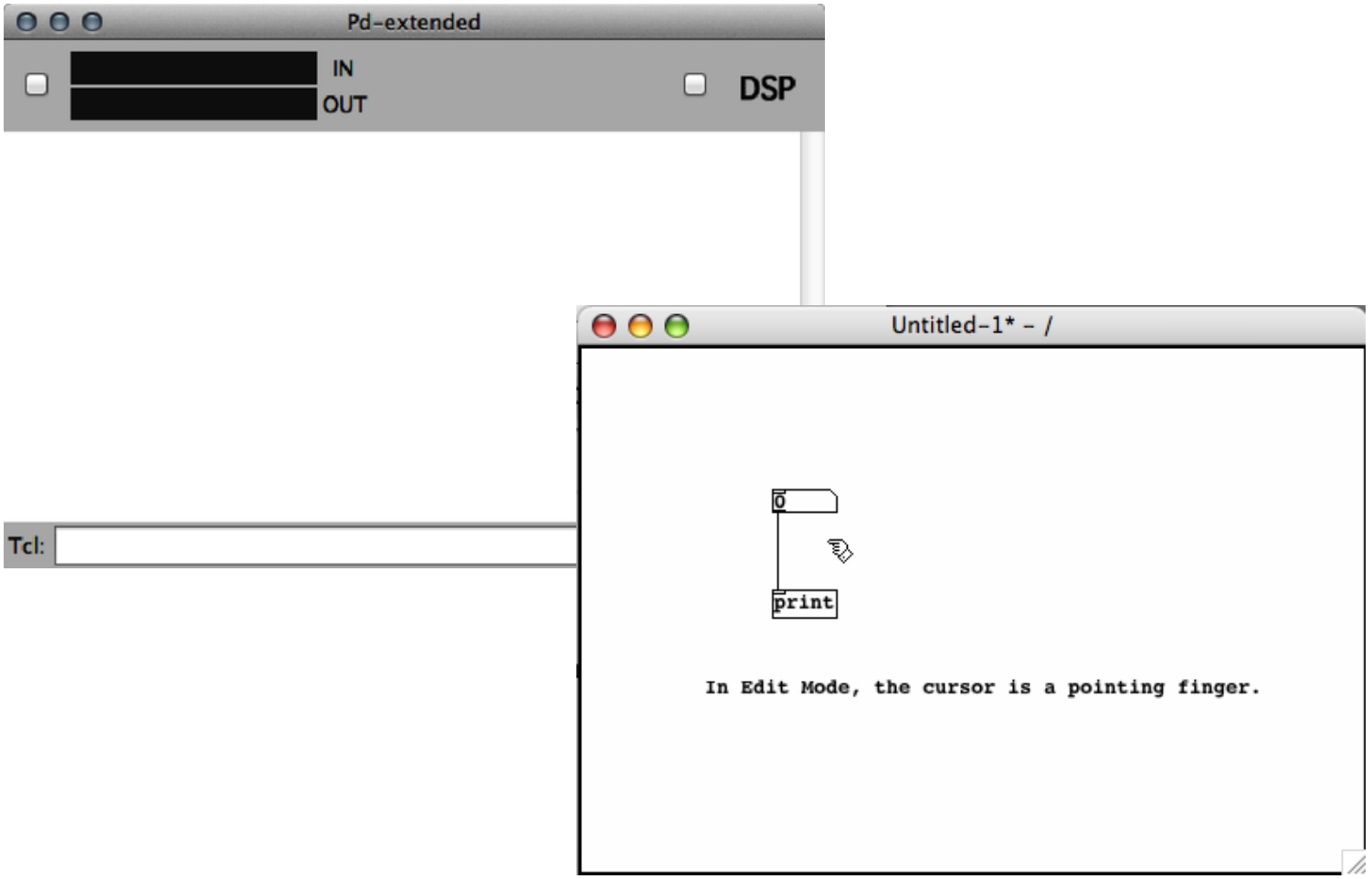
Drum Machine demo

Welcome to PD

- Installation steps
  - sudo add-apt-repository ppa:eighthave/pd-extended
  - sudo apt-get update
  - sudo apt-get install pd-extended

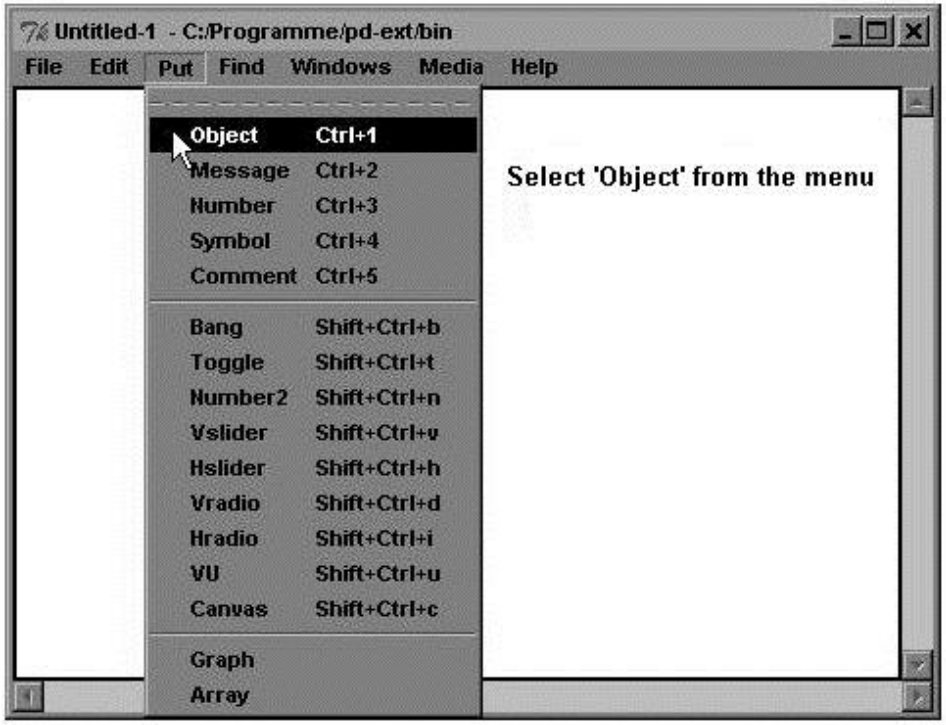
    http://puredata.info/docs/faq/debian
- Note Bugs
  - Still some bugs are there in PD ubuntu version – shows 64 bit alsa error – (already posted in forum)

PD - Extended


Pd-extended
IN
OUT
DSP
Tcl:
Untitled-1* - /
0
print
In Edit Mode, the cursor is a pointing finger.

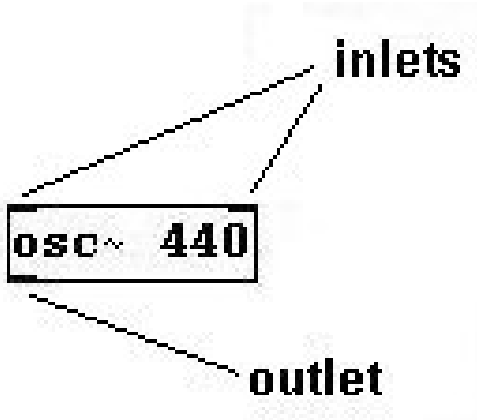
Hands on Session Starts

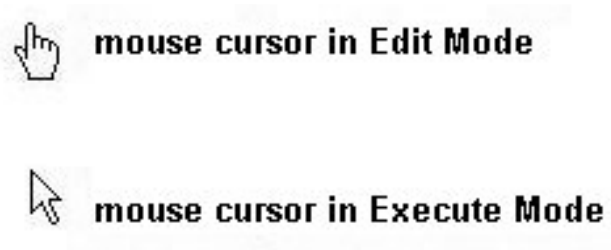
- Object
- Message
- Number
- Comment
- Bang
- Toggle
- Slider – vertical and Horizontal

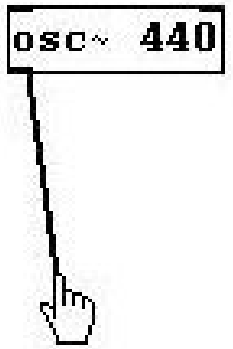


Hands on Session

- [osc~] - oscillator
- - inlets , - outlets
- Connectivity line
- [dac~] – digital to audio
- Execute
  - Ctrl + E
- Help and Properties







Hands on Session

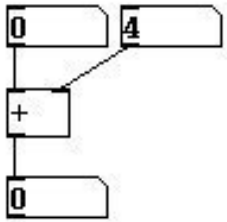
Basic mathematical operations

+

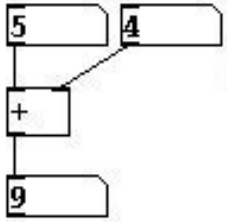
-

*

/



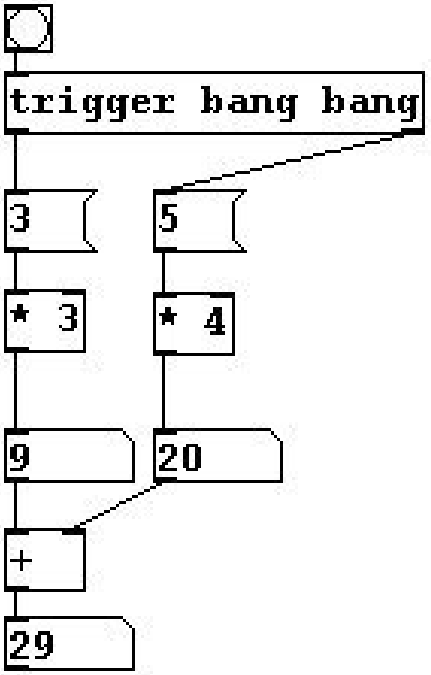
As long as the right input is the only one being sent to the object, there will be no output...



As soon as the object's left inlet receives input, the "+" object generates output.

Hands on Session

Basic mathematical operations using trigger

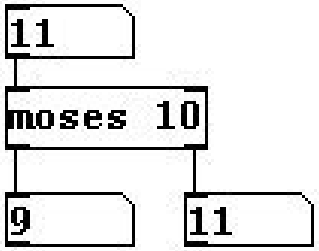


Add print in an object box and see what happens in the PD main window

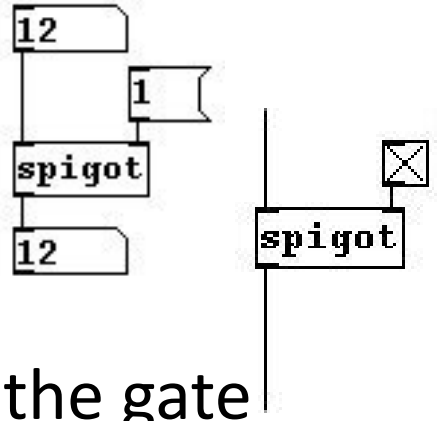
Hands on Session

Basic interesting objects

- Moses – [moses (any no.)]
  - Decides smaller than/ larger than/ equal to



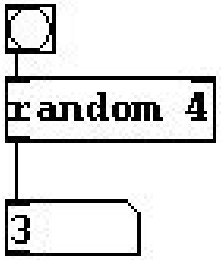
- Spigot – [spigot]
  - Like a gate (0 – close, 1 – open)
  - Or you can use a toggle to open the gate

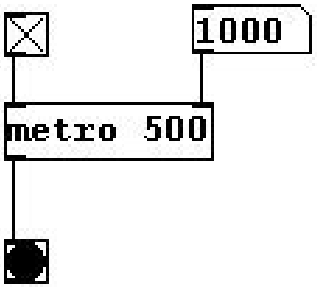


Hands on Session

Basic interesting objects

- Random [random (no.)]
  - Generates a random number with in a given range





- Metro – [metro]
  - Toggle as left input and argument as right input to bang occurs at regular interval in milliseconds

Demo Session

- Basicmath-demo.pd
- Random-fin.pd
- Random,metro-demo.pd
- Midi-demo.pd
- Demo-keyboard.pd
- Final demo – subpatch.pd

Dropbox link to download pd demo files

PD tutorial - http://www.pd-tutorial.com/english/index.html

1 million Pitch

- Is it possible to play 1 million pitches with in seconds??
  - Manually
    - Using hardware musical instrument is not possible
  - Digitally – Yes – using computer software
    - **Black Midi**

https://www.youtube.com/watch?v=oKv9S6mxnXE

Arduino + PureData

- What happens when interactive hardware and music merges ???
- Pduino – Arduino + PureData
  - Separate IDE is available to download

    http://puredata.info/downloads/pduino

  This is what happened when Arduino and Puredata handshaked

  https://www.youtube.com/watch?v=YroFBpfS36Y

Thanks for your patience

I hope you all enjoyed

My sincere thanks to

Prof. M. Kumaran
Head of Dept. CS
Jaya Engineering College
Thiruninravur, Chennai

Harinath
Student Volunteer
&
Other students attended

Feedback are welcome