

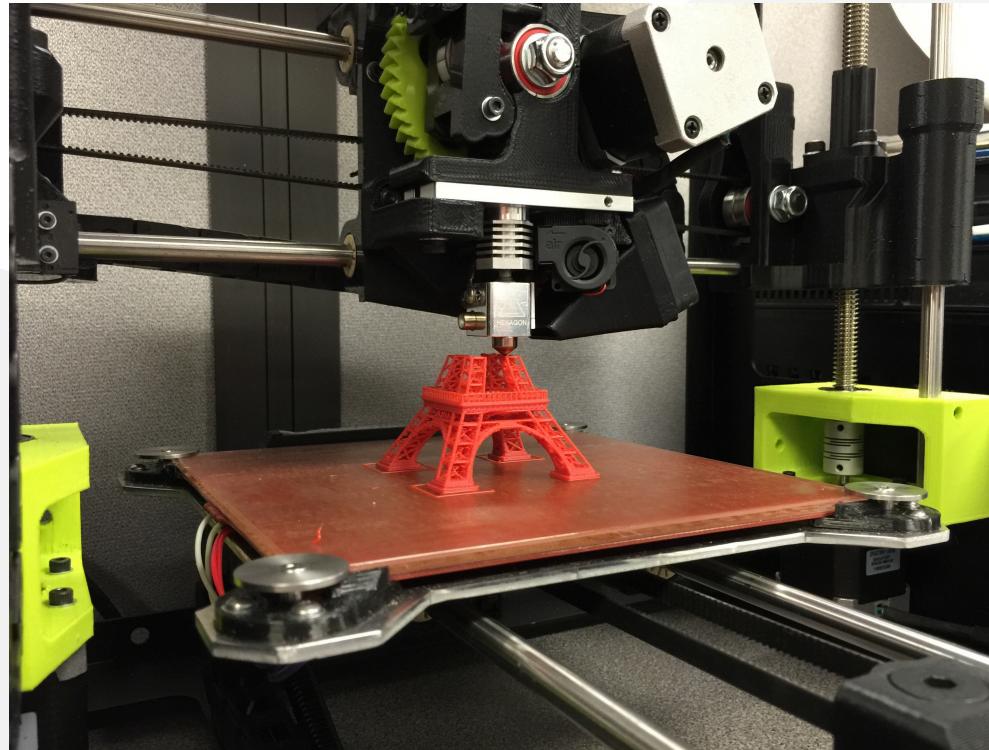
# 3D Printing



# Types of 3D Printers

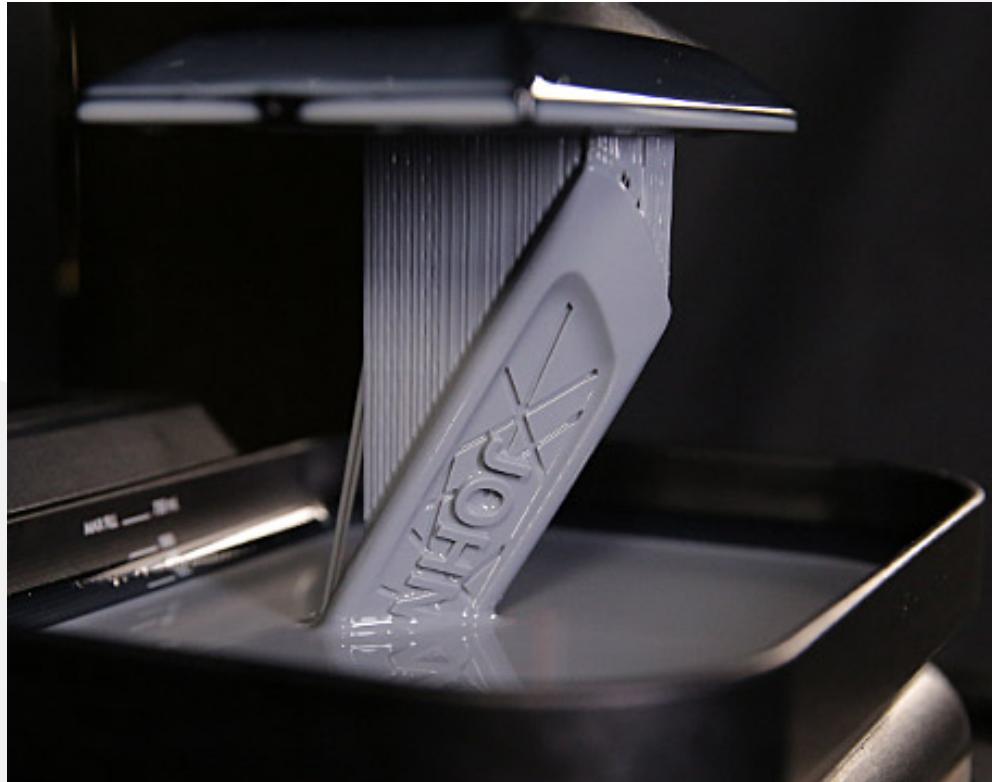
## FFF/FDM 3D Printer

- Free Form Fabrication / Fused Deposition Modeling

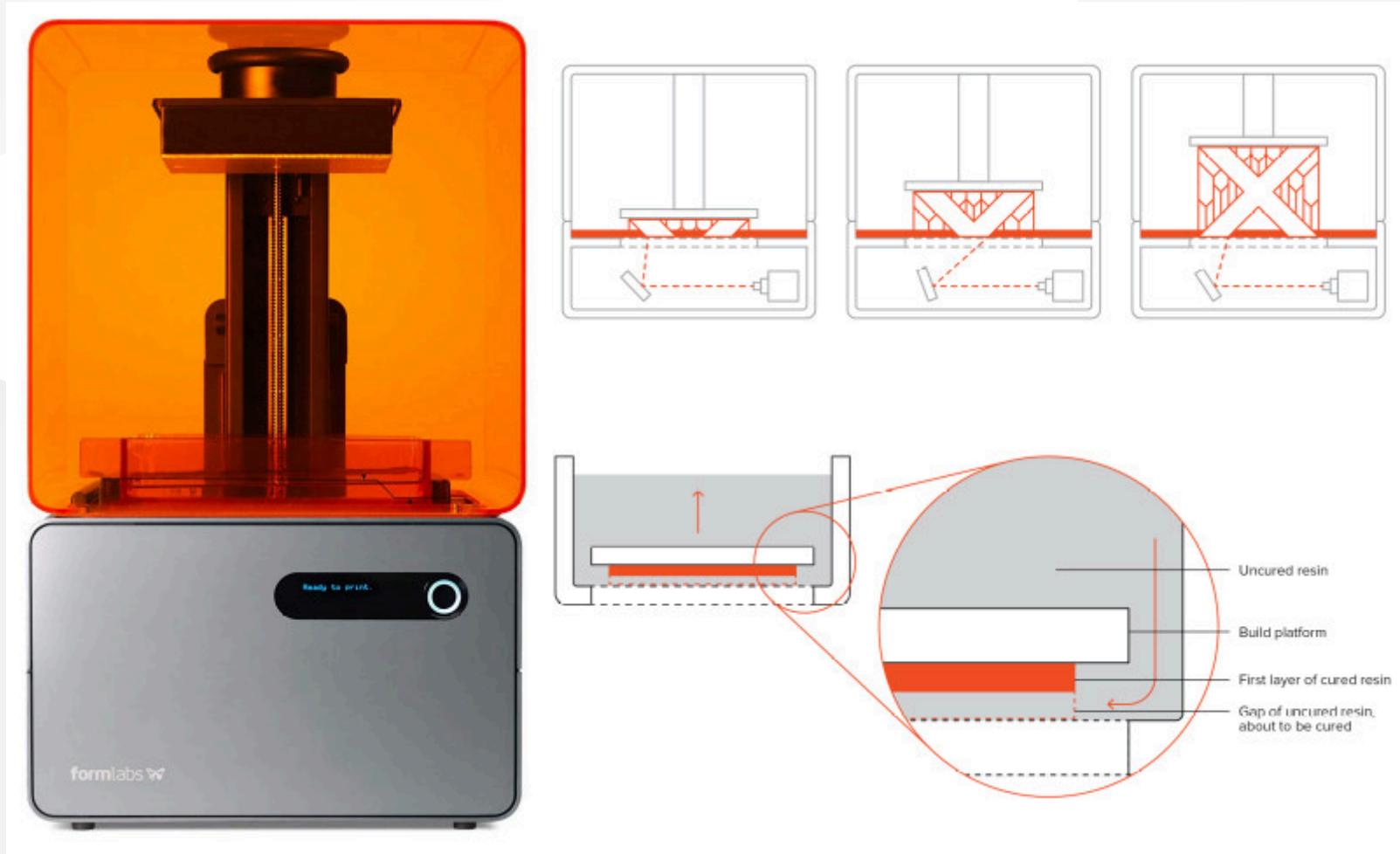


## SLA/DLP/Carbon 3D Printer

- Stereolithography / Digital Light Processing



# SLA 3D Printer



## **SLS 3D Printer**

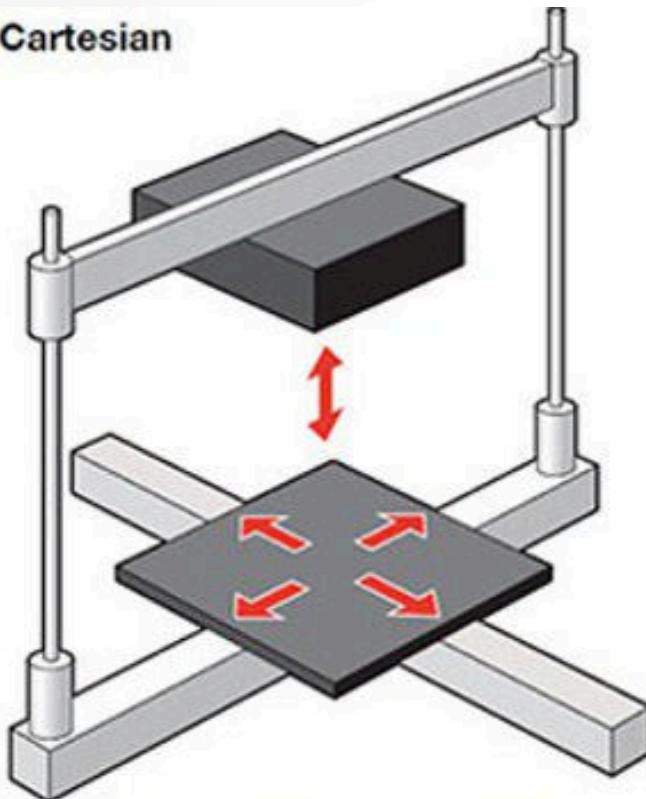
- Selective Laser Sintering

# Polar Printer



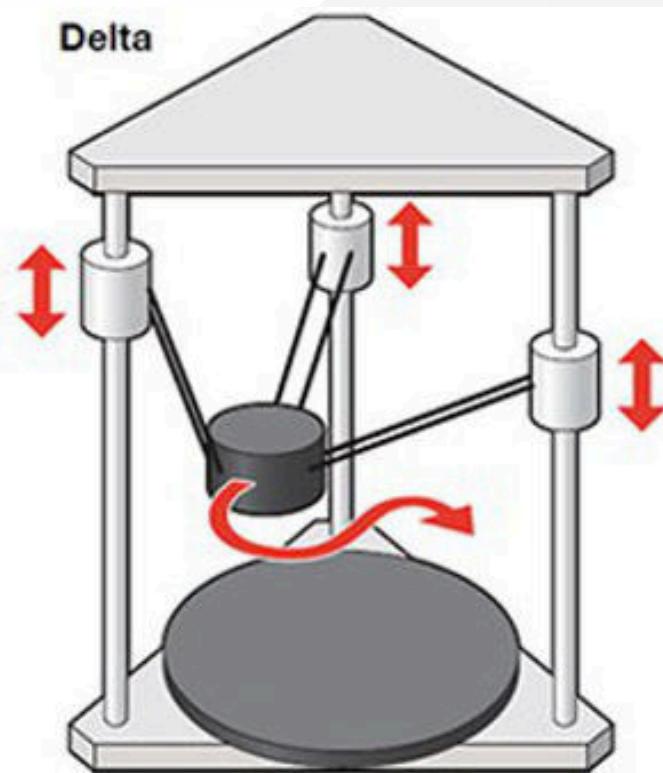
# Cartesian and Delta 3D Printer

Cartesian



Each element moves only  
in one direction.

Delta

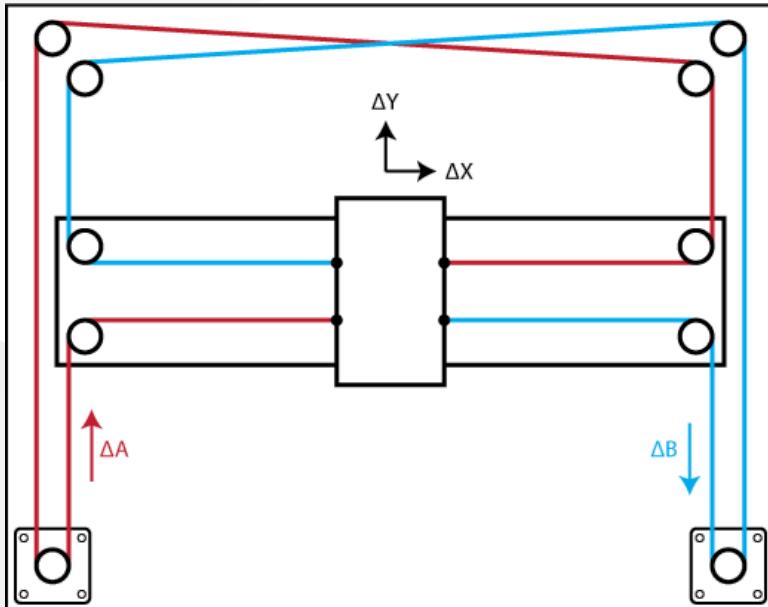


Printer head can move in any  
direction quickly.

# M3D The Micro Printer



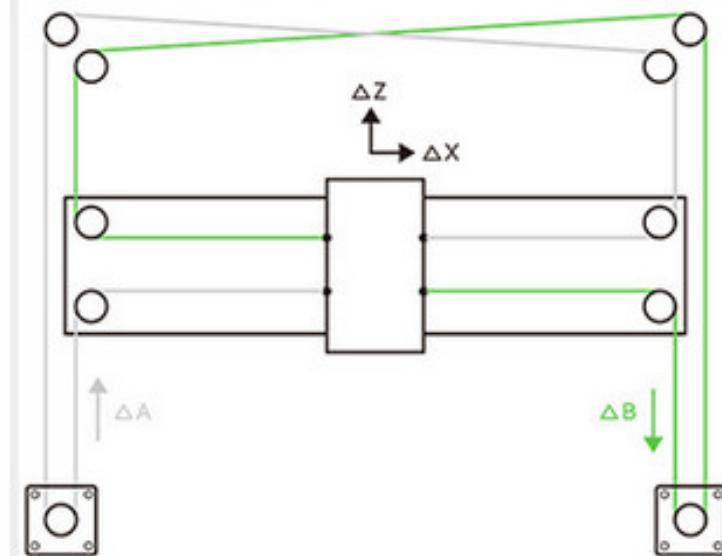
# Movement Types



Equations of Motion:

$$\Delta X = \frac{1}{2}(\Delta A + \Delta B), \quad \Delta Y = \frac{1}{2}(\Delta A - \Delta B)$$

$$\Delta A = \Delta X + \Delta Y, \quad \Delta B = \Delta X - \Delta Y$$



Equations of Motion

$$\Delta X = \frac{1}{2}(\Delta A + \Delta B), \quad \Delta Z = \frac{1}{2}(\Delta A - \Delta B)$$

$$\Delta A = \Delta X + \Delta Z, \quad \Delta B = \Delta X - \Delta Z$$

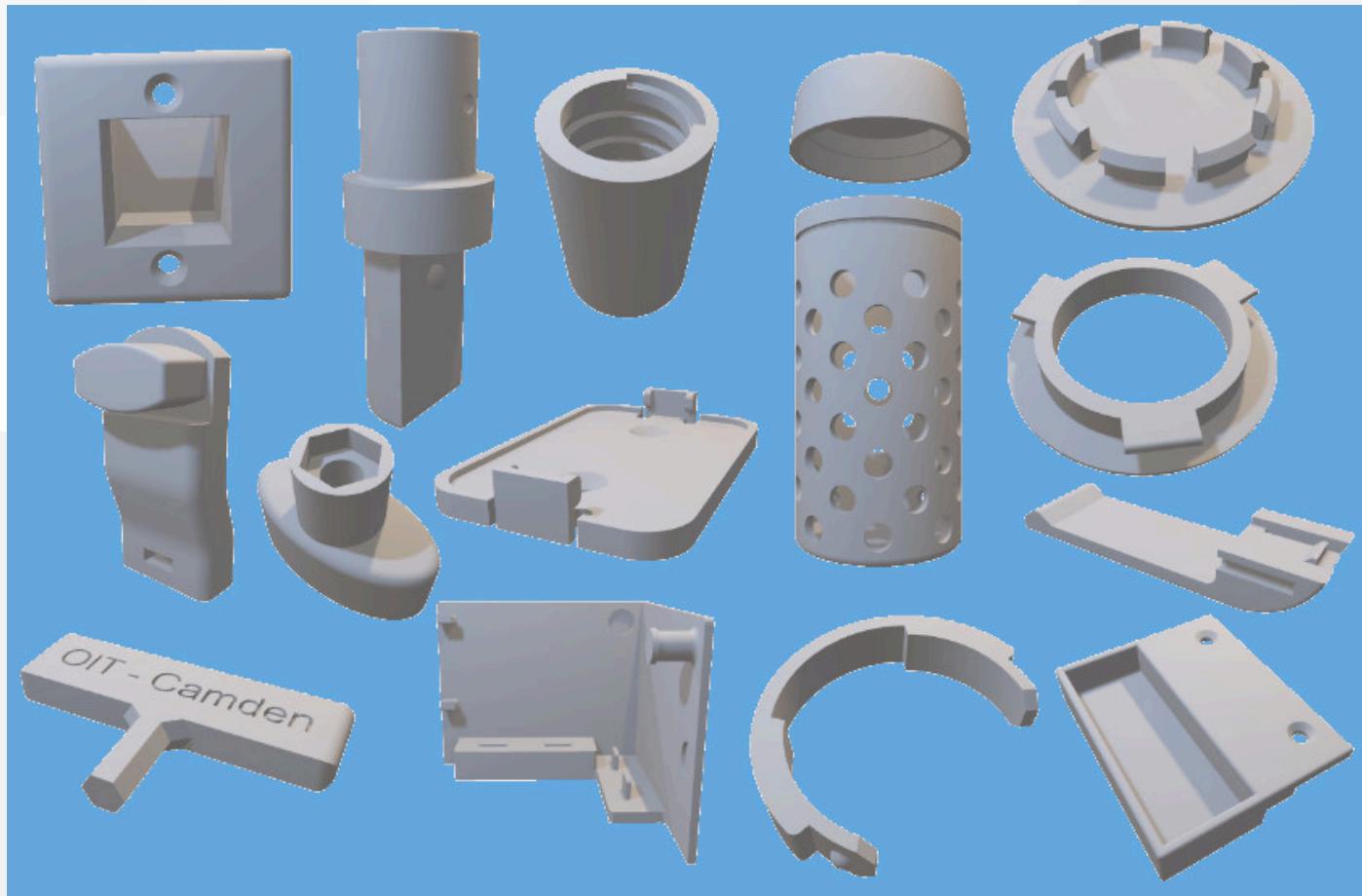
# Printing Craze



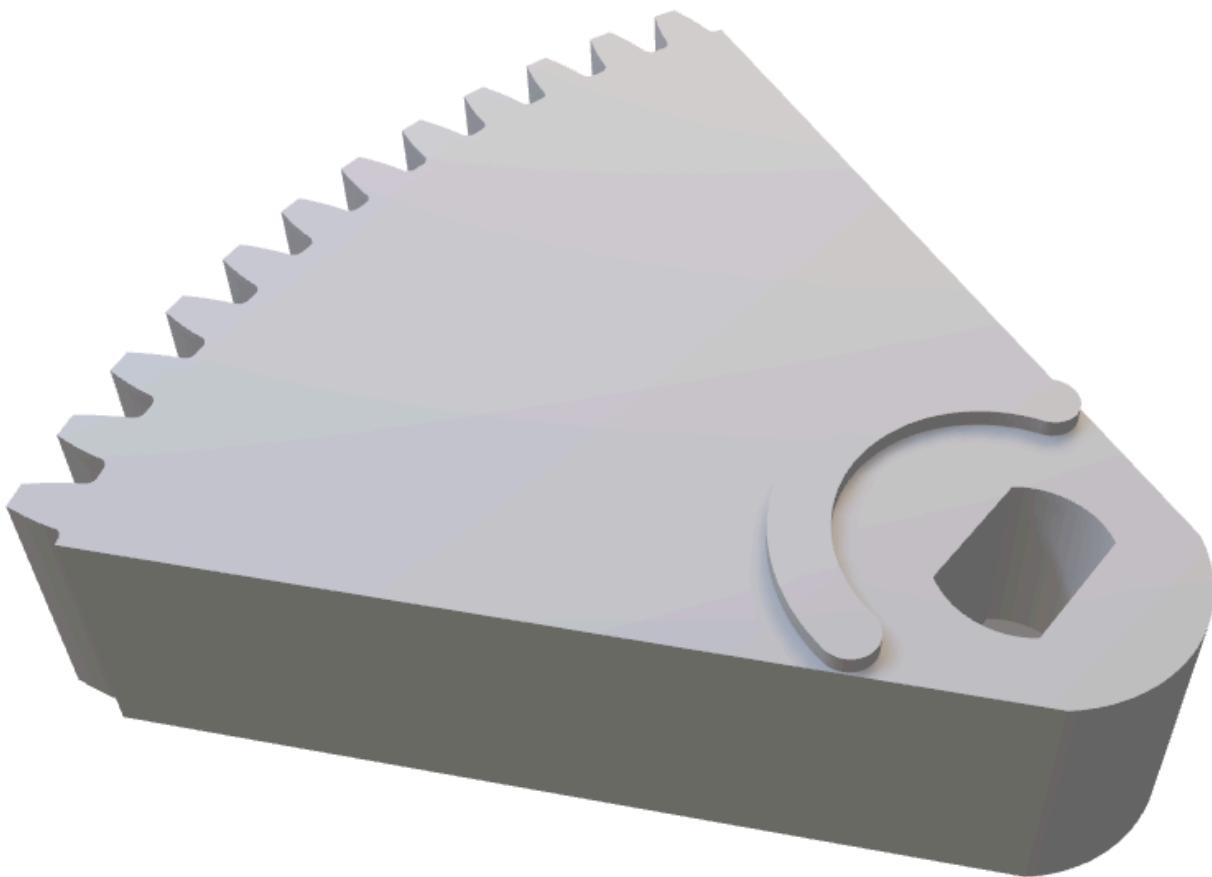
# SeeMeCNC Rostock Max 3D Printer



## Parts and more parts



## Parts and more parts



## **3D printers Cost**

- Consumer 3D printers range from \$250-\$5000

## **Material Cost**

- filament runs from \$20-\$60 per 1kg (2.2 lb) spool (~330m)

## **What if you don't have the money to invest in a 3D printer?**

- There are services, like shapeways.com, where you can upload a 3D model to their site and have them print it for you. They can often print in a variety of materials, including gold, silver, platinum, copper, and stainless steel. You can also check with local libraries, or search for “Maker Spaces” in your area, to see if they offer access to 3D printing for a nominal fee.

## What's the best way to get into 3D printing?

- Don't buy a 3D printer right away, unless you can really afford it. Instead, spend some time learning how to create three-dimensional models using some type of CAD software. Downloading 3D models is fun at first, but the real power of 3D printing comes from you creating 3D models. You don't need a printer to begin learning how to do that.
- Buy a digital caliper and learn how to use it. Take small items from around the house and learn how to measure them using the caliper then sketch them on a piece of paper using those measurements. Then practice recreating the object as a 3D model in CAD.

## Learn Slicing and Control Software

- MatterControl, Cura, Slic3r,
- KISSlicer, OctoPrint, Simplify3D

## Who Uses 3D Printers

- Engineers and designers : physical 3D models to designs
- Design and build : toys, tools, jewelry, or art
- Teachers : print out teaching aids
- Doctors : prosthetic components, cranium replacements
- Dentists : temporary
- House repair / replace everyday objects

## Types of filament

- PLA (Polylactic acid)
- ABS (Acrylonitrile Butadiene Styrene)
- PVA (Polyvinyl alcohol)
- HIPS (High Impact Polystyrene)
- Nylon
- Wood
- PET (PolyEthylene Terephthalate)
- TPE (thermoplastic elastomer)
- TPU (thermoplastic polyurethane)
- Many other materials not mentioned here

## Steps to Create a 3D object

- Download or Create: thingiverse.com, yeggi.com, mcmaster.com, repables.com, grabcad.com, tf3dm.com
- FreeCAD, OpenSCAD, TinkerCAD, Leopold, AutoCAD 360, Wings 3D, Blender
- 3D scanning
- A “slicer” layers from 0.025mm to 1mm in thickness
- The slicer program will then create the G-CODE
- G-CODE : printer uses to print 3D model layer by layer

## 3D printer maintenance

- Cleaning to keep the extruder and hot end clear of debris
- Clean print bed properly
- Correct print surface or coating for material printed
- Check the level of hot end
- Zero Z height is set properly
- Check the printer structure and supports

# Questions?