Building Your Tech Stack

How Anyone can Code (in AEC)

By Tadeh Hakopian

WHAT ARE WE TALKING ABOUT?

- My Story
- Where to get started
- Programming languages
- Text Editors
- Online resources and learning
- User groups and mutual support
- Sharing your content
- Leveling Up

WHAT ARE WE TALKING ABOUT?

- This talk is about how to get started with coding for people who don’t know much about it
- All the main steps to start use open source tech tools including learning resources
- Anything else is beyond the scope of this talk
- But feel free to ask questions ☺

ABOUT ME

- Tadeh Hakopian
- (Todd-A) (Ha-co-pea-on)
- Design Technologist and Developer
- Background in Architecture
- Experience in Architecture, Engineering and Construction disciplines with BIM and VDC workflows
- Course Author and Speaker for BIM, Dynamo and Coding content

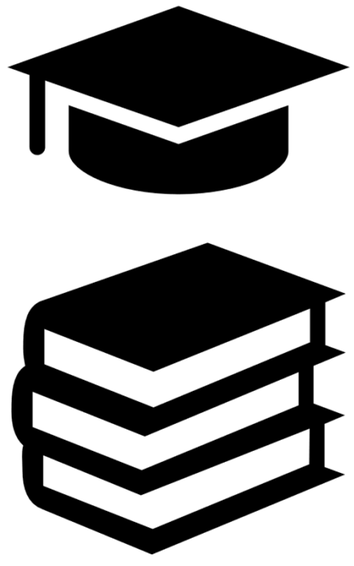
MY DEVELOPER PATH

2010	2017	2018	2019	2020
FORMULAS IN REVIT AND USING DATA IN BUILDING MODELING	VISUAL SCRIPTING IN DYNAMO	CODING WITH PYTHON IN DYNAMO	CREATE PYTHON SCRIPTS FOR AUTOMATION WITH SOFTWARE API	PLANNED: WEB APPS & CUSTOM PRODUCTS

IMPORTANT PARTS

Get out of your comfort zone

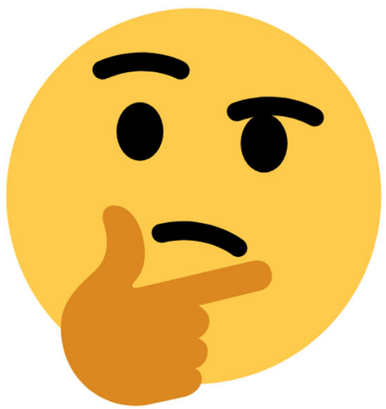
There’s always something you can learn



Just try something

CAN YOU BECOME A CODER?

- ✓ Do you like to think through problem solving
- ✓ Are you interested in visual script
- ✓ Do you find yourself reading through posts to solve problems
- ✓ Does long term projects with iterative updates sound like something that would work for you?

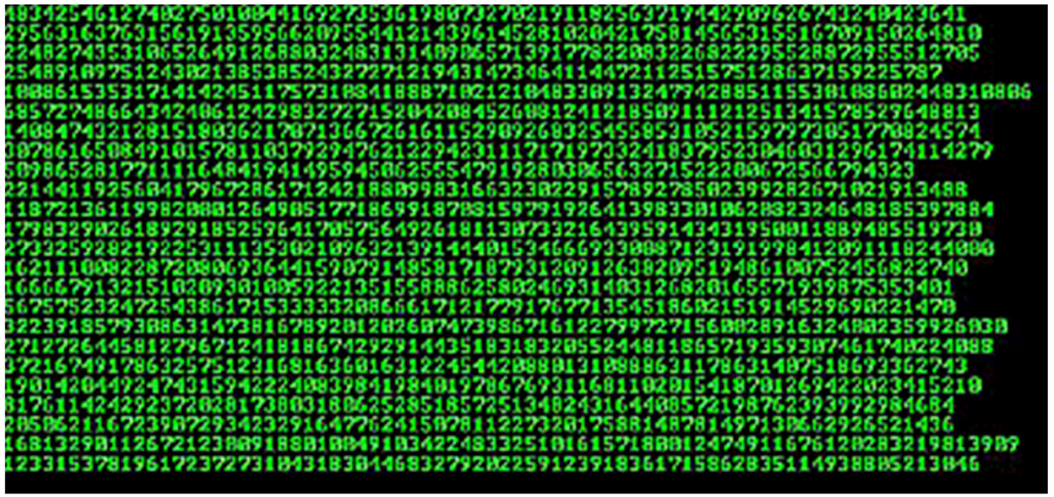


CAN YOU BECOME A CODER?

If any applies to you then you too can code!

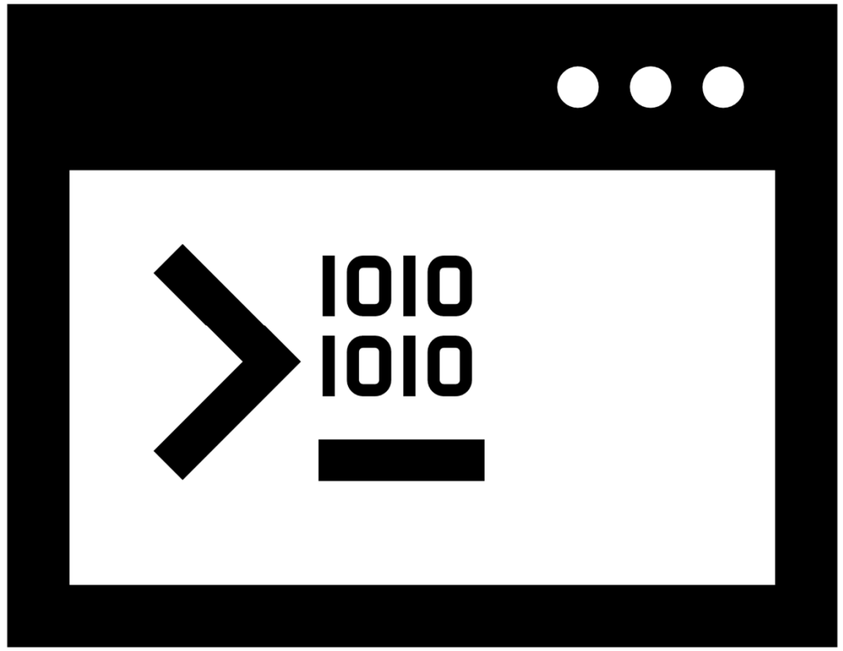
WHAT DOES CODING LOOK LIKE?

- What do you think of when you think coding?
- Does coding seem like it's all math and writing complex algorithms while wearing a hoodie?
- Feel Intimidated?



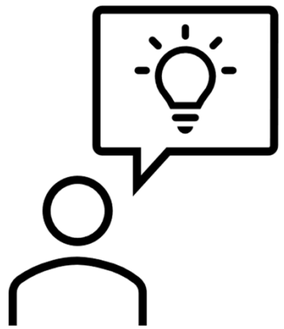
WHAT DOES CODING LOOK LIKE?

- Most Coding is straight forward
- You add lines of text to instruct the computer to complete a process
- Then execute that code in a script to perform the process
- A good chunk of your time is understanding the right problem to solve then debugging the code so it runs correctly



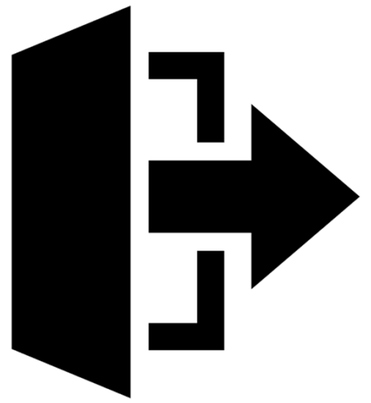
FIRST STEP – WHAT'S YOU END GOAL?

What interests you?



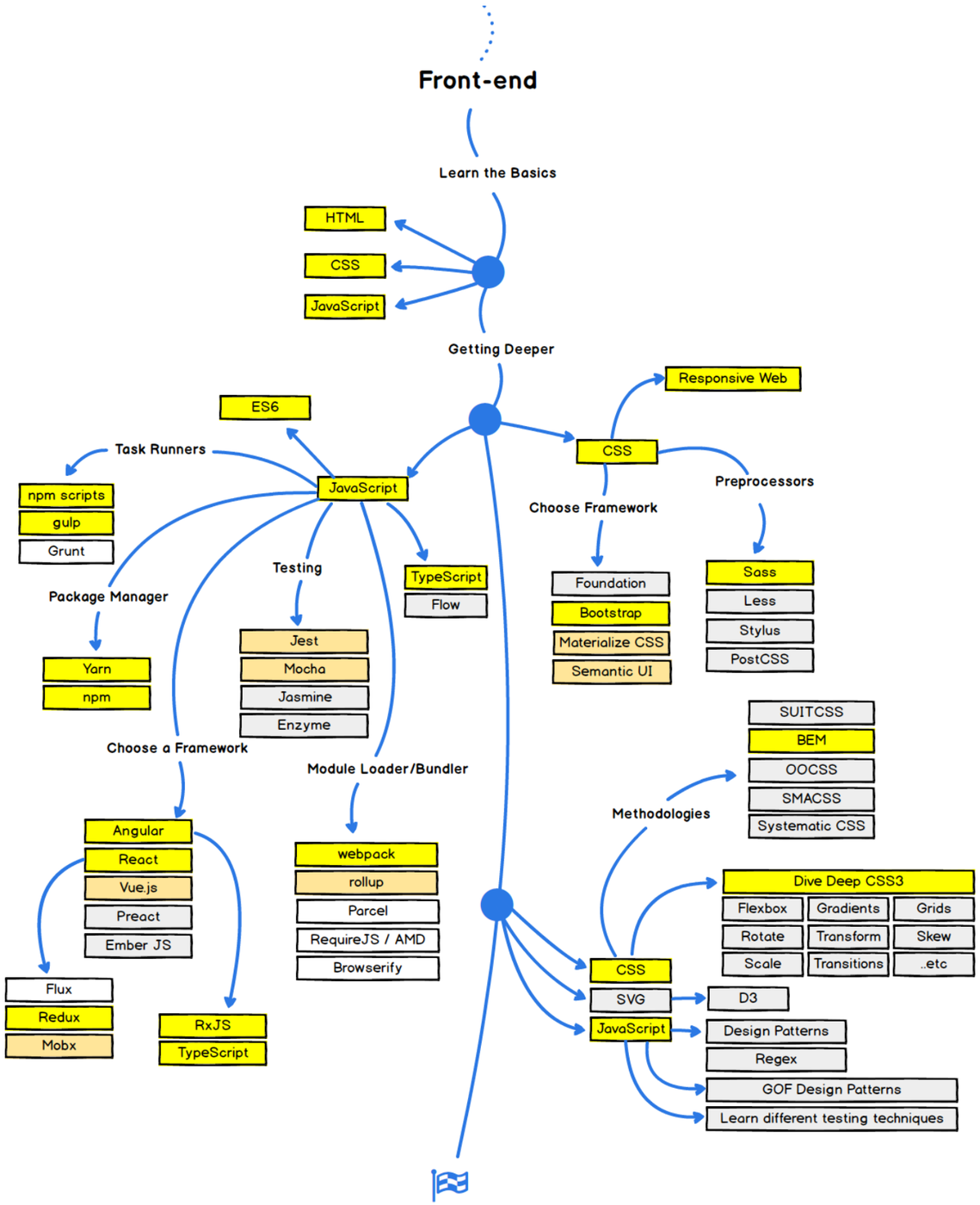
Which problems do you want to solve?

What is the best ways to deliver these solutions?



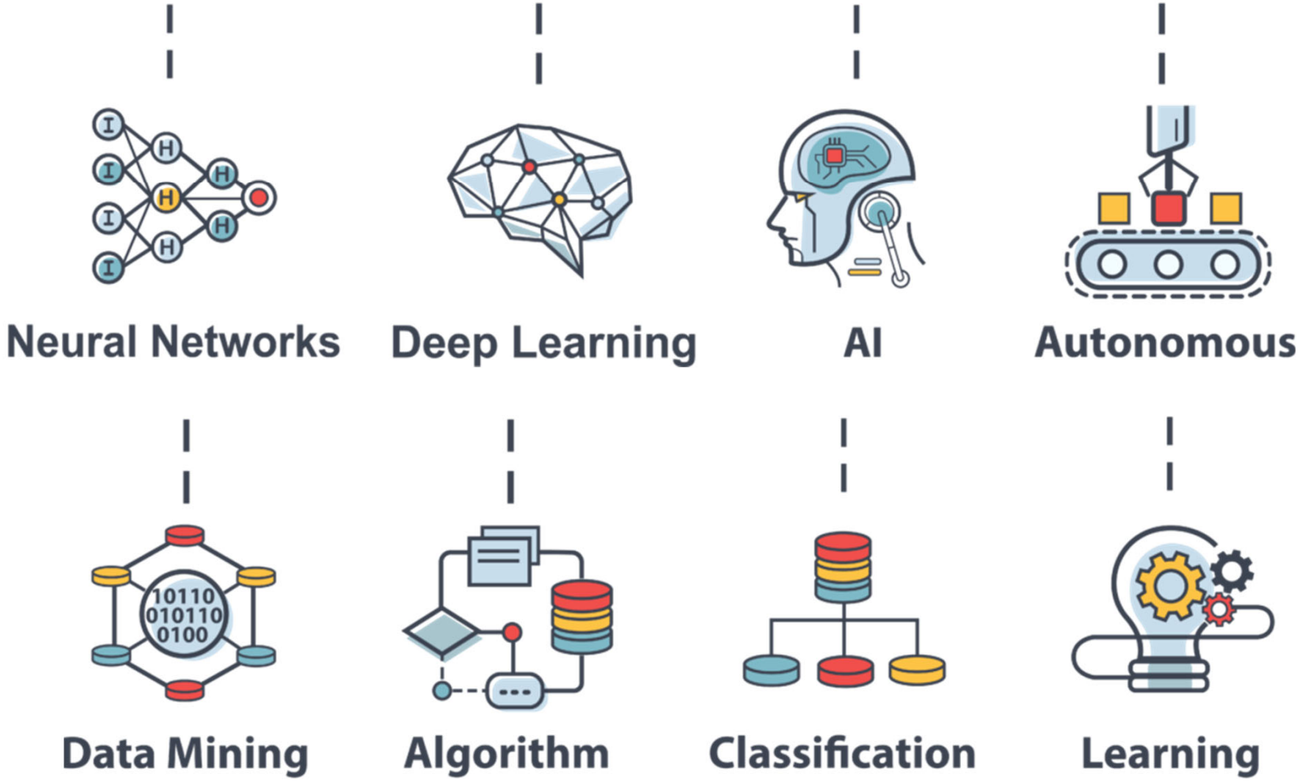
ROADMAP – WEB DEVELOPMENT

- Web Development
- Everything is online and everything is a web tool
- If you want to make web tools then you have to learn about modern web frameworks and languages
- There are easy steps and hard steps but there are lots of steps
- Constantly changing environment but high growth



ROADMAP = DATA ENGINEERING

- Machine Learning and AI
- Basically get the computer CPU to do the thinking work for you
- Not one path though there is a lot of variety
- Can get started on large or small scale
- Python heavy scenario which is a good thing



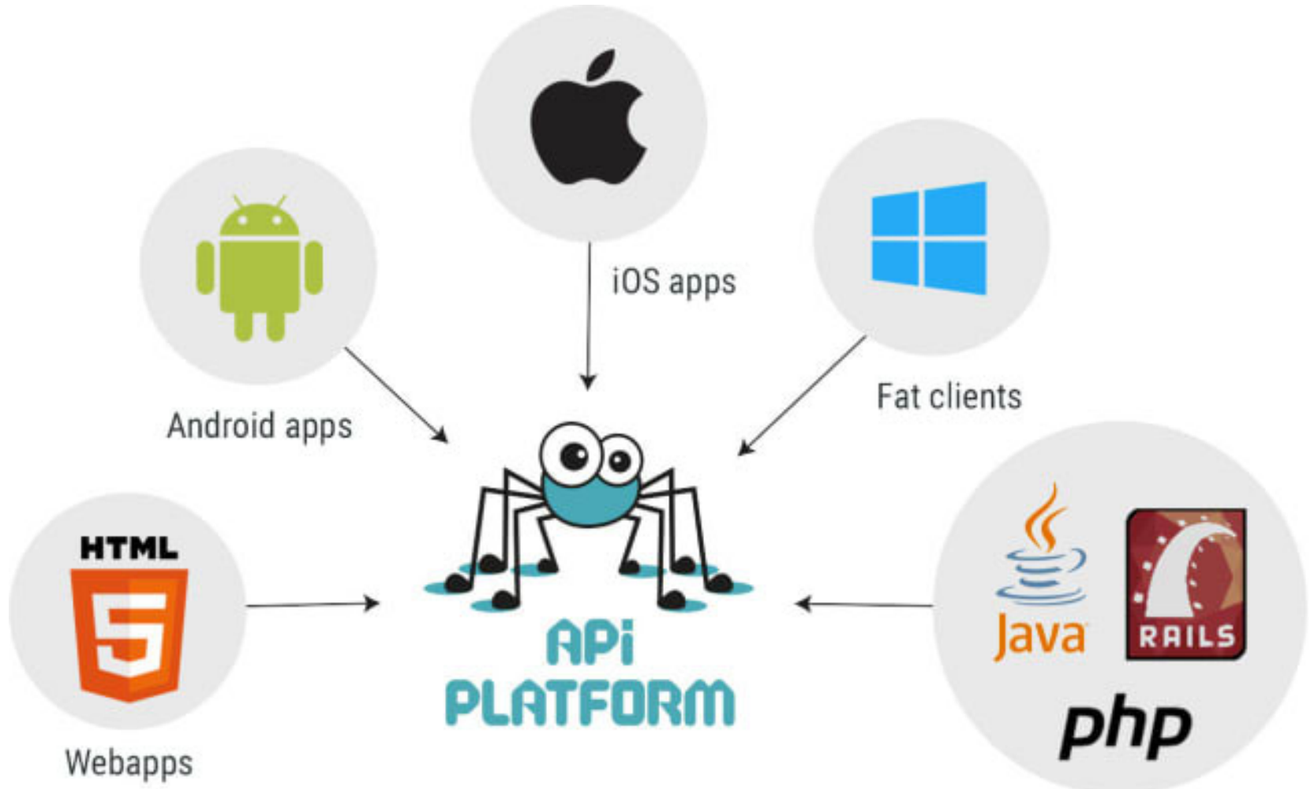
ROADMAP – SCRIPTS AND INTEGRATIONS

- Scripting

- Not interested in being a full time professional software development? There's always scripting!

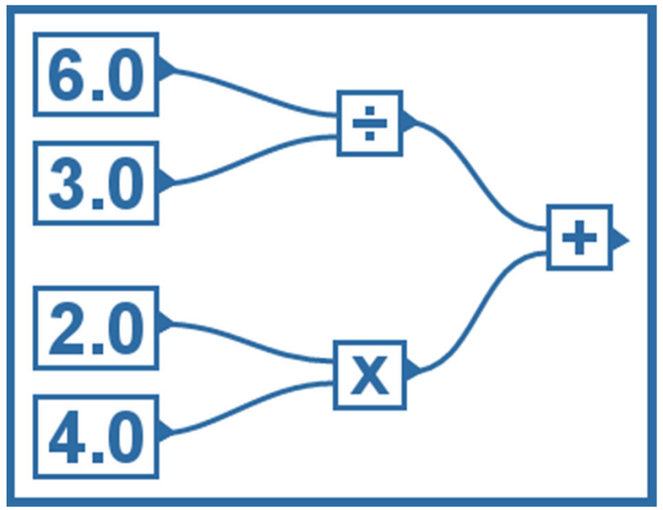
- Most software you use has an API that can provide access to the functions of the platform and you can automate tasks

- Just knowing enough to script is extremely useful and pays dividends for any work you do



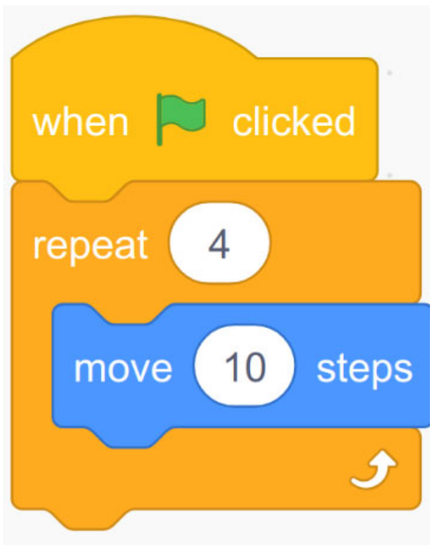
EASY STEPS

Visual Scripts



HTML / CSS

Scratch



WHICH CODING LANGUAGE DO YOU NEED TO LEARN?

WEB TOOLS	WINDOWS / .NET TOOLS	DATA / ML / AI
JavaScript	C#	Python

WHICH CODING LANGUAGE DO YOU NEED TO LEARN?

- Don’t know?
- Just pick Python and go from there
- It does just about everything

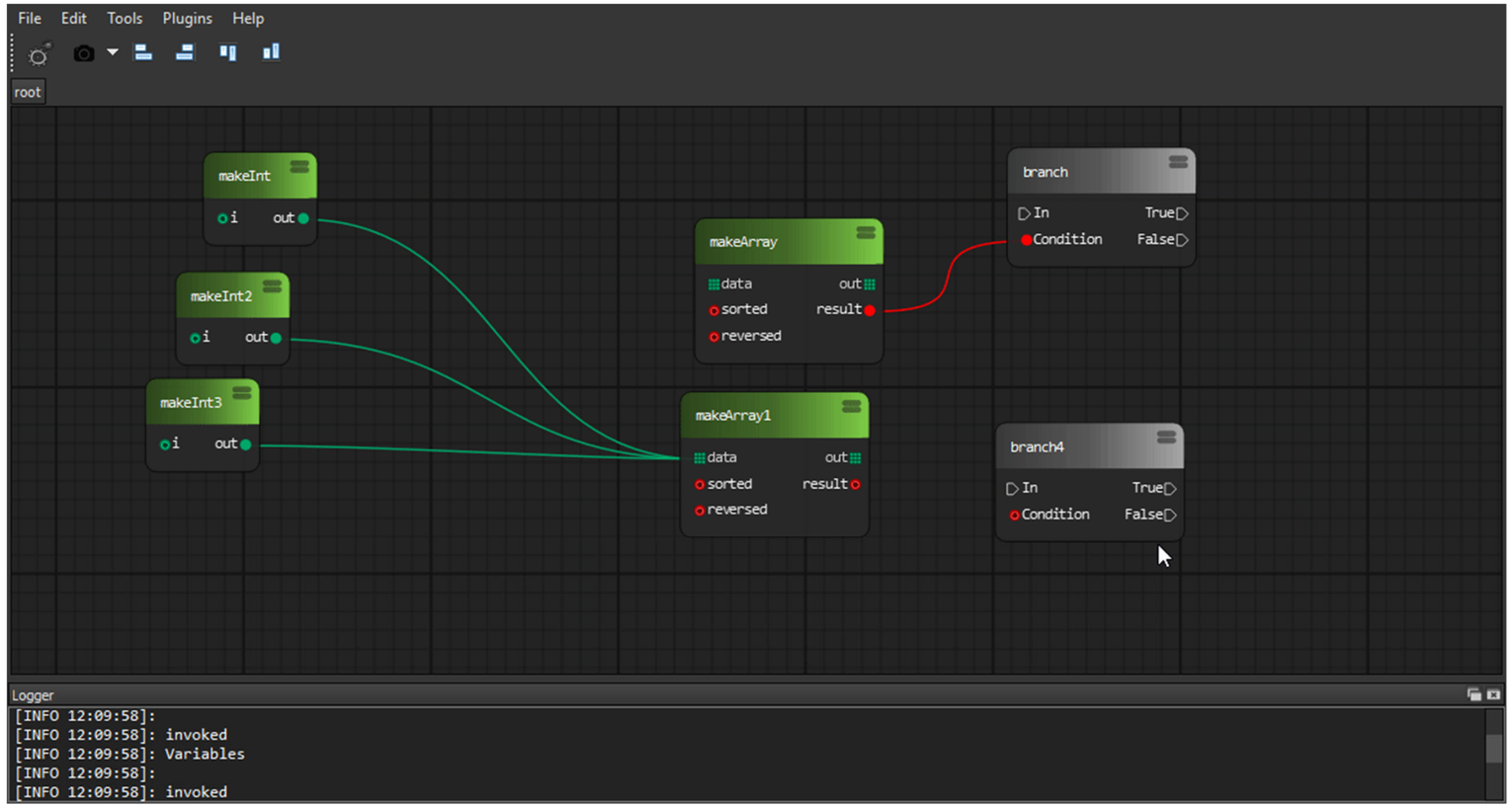
QA

WHICH CODING LANGUAGE DO YOU NEED TO LEARN?

- By the way if you like visual scripts there's even an open source project called PyFlow which makes Python accessible to non-coders.

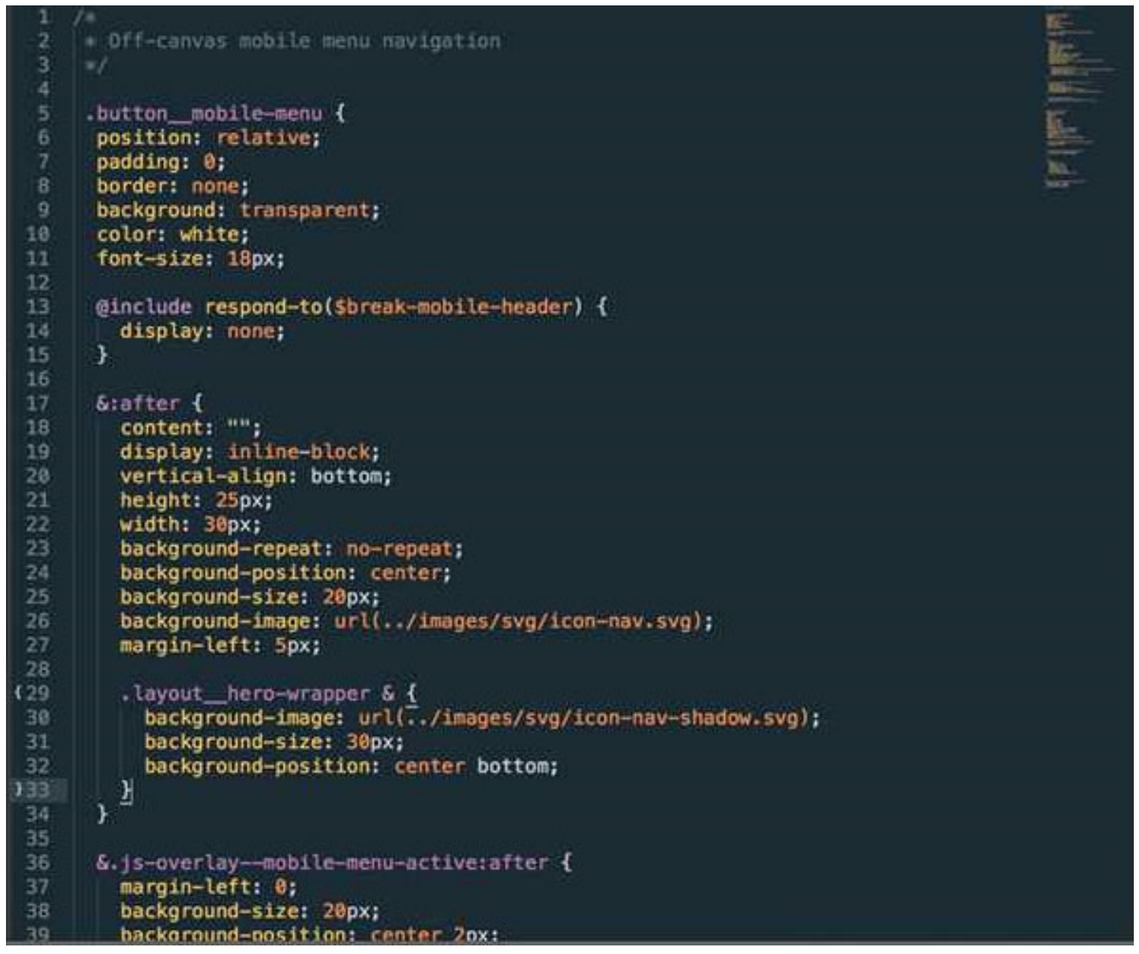
- https://wonderworks-software.github.io/PyFlow/

- So long as you learn the code you're off to a good start.



GET AN EDITOR!

- If you can’t write code then you can’t do much
- Text editors are helpful to write and format code
- You can type all your code on Windows Notepad but that sucks
- They include helpful auto-complete, error checking and debug systems
- Text editors can also run code and create virtual environments to deploy code



GET AN EDITOR!

- There are a lot of editors out there which to choose from

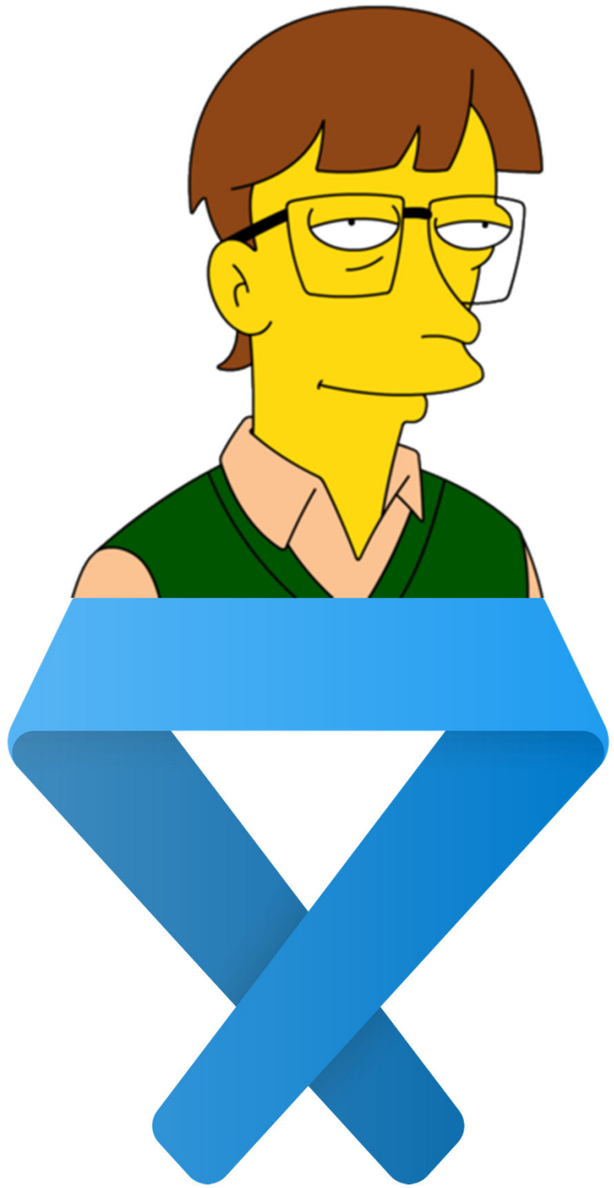
- Vim
- Sublime Text
- Atom
- Gnat
- Brackets
- Komodo
- Notepad++
- Regular Notepad
- Maybe 20-30 more out there…

GET AN EDITOR!

- Or just get Visual Studio Code

- Easy for beginners and has a lot of expansion capability as you grow as a programmer

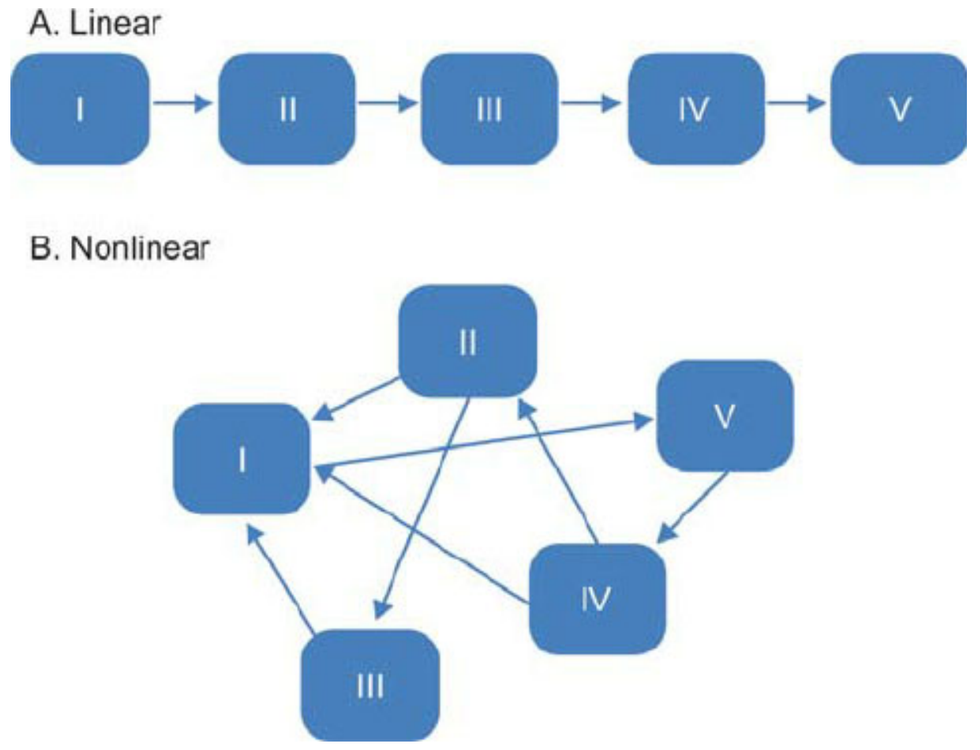
- https://code.visualstudio.com/



LEARNING STYLES

Learning Styles

Linear and Non-Linear



LEARNING RESOURCES

- There are many free resources to start coding on any language you want to learn
- If you are a beginner then any of these are a good start for the basics

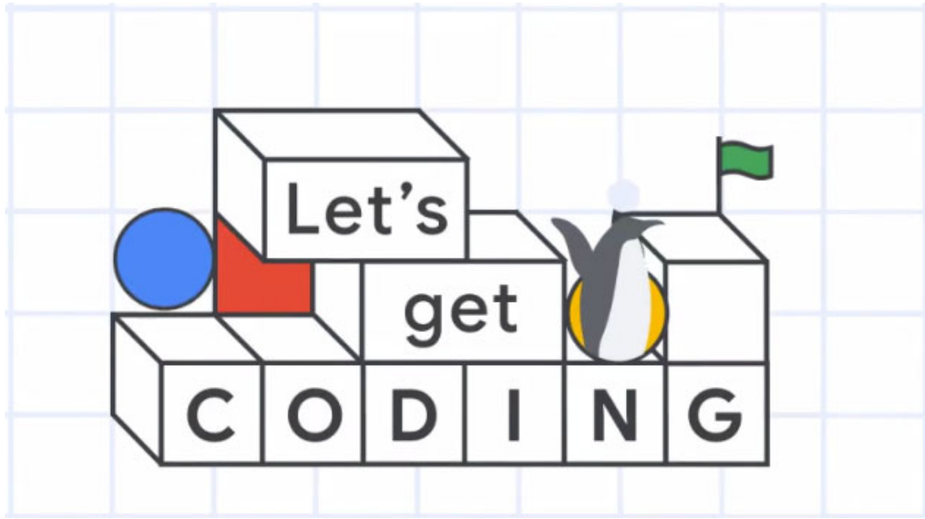
- Code Academy
- Edx
- Udemy
- Pluralsight
- SoloLearn
- Treehouse
- FreeCodeCamp
- Udacity
- And Many more….

LEARNING RESOURCES

- Or Just take Google's learning series about software basics
- You can finish these lessons in a day or two

- Python
  - https://developers.google.com/edu/python

- JavaScript
  - https://learndigital.withgoogle.com/digitalgarage/course/learn-programming-with-javascript



LEARNING RESOURCES

- Protip: You can get free access to Linkedin Learning Courses with a LA Public Library account.
- Linkedin Learning has learning paths that format courses in different programming topics for you with certifications

LOS ANGELES PUBLIC LIBRARY

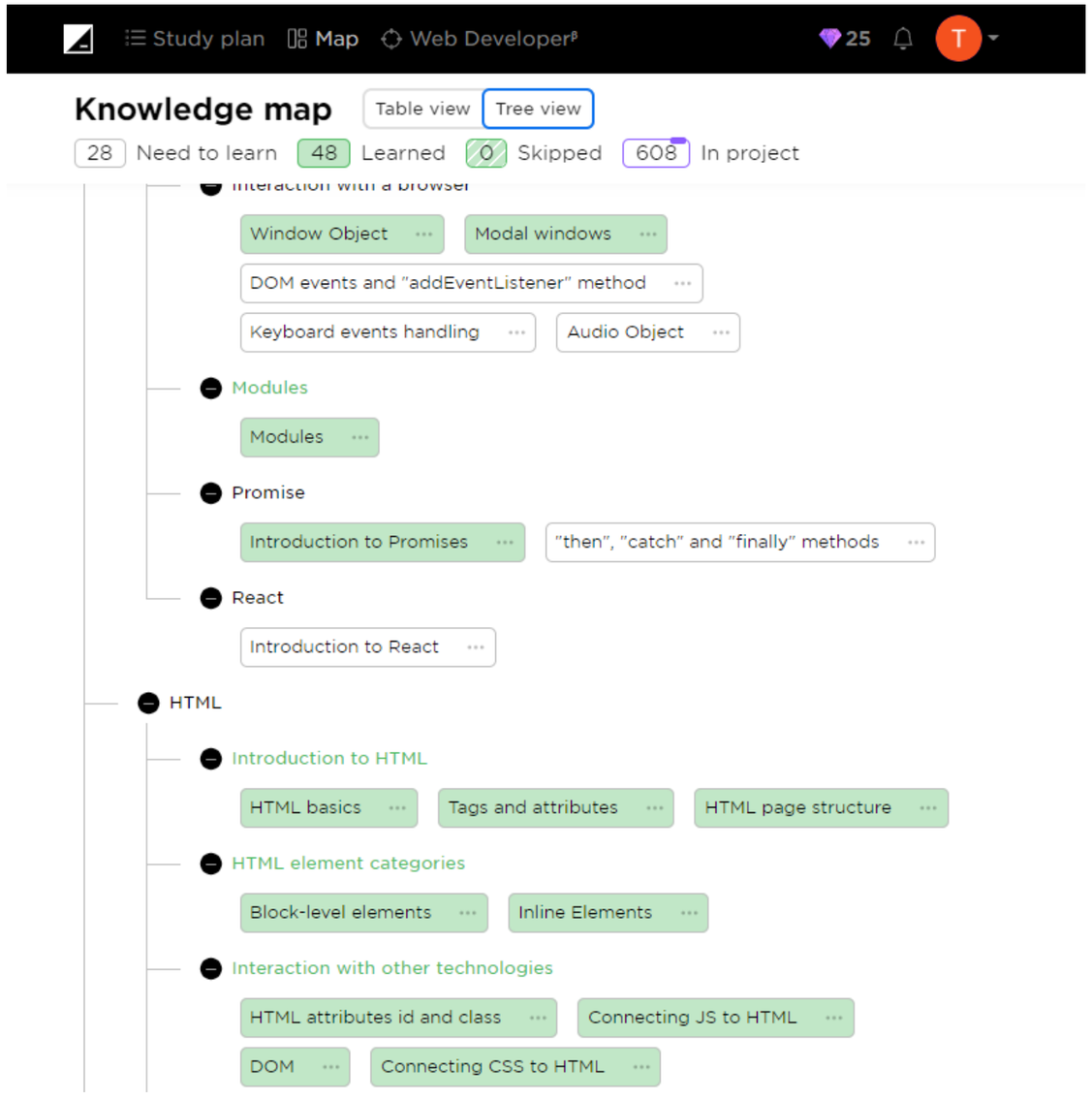
- Register LA Library account online:
- https://www.lapl.org/about-lapl/contact-us/e-card/e-card-registration

LinkedIn LEARNING

- Linkedin learning login :
- https://www.lynda.com/portal/sip?org=lapl.org

LEARNING RESOURCES

- My Preference – Hyperskill by JetBrains
- Multiple learning paths
- Non-Linear
- Comprehensive
- Includes community of learners
- Reinforces learning
- hyperskill.org



SHARE YOUR CODE

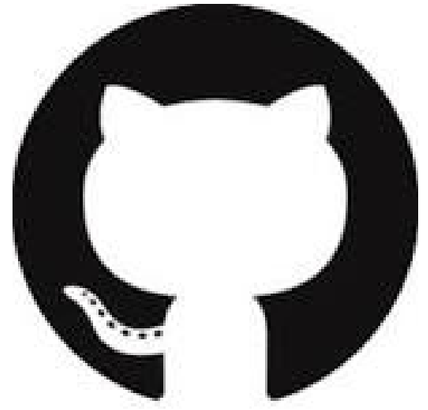
- Github is an online repository for versions of your code

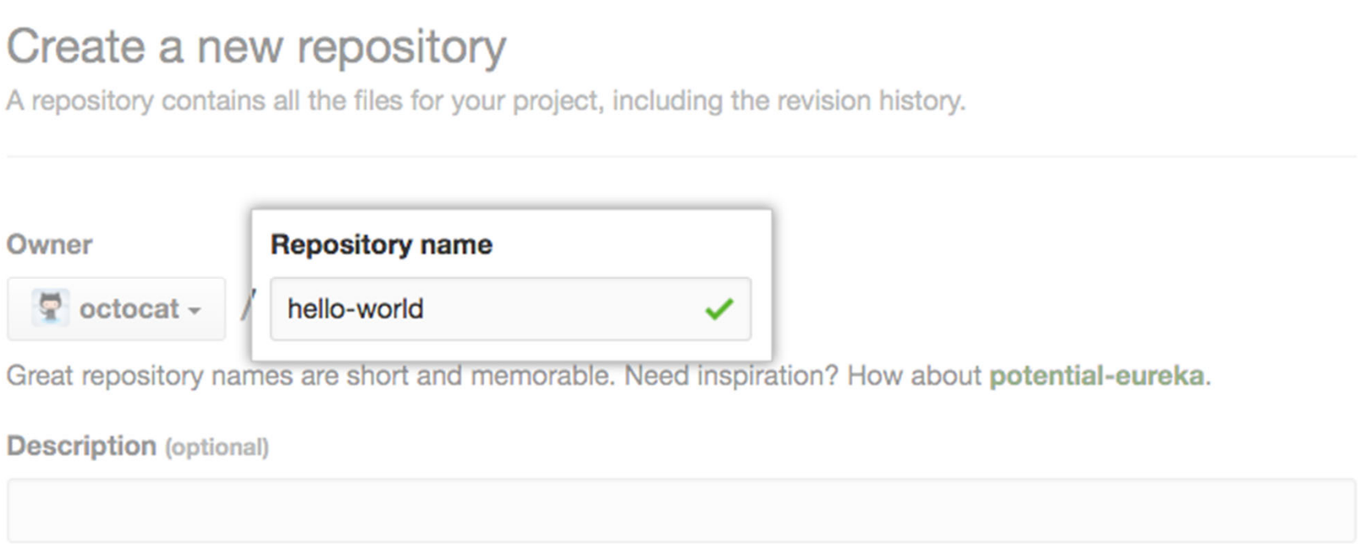
- Sometimes you want to version control the code in case you have to roll back to an earlier version

- Or release a specific public version of code while you test the working code

- Easy to use and can host wikis and most file types for anyone to access

- Quickstart guide: https://docs.github.com/en/github/getting-started-with-github/quickstart





NEED HELP? – ASK THE INTERNET!

- Ask questions with keywords to get the results you need

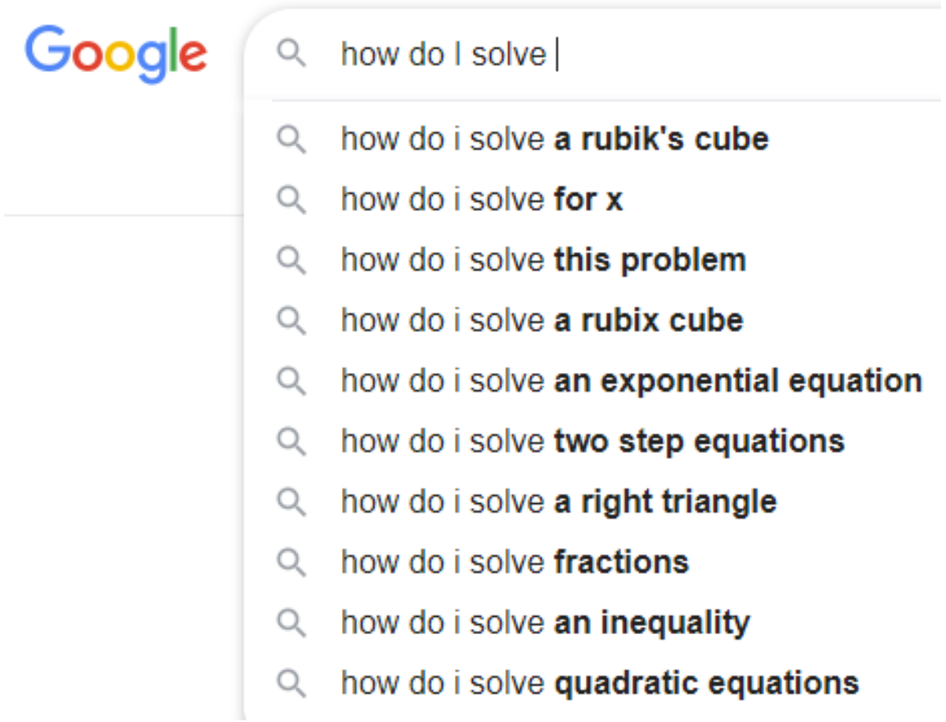
- Stack Overflow – First place to ask for help on actual code problems

- Reddit – Lots of subreddits on many coding languages that can provide support on your issues

- Quora – Question and Answer site for general and specific tech problems

NEED HELP? – ASK THE INTERNET!

- Or just ask Google
- Google is your friend



SUPER POWERS FOR SUPER USERS

20 lines (16 sloc) | 471 Bytes

```
# Enable Python support and load DesignScript library
import clr
clr.AddReference('ProtoGeometry')
from Autodesk.DesignScript.Geometry import *
clr.AddReference('RevitNodes')
from Revit.Elements import *

famtype = IN[0]
pbc = Point.ByCoordinates(0,0,0)
output = []

for x in range(0, 100, 20):
        for y in range(0, 100, 20):
                for z in range(0, 100, 20):
                        pbc = Point.ByCoordinates(x,y,z)
                        col = FamilyInstance.ByPoint(famtype,pbc)
                        output.append(col)

OUT = output
```

PS - XYZ matrix Family PY

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OUT = output
```

QA

SOFTWARE PROJECTS BY PEOPLE FROM AEC

PyRevit By Ehsan

Hypar

Layer by Zach Soflin

Testfit

SOFTWARE PROJECTS BY PEOPLE FROM AEC

Blender 3D

blender

BlenderBIM by
Dion Moult

BLENDER**BIM**
ADD-ON

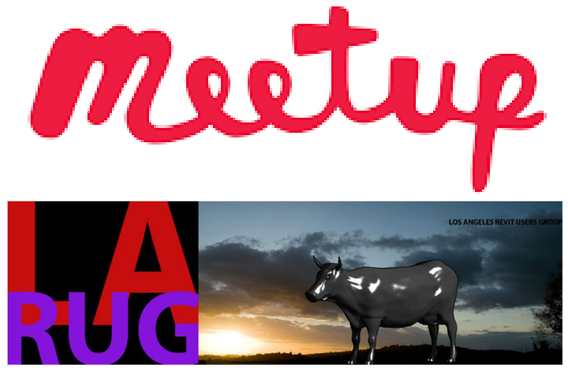
GROUPS

- There are many groups to follow that provide workshops, training guides, hackathons and events

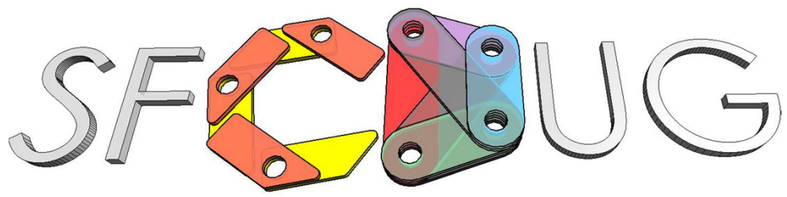
- Find them locally or online and connect with the people there

- Ideally connect with some meetup groups with real tech professionals where you can meet and talk shop

- Hackathons are some of the best places to learn coding on the fly – usually with support from experienced developers



CORE
studio



PEOPLE TO FOLLOW

- Ehsan Iran-Nejad - @eirannejad
- Ian Keough - @ikeough
- Jose Oliveira - @TugaBIM
- Sol Amour - @solamour
- Gavin Crump - @thebimguru
- Thomas Mahon - @Thomas__Mahon
- Wassim Jabi - @wassimj
- Gui Talarico - @gtalarico
- Lisa Marie Mueller - @lm2_me
- Find More on the interwebs!

HOW LONG DOES IT TAKE?

- Becoming capable of writing code on your own on a regular basis can take time but most people can do it

- Speed of learning depends on how much time you put in

- How often you code (daily is best)

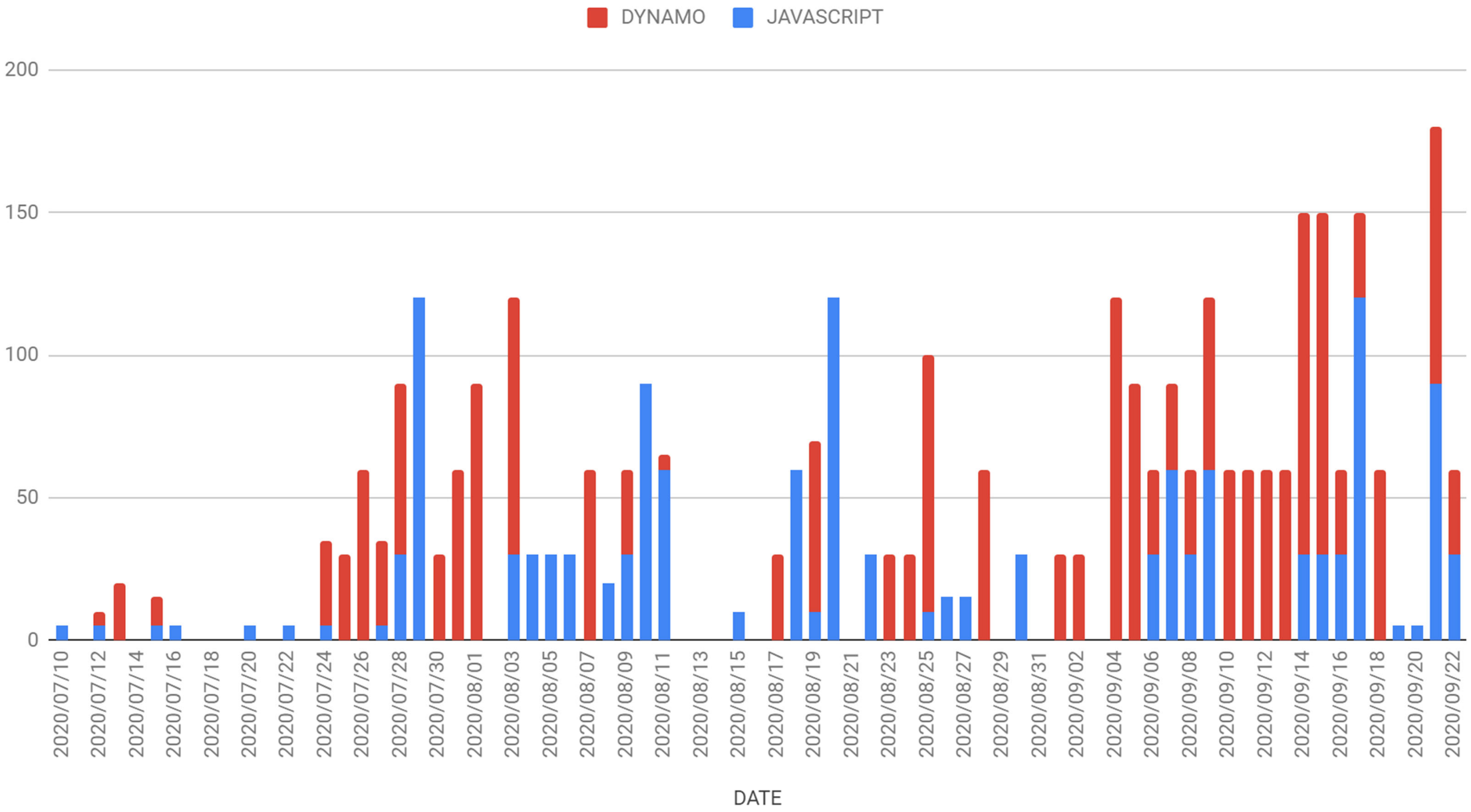
- If you're working on real projects

- Keep a journal of time spent coding

- More than zero effort put into the work every day to see progress

LEARNING METHOD	TIME TO LEARN CODING
Self-Study	6 – 12 months
College Degree	4+ years
Coding Bootcamp	3 – 6 months

MORE THAN ZERO MINUTES



PROJECTS TO TRY OUT

- After you get started coding and have a handle on it create some projects and get your own product portfolio going

- Python in Grasshopper - https://developer.rhino3d.com/guides/rhinopython/your-first-python-script-in-grasshopper/
- Python in Dynamo - https://dynamopythonprimer.gitbook.io/dynamo-python-primer/
- Data Science in AEC - https://www.edx.org/course/Data-Science-for-Construction-Architecture-and-Engineering
- Web Development with Autodesk Forge - https://learnforge.autodesk.io/#/tutorials/dashboard
- Automate the Boring stuff - https://automatetheboringstuff.com/

HOW LONG DOES IT TAKE?

- However you are never really going to stop coding
- The programming environment always changes and you have to keep up to date
- Get used to learning new things and trying them out
- The ride never ends…

QA

MY LEARNING PATH

1

VISUAL SCRIPTING IN DYNAMO

2

PYTHON BASICS WITH A TEXT EDITOR

3

PYTHON NODE IN DYNAMO ON WORK PROJECTS

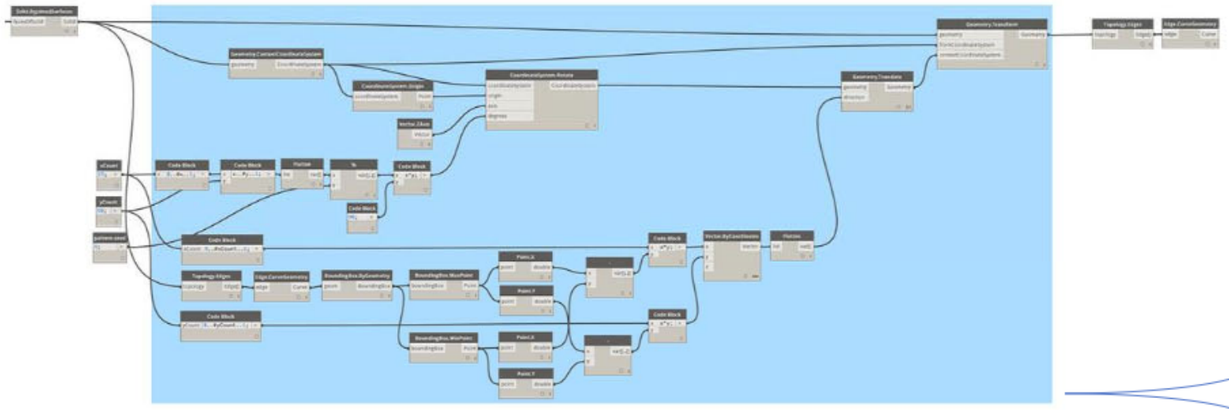
4

PYTHON SCRIPTS RUNNING IN SHELL FILES FOR AUTOMATION PURPOSES

5

PLANNED: USER TOOLS WITH GUI

MY EXAMPLES



```
import clr
clr.AddReference('ProtoGeometry')
from Autodesk.DesignScript.Geometry import *

solid = IN[0]
seed = IN[1]
xCount = IN[2]
yCount = IN[3]

solids = []

yDist = solid.BoundingBox.MaxPoint.Y-solid.BoundingBox.MinPoint.Y
xDist = solid.BoundingBox.MaxPoint.X-solid.BoundingBox.MinPoint.X

for i in xRange:
    for j in yRange:
        fromCoord = solid.ContextCoordinateSystem
        toCoord =
fromCoord.Rotate(solid.ContextCoordinateSystem.Origin,Vector.ByCoordinates
(0,0,1),(90*(i+j%val)))
        vec = Vector.ByCoordinates((xDist*i),(yDist*j),0)
        toCoord = toCoord.Translate(vec)
        solids.append(solid.Transform(fromCoord,toCoord))

OUT = solids
```

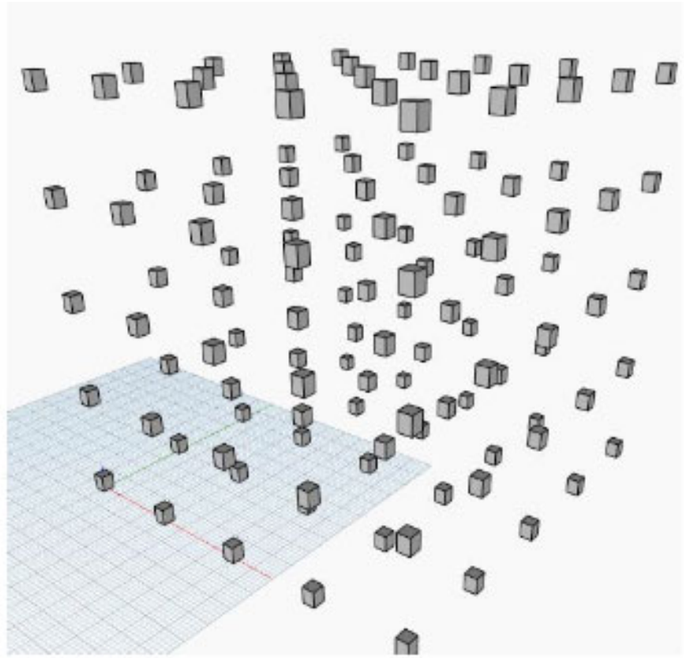
MY EXAMPLES

Python in Dynamo

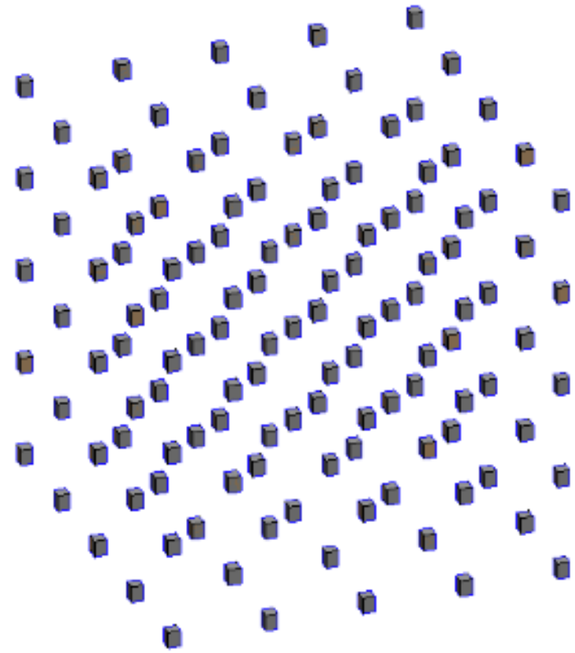
PS - XYZ matrix Family PY

```python
# Enable Python support and load DesignScript library
import clr
clr.AddReference('ProtoGeometry')
from Autodesk.DesignScript.Geometry import *
clr.AddReference('RevitNodes')
from Revit.Elements import *

famtype = IN[0]
pbc = Point.ByCoordinates(0,0,0)
output = []

for x in range(0, 100, 20):
    for y in range(0, 100, 20):
        for z in range(0, 100, 20):
            pbc = Point.ByCoordinates(x,y,z)
            col = FamilyInstance.ByPoint(famtype,pbc)
            output.append(col)

OUT = output
```

Solids in Dynamo



Elements in Revit



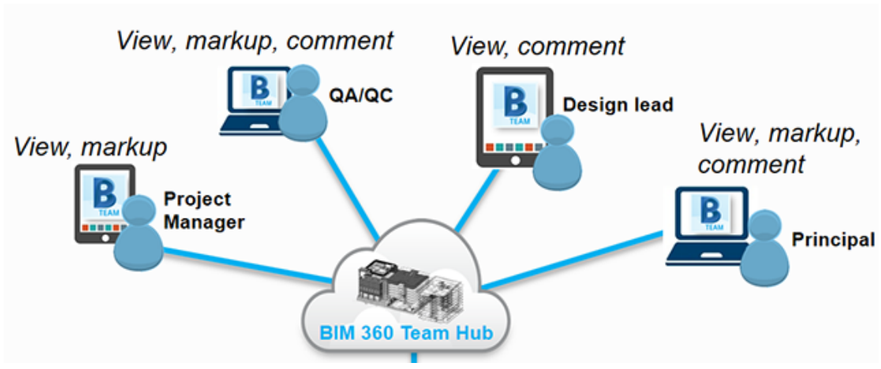
Exploring Python Nodes in Dynamo from Autodesk University

https://www.autodesk.com/autodesk-university/class/Exploring-Python-Nodes-Dynamo-2019#presentation

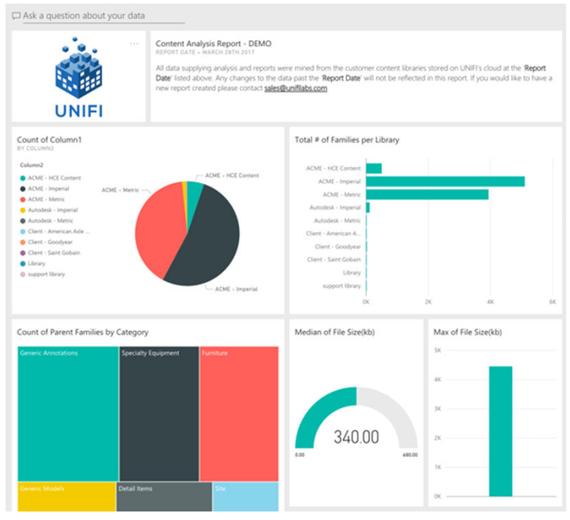
MY EXAMPLES

HMC DIGITAL PRACTICE GOALS

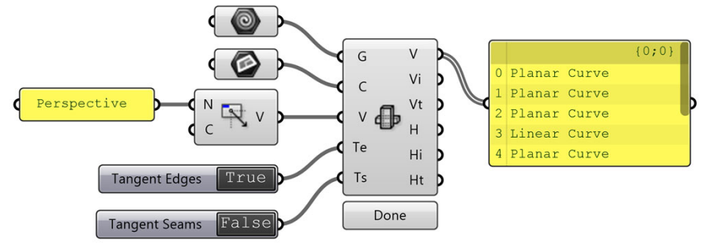
Cloud Native Teams



Data Driven Design



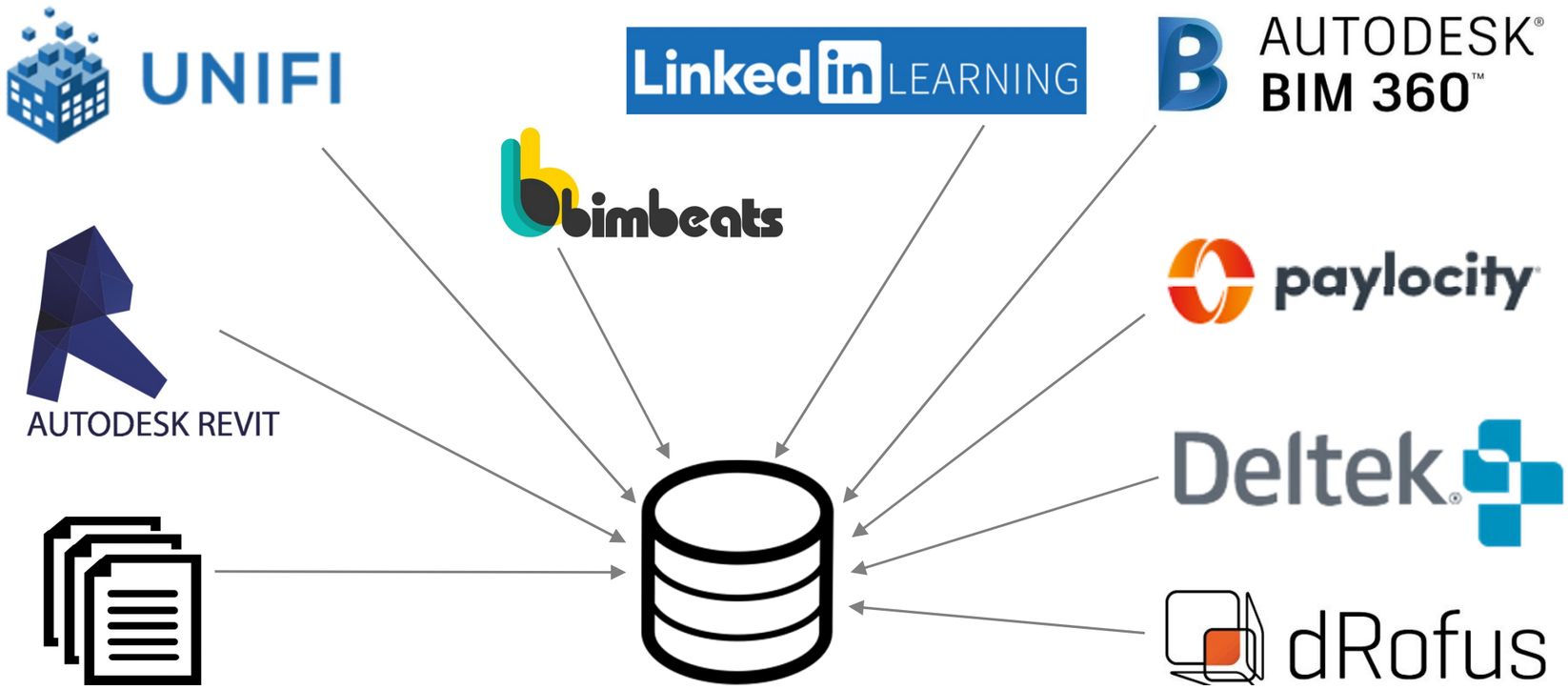
Analysis



HMC Digital Practice

HMC

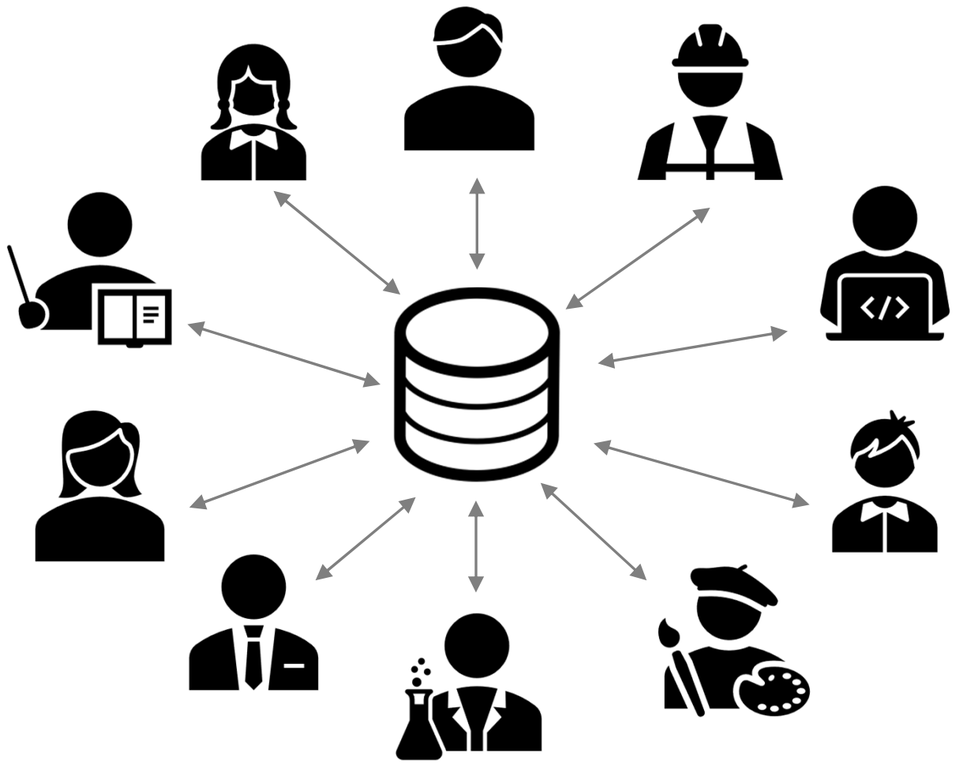
DATABASE CREATION

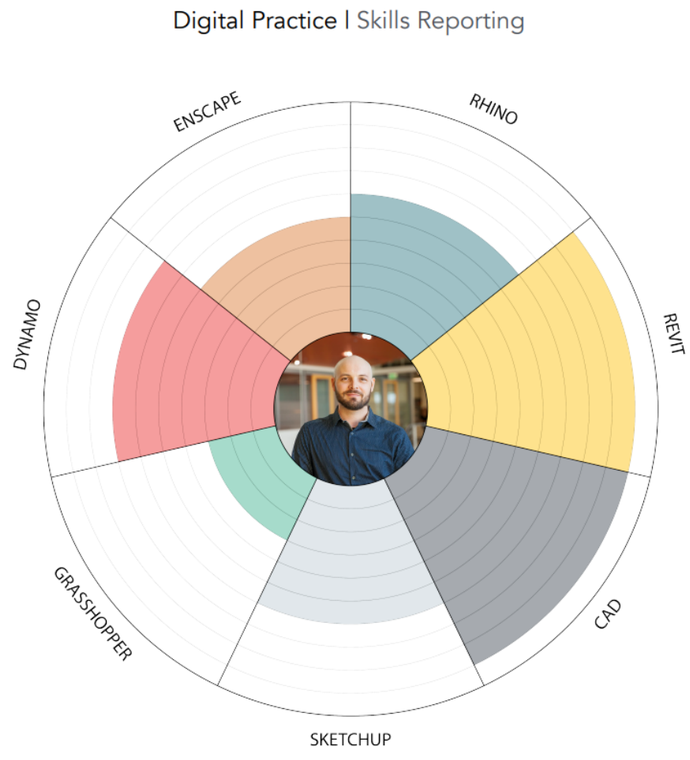


HMC Digital Practice

HMC

DATABASE CREATION





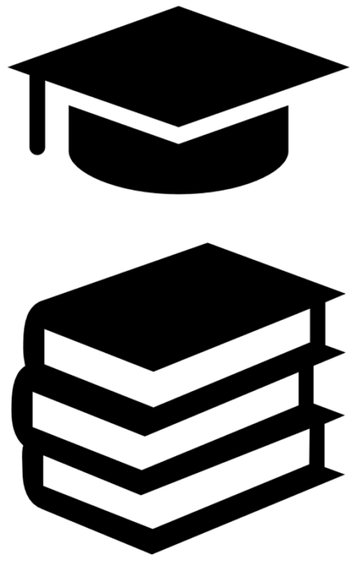
HMC Digital Practice

HMC

IMPORTANT PARTS, AGAIN

Get out of your comfort zone

There’s always something you can learn



Just try something

THAT'S IT! GET GOING! THANKS!

- **Tadeh's Contacts:**

- Twitter - @tadeh_hakopian
- Linkedin - https://www.linkedin.com/in/thakopian/
- Github Decks - https://github.com/thakopian/Presentations
- Email – thakopian@gmail.com

UPCOMING TALKS:

- AEC TECH 2020 - Oct 16 - https://www.aectech.us/agenda
- ENR FUTURE TECH PANEL - Oct 15 - https://www.enr.com/future-tech/agenda
- PYGOTHAM – Oct 02 - https://2020.pygotham.tv/
- AUTODESK UNIVERSITY 2020 - Nov 17 - https://www.autodesk.com/autodesk-university/conference/overview
- 2021 – MORE TO COME !