Session 1 - Python for Machine Learning Course

Agenda:

- Why Program?
- Hardware Architecture
- Python as a Language
- Talking to Python

About CloudxLab

Making learning fun and for life

Videos

Quizzes

Hands-On

Projects

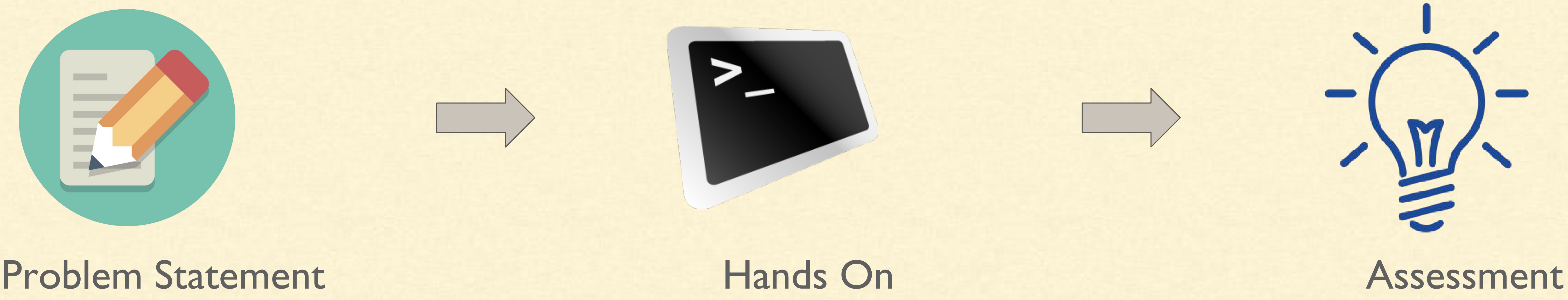
Case Studies

Real Life Use Cases

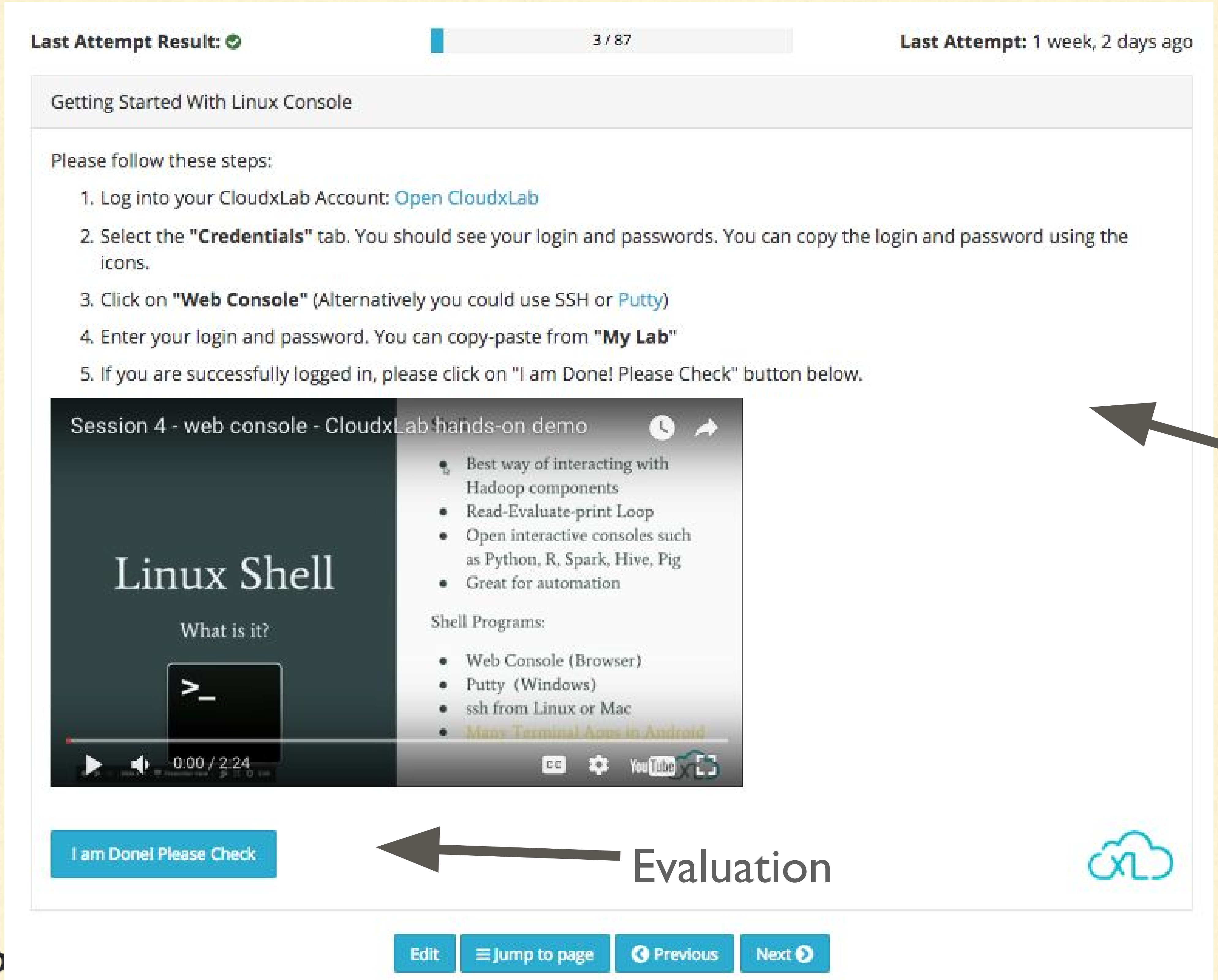
Automated Hands-on Assessments

Learn by doing

Automated Hands-on Assessments



Automated Hands-on Assessments



Last Attempt Result: ✓ 3 / 87 **Last Attempt:** 1 week, 2 days ago

Getting Started With Linux Console

Please follow these steps:

1. Log into your CloudxLab Account: Open CloudxLab
2. Select the **"Credentials"** tab. You should see your login and passwords. You can copy the login and password using the icons.
3. Click on **"Web Console"** (Alternatively you could use SSH or Putty)
4. Enter your login and password. You can copy-paste from **"My Lab"**
5. If you are successfully logged in, please click on "I am Done! Please Check" button below.

Session 4 - web console - CloudxLab hands-on demo

Linux Shell

What is it?

- Best way of interacting with Hadoop components
- Read-Evaluate-print Loop
- Open interactive consoles such as Python, R, Spark, Hive, Pig
- Great for automation

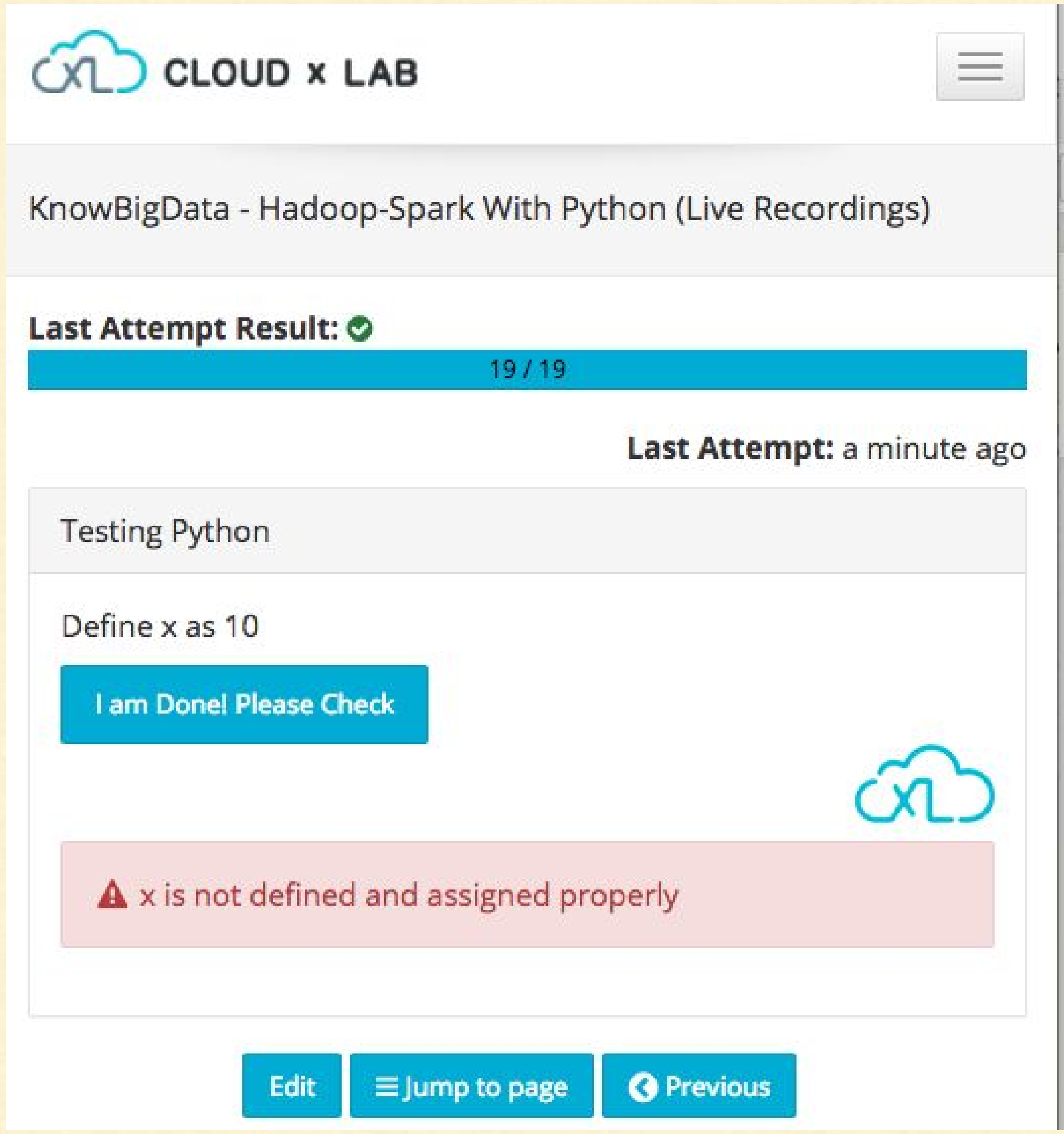
Shell Programs:

- Web Console (Browser)
- Putty (Windows)
- ssh from Linux or Mac
- Many Terminal Apps in Android

Problem Statement

Evaluation

Automated Hands-on Assessments


KnowBigData - Hadoop-Spark With Python (Live Recordings)

Last Attempt Result: ✓

19 / 19

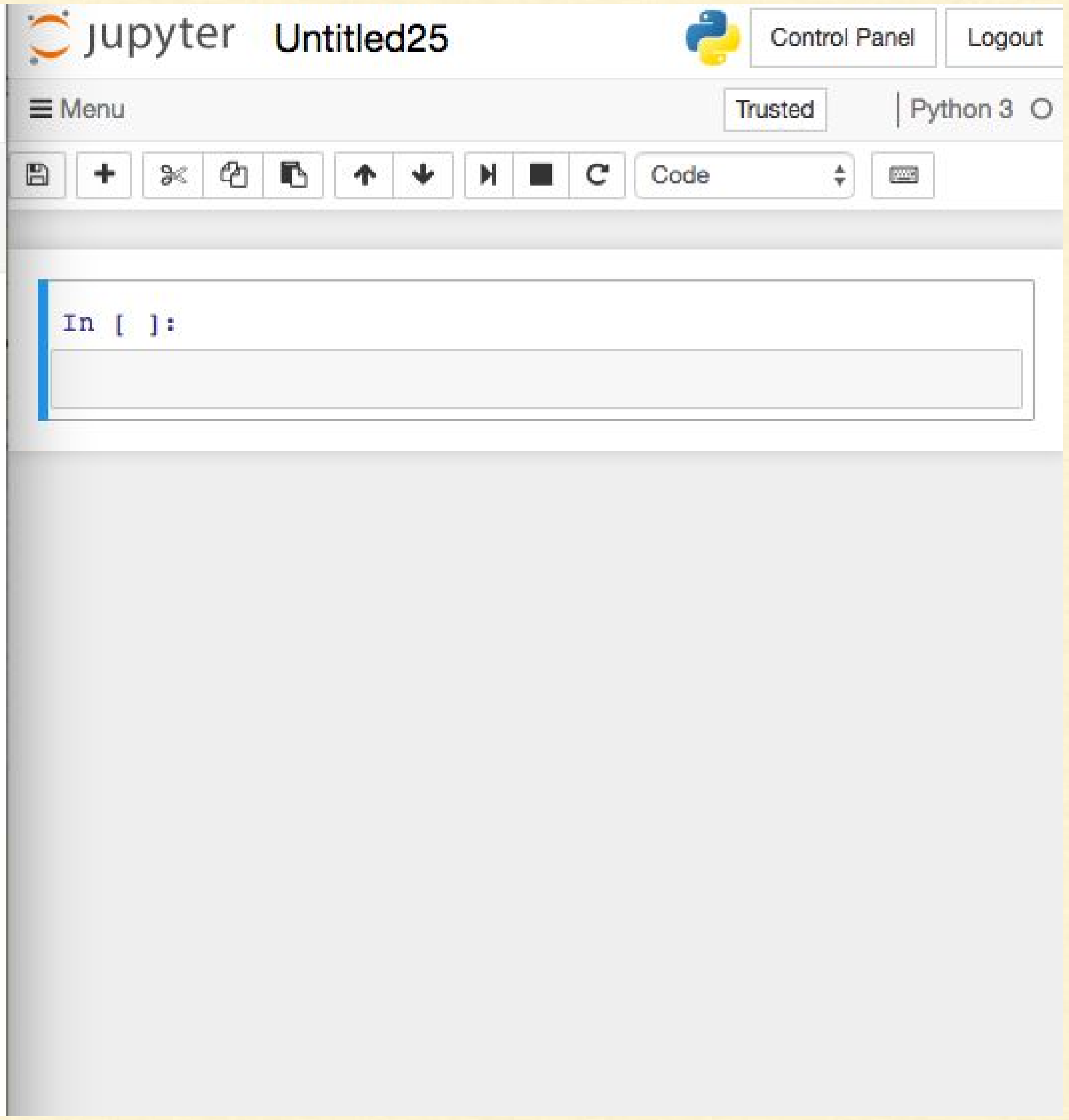
Last Attempt: a minute ago

Testing Python

Define x as 10

I am Done! Please Check

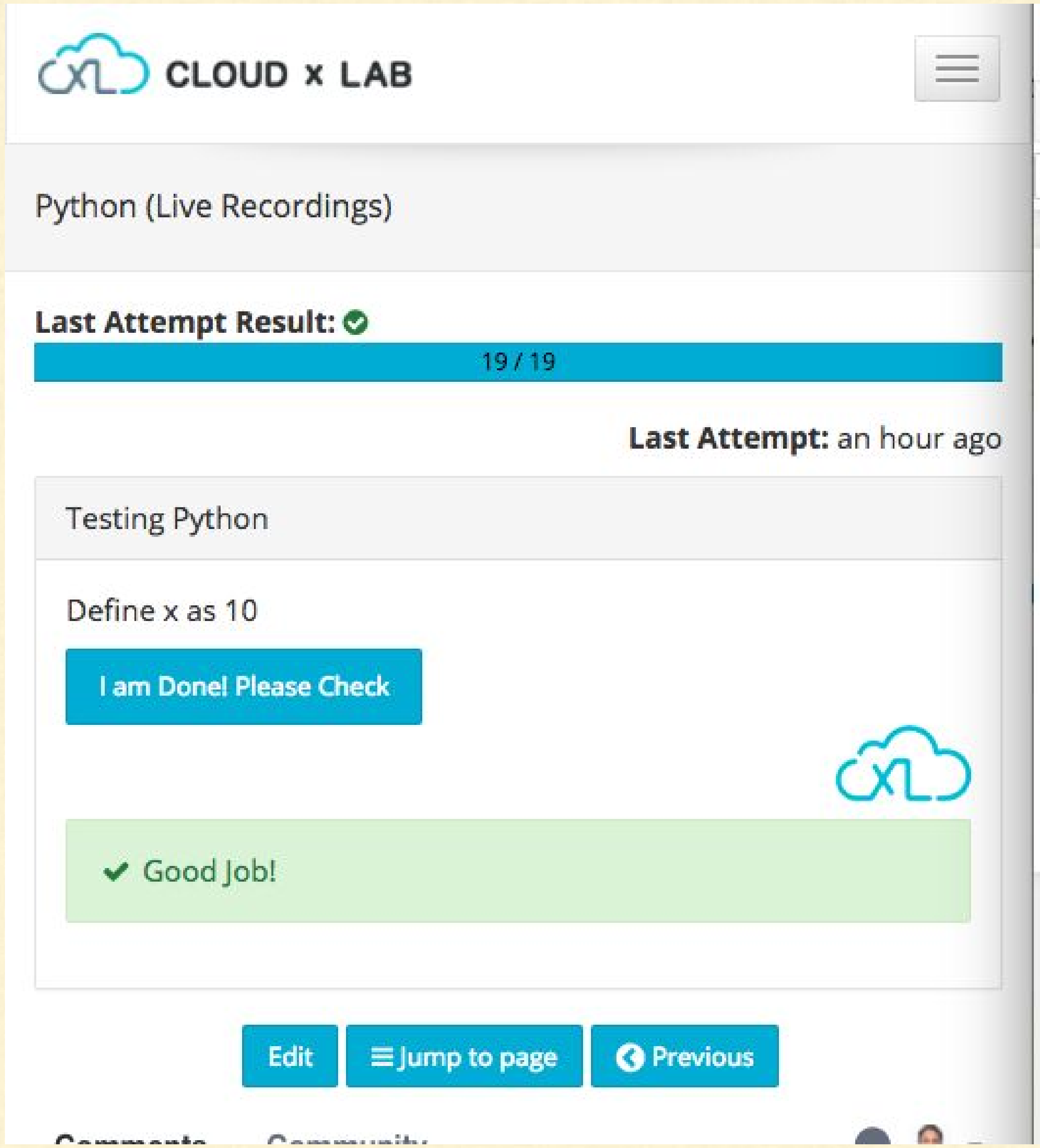
x is not defined and assigned properly



Python Assessment

Jupyter Notebook

Automated Hands-on Assessments



Python (Live Recordings)

Last Attempt Result: ✓

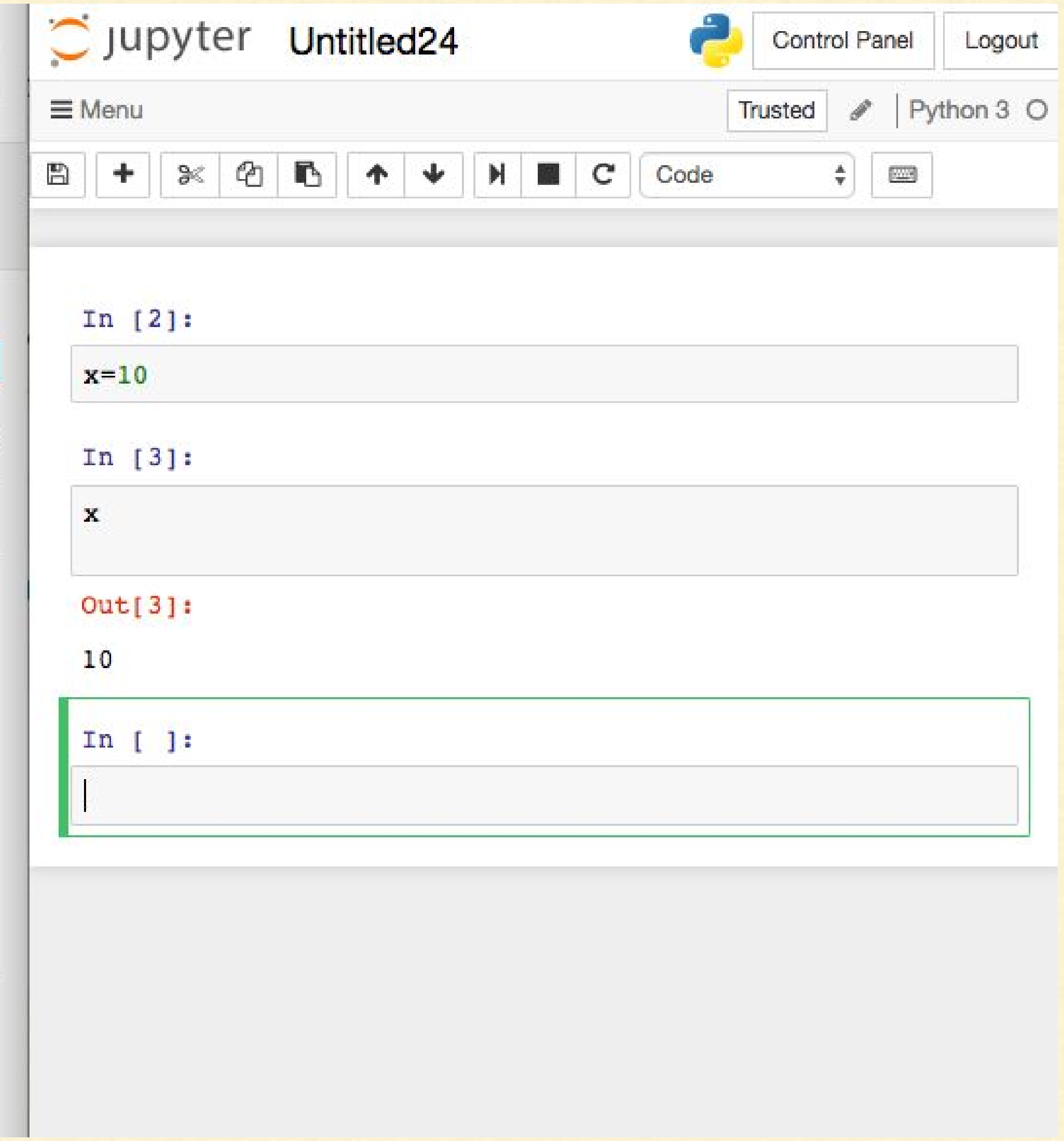
19 / 19

Last Attempt: an hour ago

Testing Python

Define x as 10

✓ Good Job!



```
In [2]:
x=10

In [3]:
x

Out[3]:
10

In [ ]:
```

[Python Assessment](#) [Jupyter Notebook](#)

Course Objective

Learning Python

For

Machine Learning

&

Deep Learning

Course Instructor

Sandeep Giri

Founder CLOUD x LAB

Loves Explaining Technologies

Software Engineer

amazon INMOBI DE Shaw & Co

Worked On Large Scale Computing

Graduated from IIT Roorkee

Session 1 - Python for Machine Learning Course

Agenda:

- Why Program?
- Hardware Architecture
- Python as a Language
- Talking to Python

Why Program?

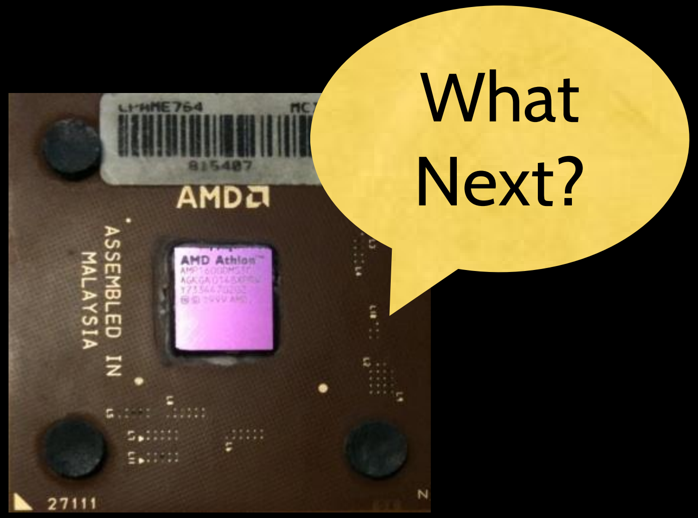
Chapter 1

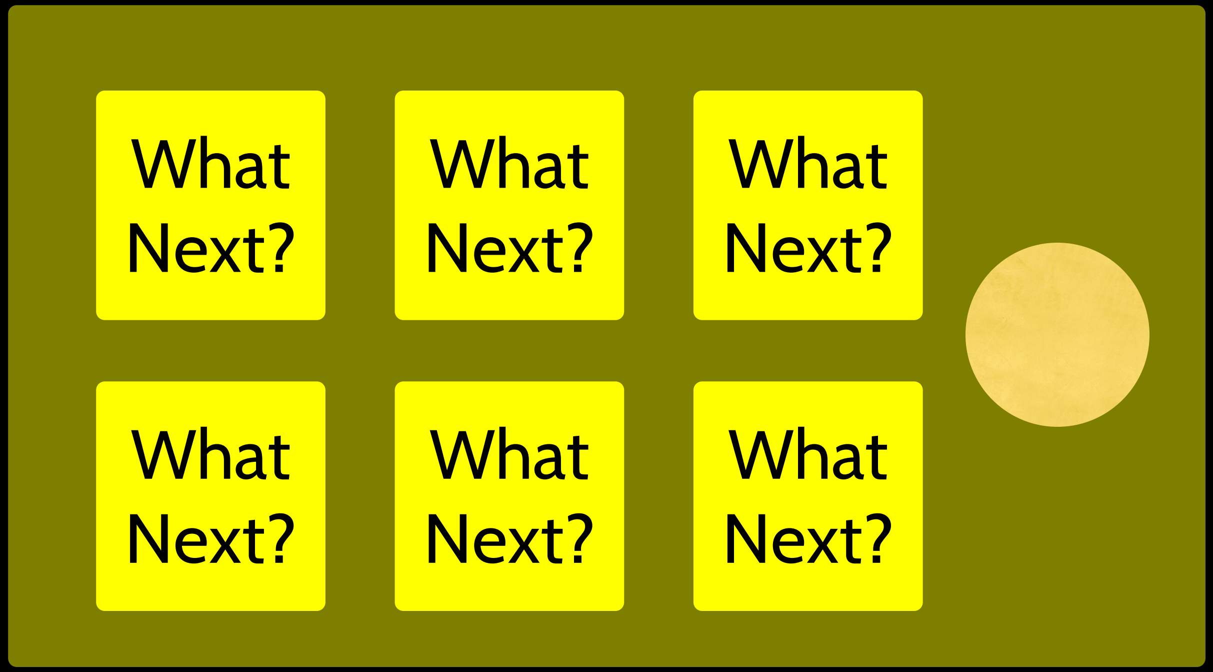
Why Program?

Steve Jobs once said, "Everybody should learn how to program a computer because it teaches you how to think."

Computers want to be helpful...

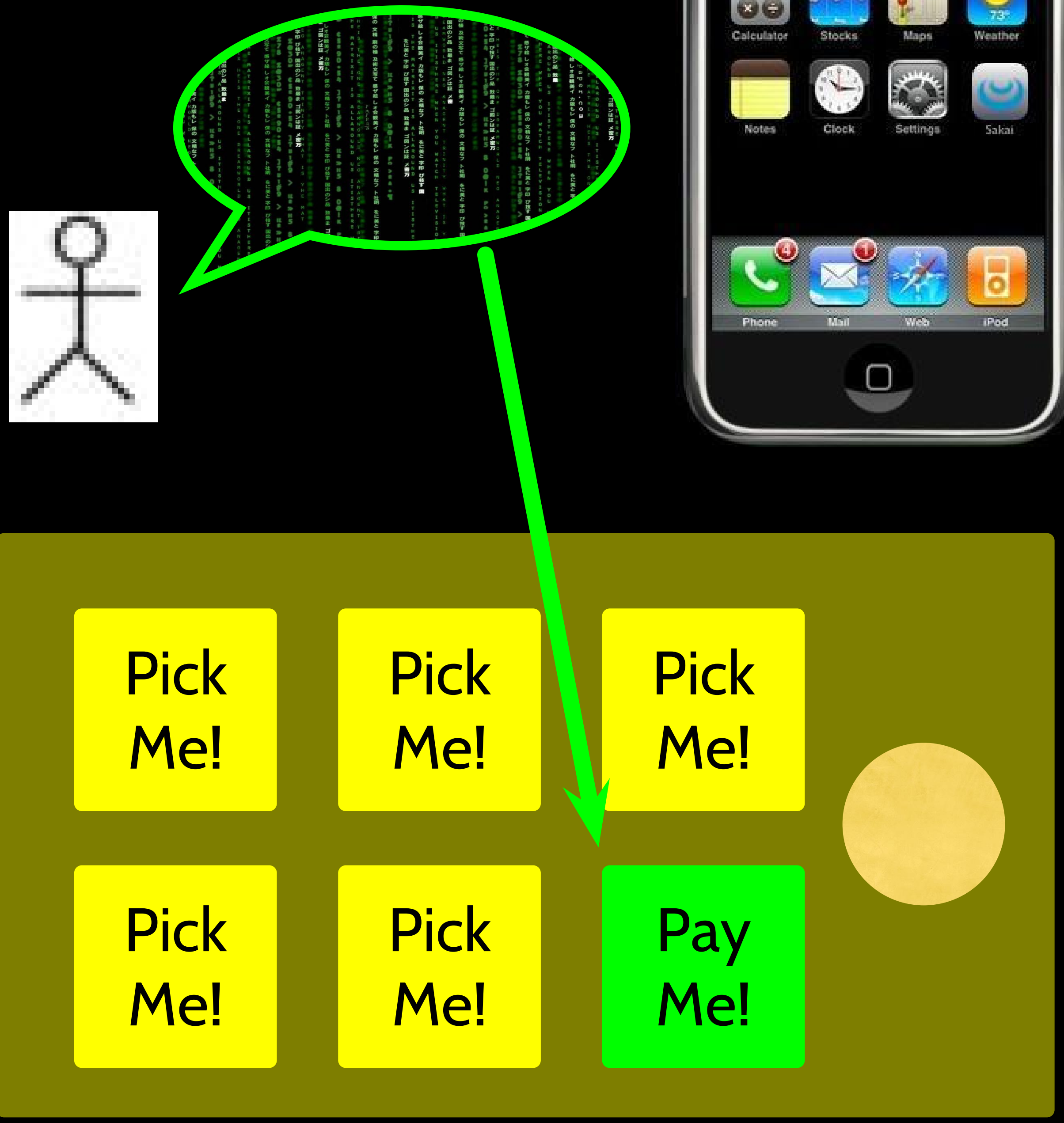
- Computers are built for one purpose - to do things for us
- But we need to speak their language to describe what we want done
- Users have it easy - someone already put many different programs (instructions) into the computer and users just pick the ones we want to use





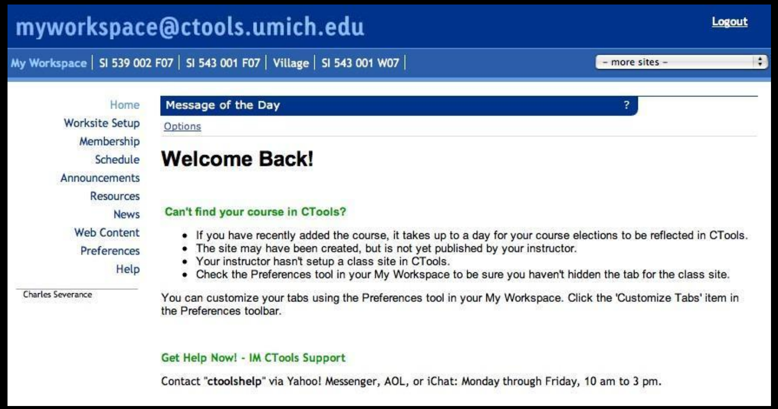
Programmers Anticipate Needs

- iPhone Applications are a market
- iPhone Applications have over 3 Billion downloads
- Programmers have left their jobs to be full-time iPhone developers
- Programmers know the ways of the program



Users vs. Programmers

- Users see computers as a set of tools - word processor, spreadsheet, map, todo list, etc.
- Programmers learn the computer “ways” and the computer language
- Programmers have some tools that allow them to build new tools
- Programmers sometimes write tools for lots of users and sometimes programmers write little “helpers” for themselves to automate a task



myworkspace@ctools.umich.edu

Logout

My Workspace | SI 539 002 F07 | SI 543 001 F07 | Village | SI 543 001 W07 | – more sites –

Home
Worksite Setup
Membership
Schedule
Announcements
Resources
News
Web Content
Preferences
Help

Charles Severance

Message of the Day ?

Options

Welcome Back!

Can't find your course in CTools?

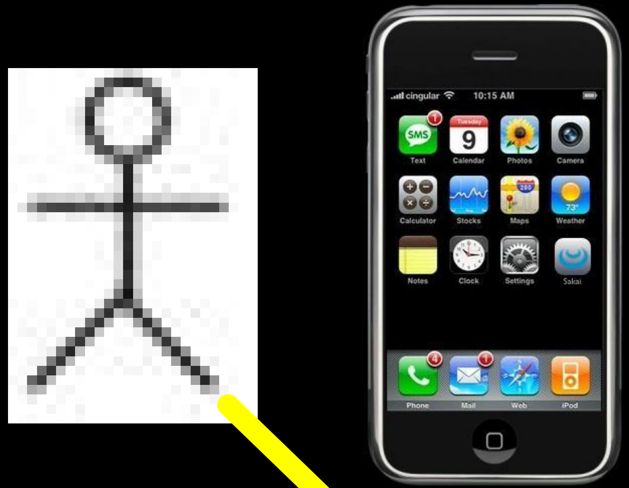
- If you have recently added the course, it takes up to a day for your course elections to be reflected in CTools.
- The site may have been created, but is not yet published by your instructor.
- Your instructor hasn't setup a class site in CTools.
- Check the Preferences tool in your My Workspace to be sure you haven't hidden the tab for the class site.

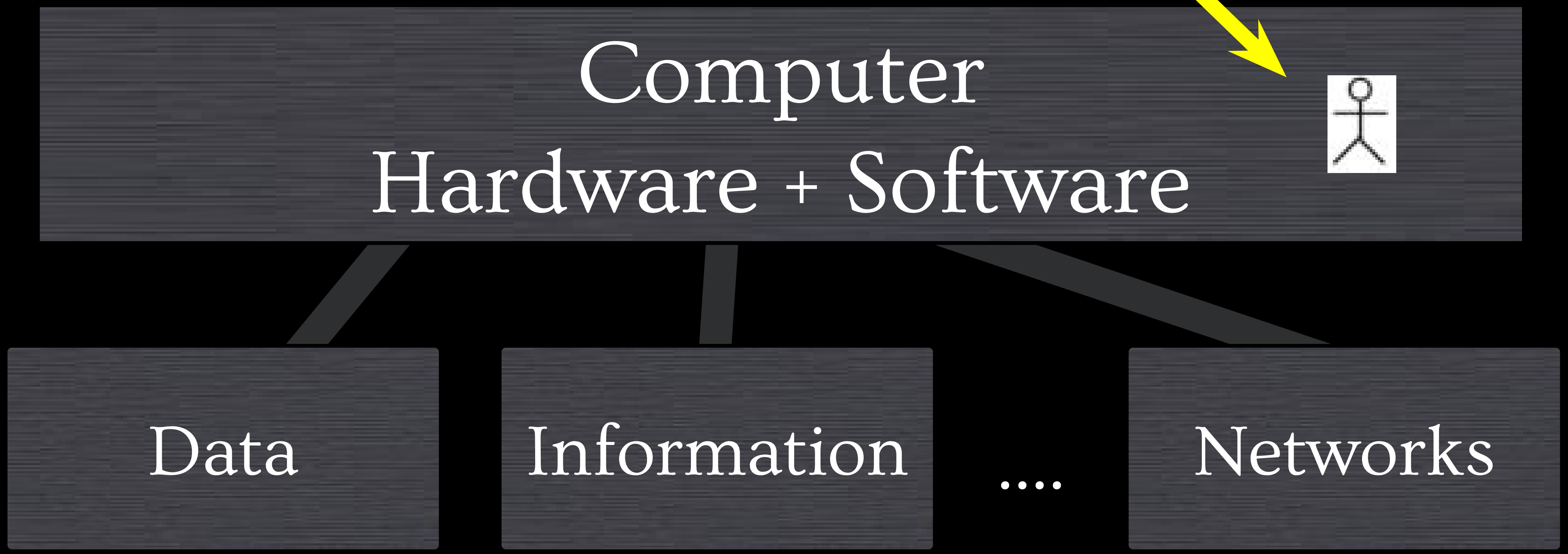
You can customize your tabs using the Preferences tool in your My Workspace. Click the 'Customize Tabs' item in the Preferences toolbar.

Get Help Now! - IM CTools Support

Contact "**ctoolshelp**" via Yahoo! Messenger, AOL, or iChat: Monday through Friday, 10 am to 3 pm.

User





Programmer

From a software creator's point of view, we build the software. The end users (stakeholders/actors) are our masters - who we want to please - often they pay us money when they are pleased. But the data, information, and networks are our problem to solve on their behalf. The hardware and software are our friends and allies in this quest.

Why be a programmer?

- To get some task done - we are the user and programmer
  - > Clean up survey data
- To produce something for others to use - a programming job
  - > Fix a performance problem in the Sakai software
  - > Add guestbook to a web site

What is Code? Software? A Program?

- A sequence of stored instructions
  - > It is a little piece of our intelligence in the computer
  - > It is a little piece of our intelligence we can give to others - we figure something out and then we encode it and then give it to someone else to save them the time and energy of figuring it out
- A piece of creative art - particularly when we do a good job on user experience

Programs for Humans...

http://www.youtube.com/watch?v=vlzwuFkn88U

Programs for Humans...

```
while music is playing:
    Left hand out and up
    Right hand out and up
    Flip Left hand
    Flip Right hand
    Left hand to right shoulder
    Right hand to left shoulder
    Left hand to back of head
    Right hand to back of head
    Left hand to right hip
    Right hand to left hip
    Left hand on left bottom
    Right hand on right bottom
    Wiggle
    Wiggle
    Jump
```

http://www.youtube.com/watch?v=vlzwuFkn88U

the clown ran after the car and the car ran into the tent and the tent fell down on the clown and the car

Programs for Python...

Programs for Python...

```
name = input('Enter file:')
handle = open(name, 'r')
text = handle.read()
words = text.split()

counts = dict()
for word in words:
   counts[word] = counts.get(word,0) + 1
bigcount = None
bigword = None

for word,count in counts.items():
    if bigcount is None or count >
bigcount:
        bigword = word
        bigcount = count
print (bigword + "\t" + str(bigcount))
```

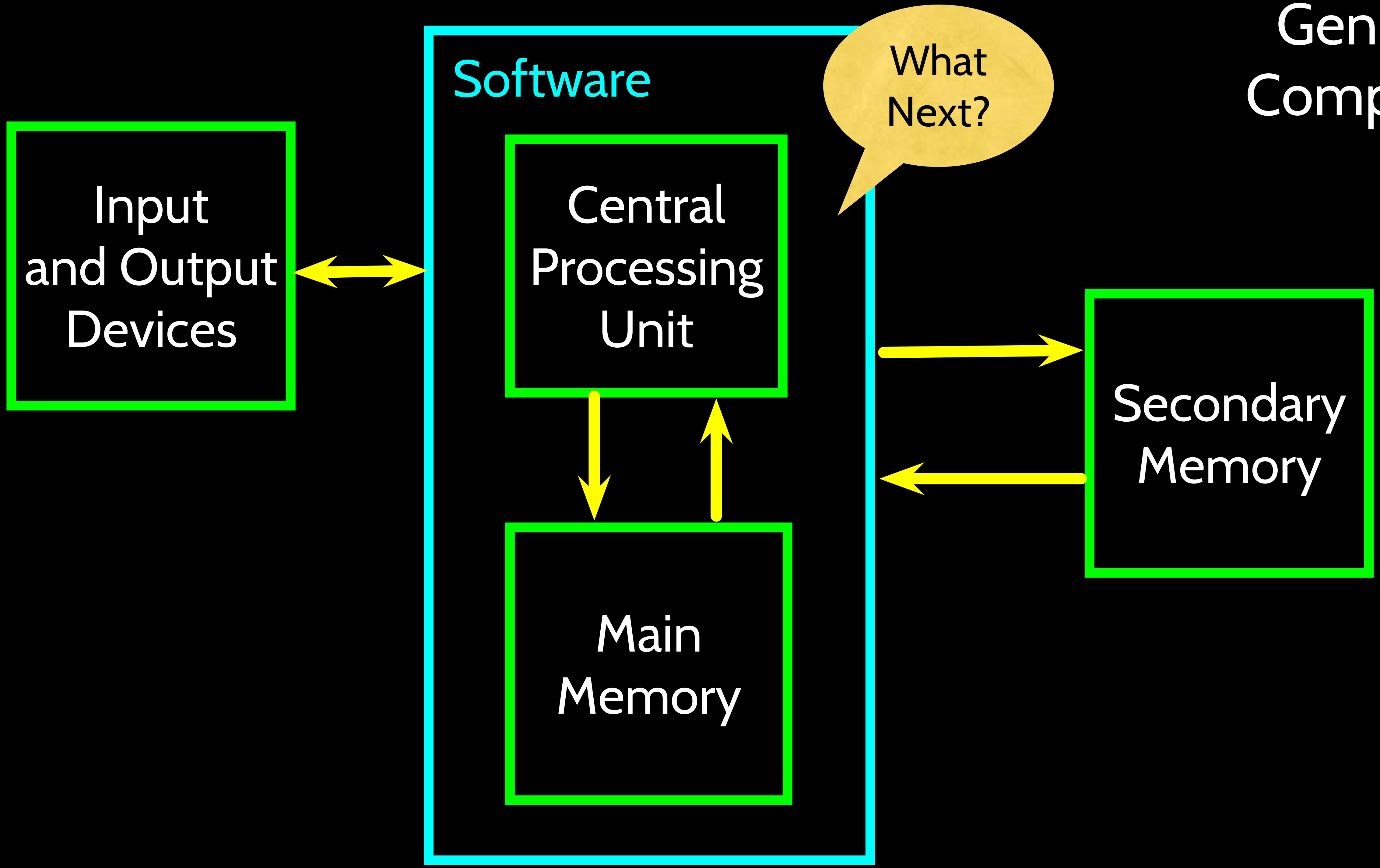
```
python words.py
Enter file: words.txt
to 16
```

```
python words.py
Enter file: clown.txt
the 7
```

Hardware Architecture

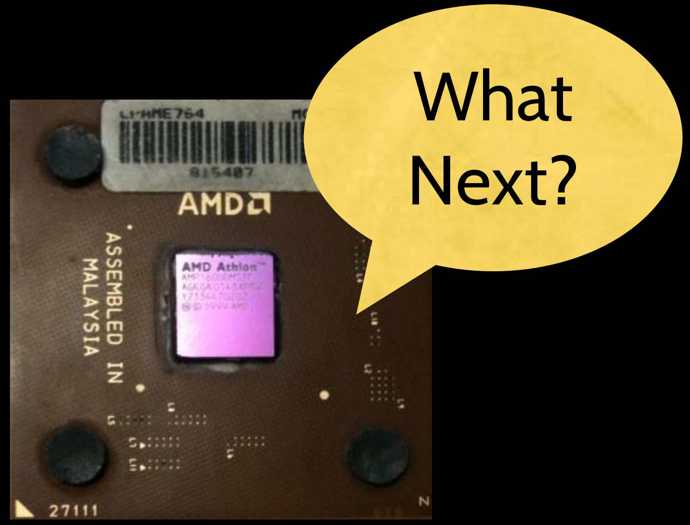
http://upload.wikimedia.org/wikipedia/commons/3/3d/RaspberryPi.jpg

Generic Computer



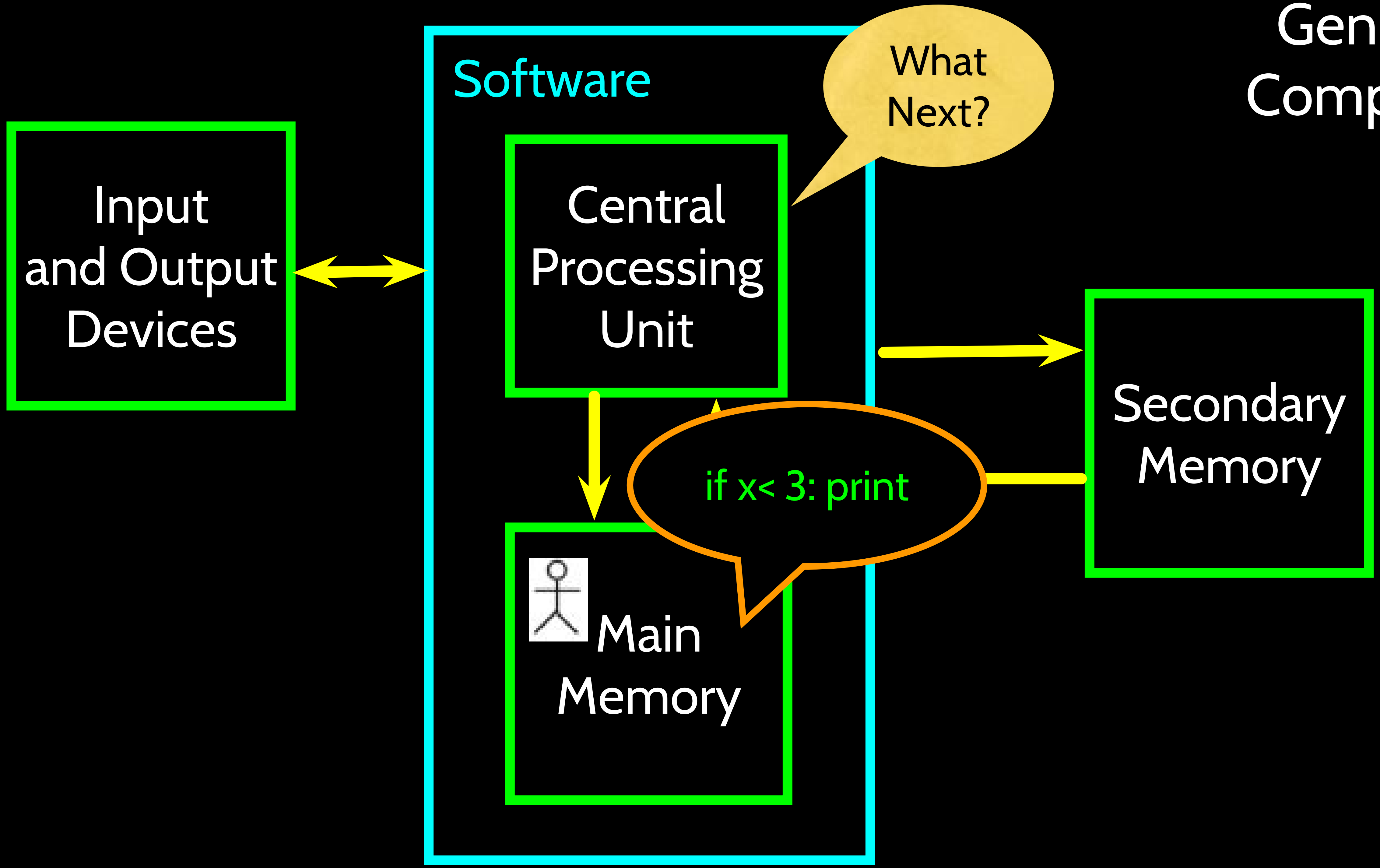
Definitions

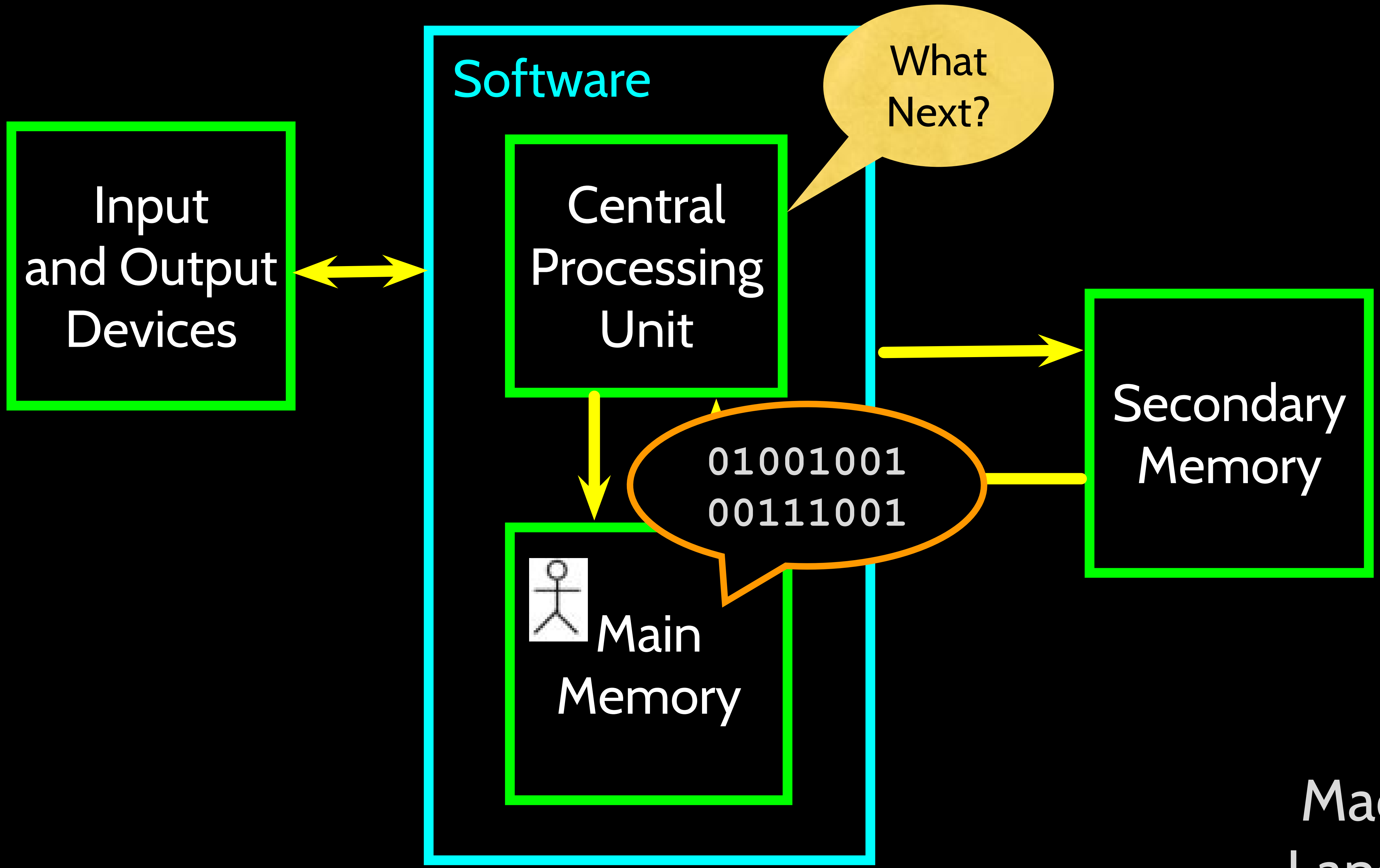
- Central Processing Unit: Runs the Program - The CPU is always wondering "what to do next"? Not the brains exactly - very dumb but very very fast



- Input Devices: Keyboard, Mouse, Touch Screen
- Output Devices: Screen, Speakers, Printer, DVD Burner
- Main Memory: Fast small temporary storage - lost on reboot - aka RAM
- Secondary Memory: Slower large permanent storage - lasts until deleted - disk drive / memory stick

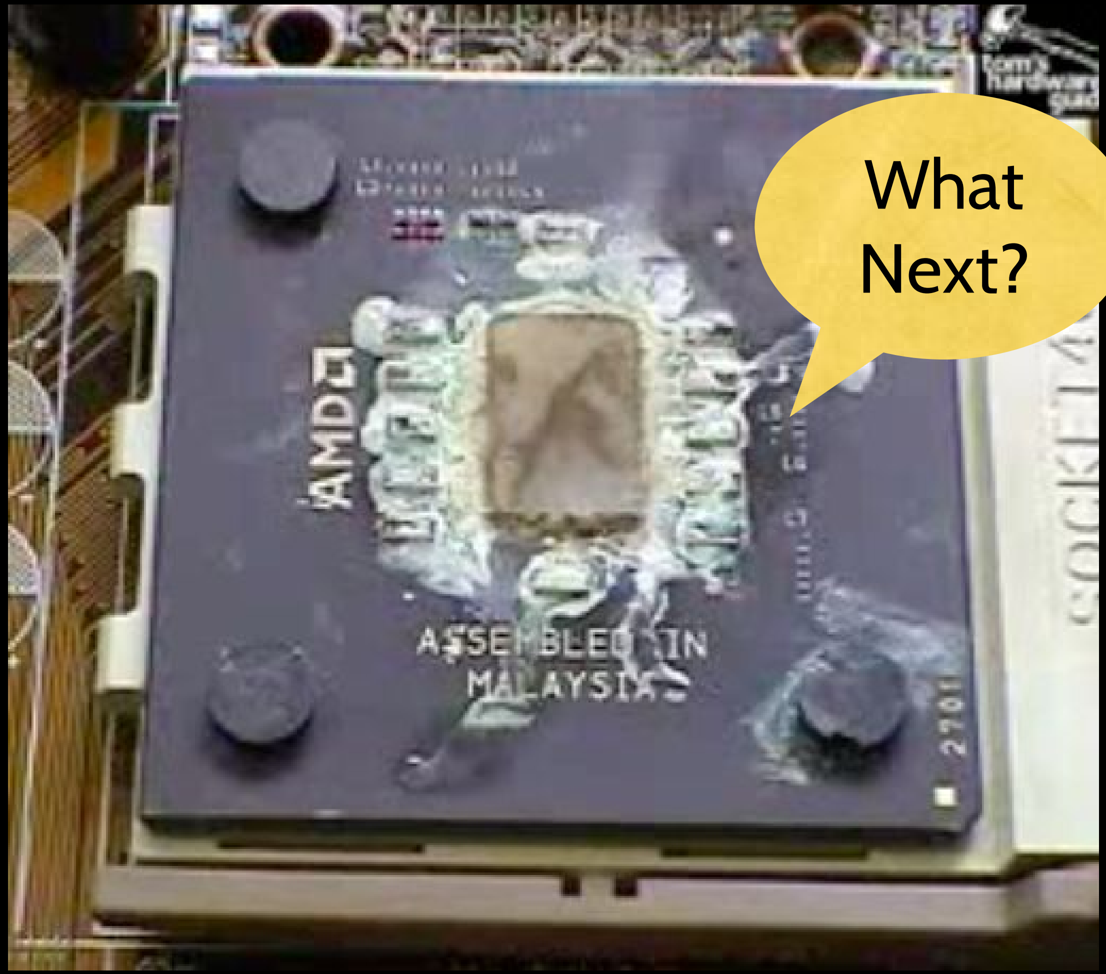
Generic Computer





Machine Language

Totally Hot CPU



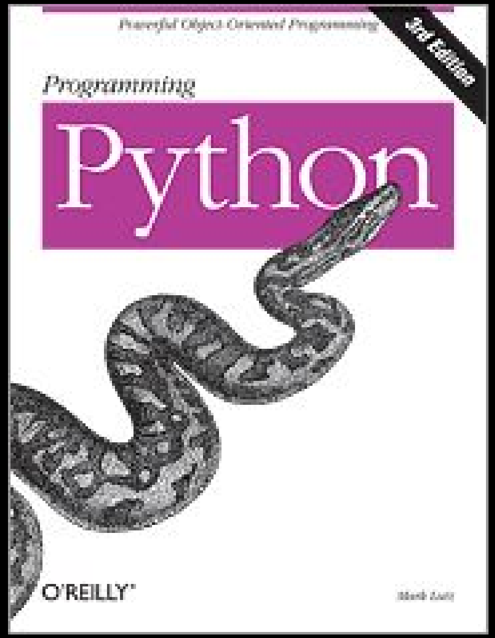
http://www.youtube.com/watch?v=y39D4529FM4

Hard Disk in Action

http://www.youtube.com/watch?v=9eMWG3fwiEU

Python as a Language

Python is the language of the Python Interpreter and those who can converse with it. An individual who can speak Python is known as a Pythonista. It is a very uncommon skill, and may be hereditary. Nearly all known Pythonistas use software initially developed by Guido van Rossum.



Early Learner: Syntax Errors

- We need to learn the Python language so we can communicate our instructions to Python. In the beginning we will make lots of mistakes and speak gibberish like small children.

- When you make a mistake, the computer does not think you are "cute". It says "syntax error" - given that it *knows* the language and you are just learning it. It seems like Python is cruel and unfeeling.

- You must remember that *you* are intelligent and *can* learn. The computer is simple and very fast, but cannot learn. So it is easier for you to learn Python than for the computer to learn English...

General Questions

Why Do People Use Python?

Why Do People Use Python?

1. Software quality
Readability => Reusable, Maintainable
Object-oriented (OO)
Functional

2. Developer productivity
Dynamic Types
Code Size: 1/3 to 1/5 of C++ or Java code.
Short Code => Less to type, debug, maintain

Why Do People Use Python?

3. Program portability

Same program runs on windows, linux and mac

4. Support libraries

Standard library

text pattern matching to network scripting

Third-party

+ Website construction
+ Numeric programming
+ Serial port access
+ Game development
+ (e.g.) NumPy is better than Matlab

Why Do People Use Python?

Component Integration

- Can invoke C and C++ libraries
- Can be called from C and C++
- Can integrate with Java and .NET, COM and Silverlight,
- Can interface with devices over serial ports
- Interact over networks with interfaces like SOAP, XML-RPC, and CORBA.

Enjoyment

- Act of programming more pleasure than chore

Is it scripting Language?

Is it scripting Language?

Yes, general-purpose programming language that blends procedural, functional, and object-oriented paradigms

What is downside?

- **Execution speed - lower than C/C++**
  - Source Code => byte code => execution
  - You can use PyPy to compile & speed up by 10x-100x
  - You can also link the compiled extension for Numeric

Who is using Python?

Google

Tube

Dropbox

NETFLIX

intel inside

INDUSTRIAL
LIGHT & MAGIC
A LUCASFILM COMPANY

CISCO

Who is using Python?

- **Success stories:** http://www.python.org/about/success
- **Application domains:** http://www.python.org/about/apps
- **User quotes:** http://www.python.org/about/quotes
- **Wikipedia page:** http://en.wikipedia.org/wiki/List_of_Python_software

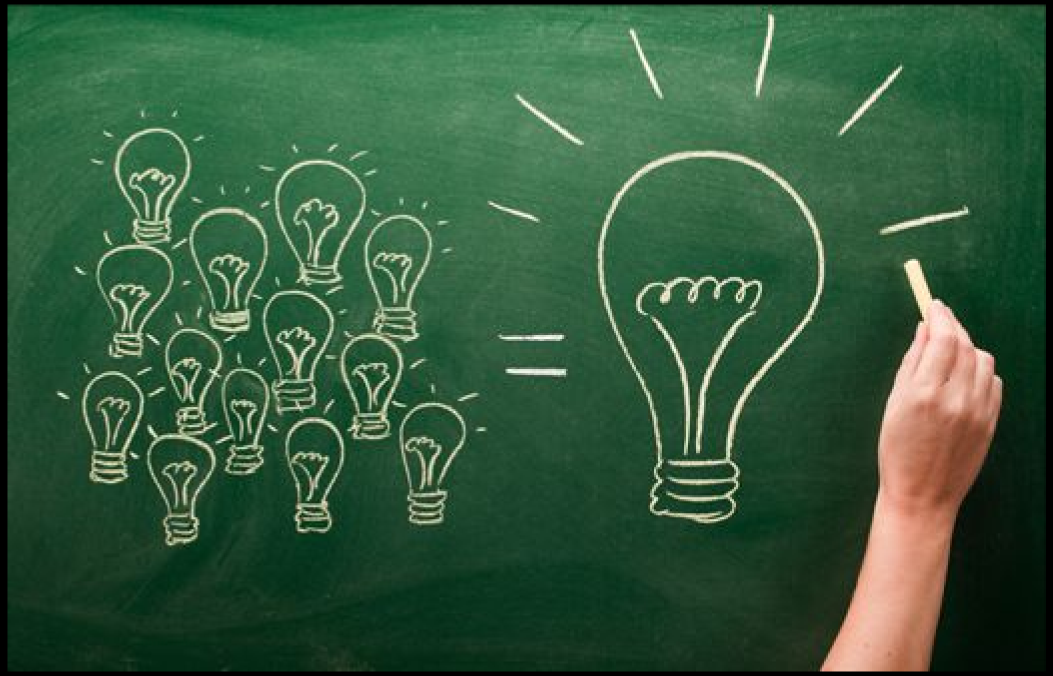
What Can I Do with Python?

What Can I Do with Python?

- Systems Programming
- GUIs
- Internet Scripting
- Component Integration
- Database Programming
- Rapid Prototyping
- Numeric and Scientific Programming
- And More: Gaming, Images, Data Mining, Robots, Excel...

Why python not R for ML?

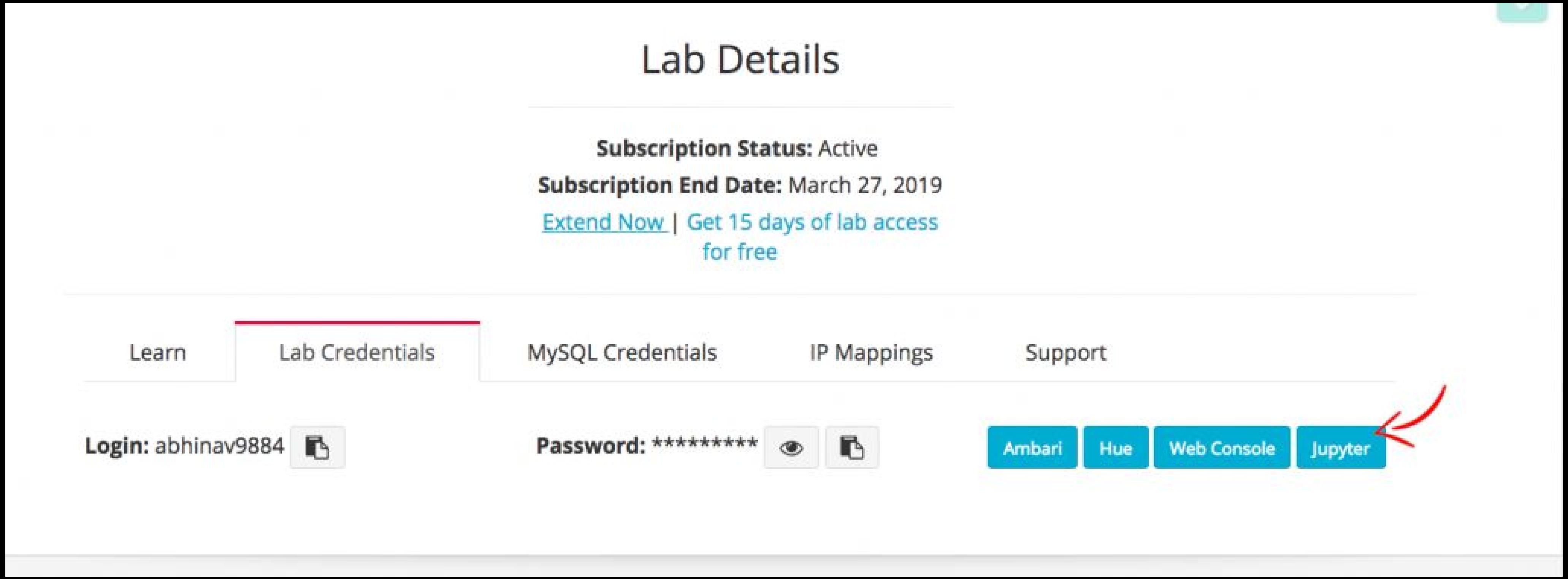
1. Python is general purpose (web, devops, automation)
2. Python is easier
3. Python is preferred choice of deep learning



- Python Software Foundation
- PyCon
- Python Enhancement Proposal

Talking to Python - Using Jupyter (On CloudxLab)

Step 1 - Launch Jupyter

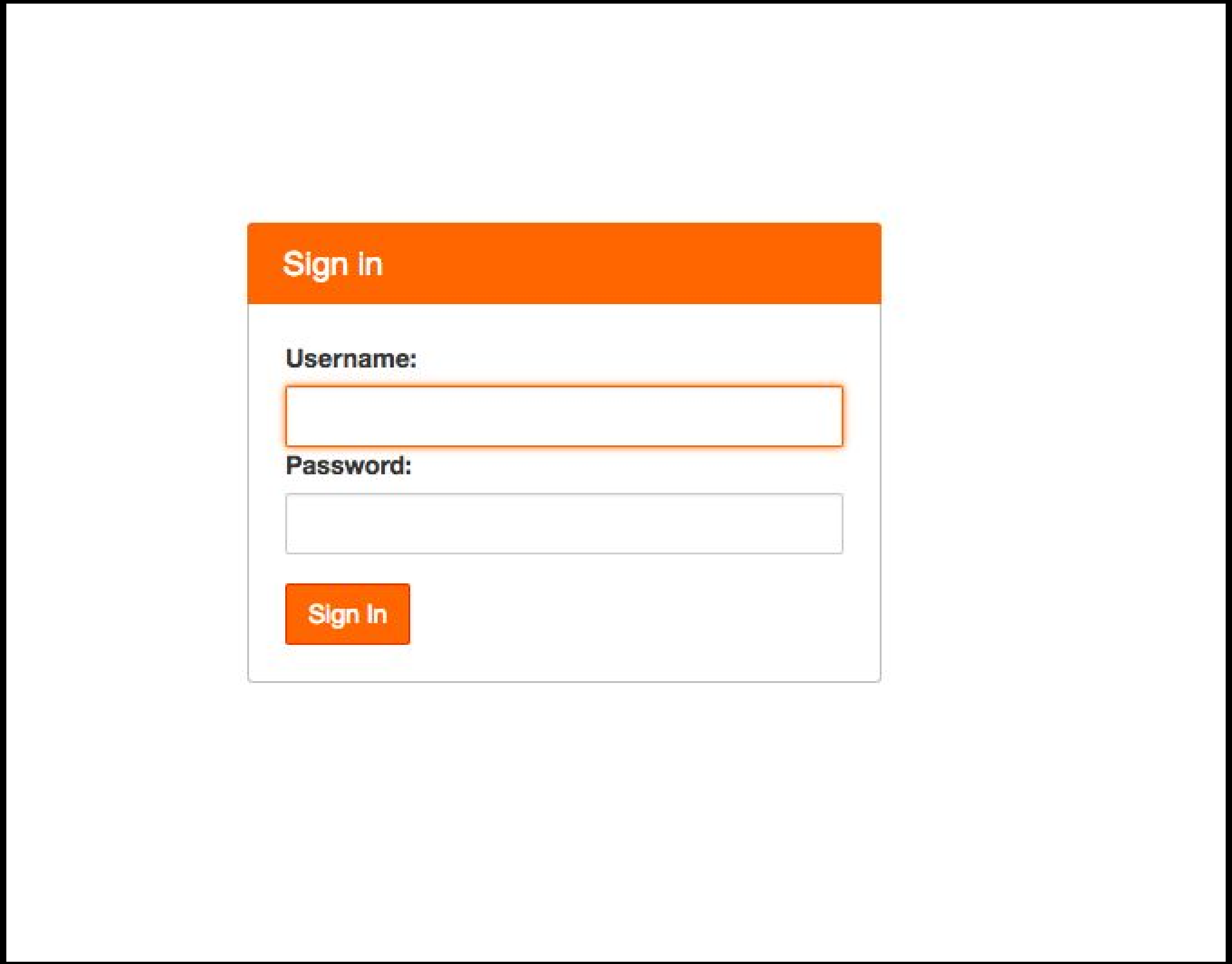

Lab Details

Subscription Status: Active
Subscription End Date: March 27, 2019
Extend Now | Get 15 days of lab access for free

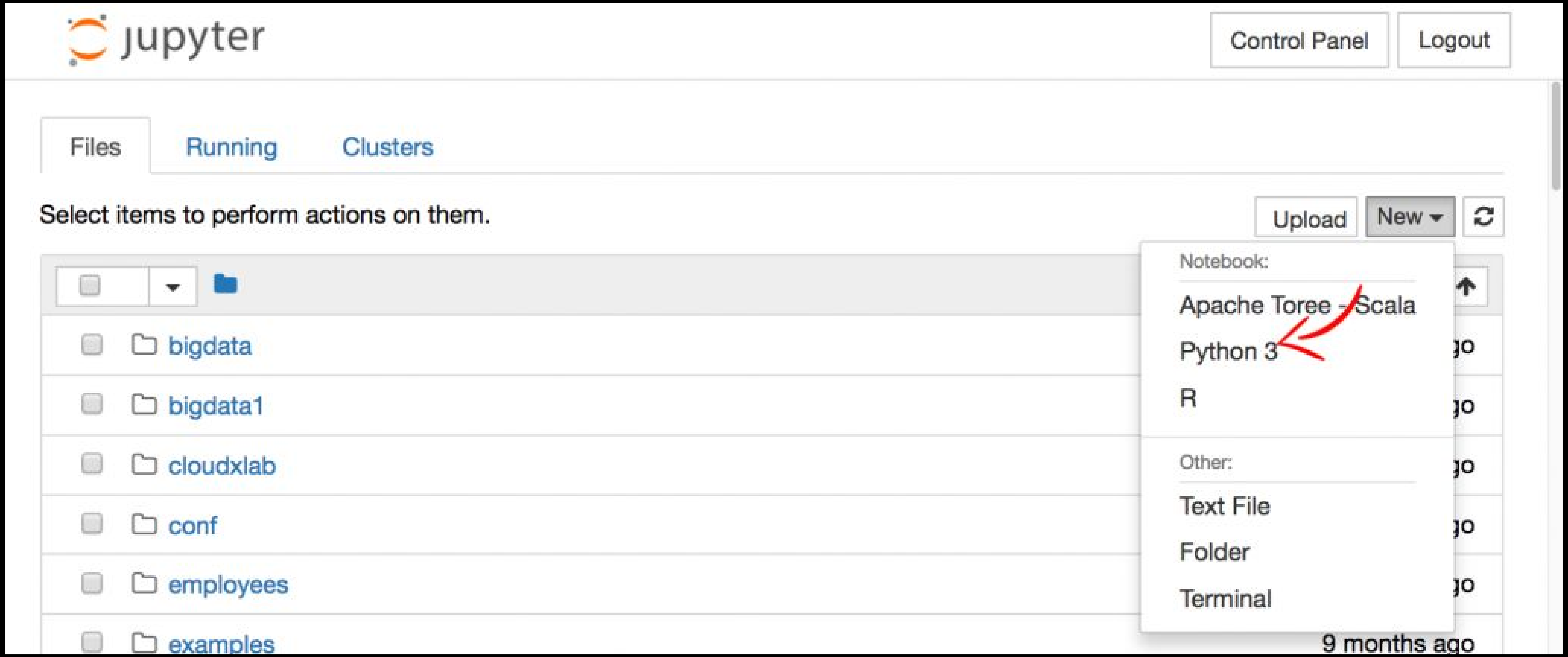
Login: abhinav9884

Password: *********

Step 2 - Login with Your Lab Username & Password



Step 3 - Open Python 3 Notebook



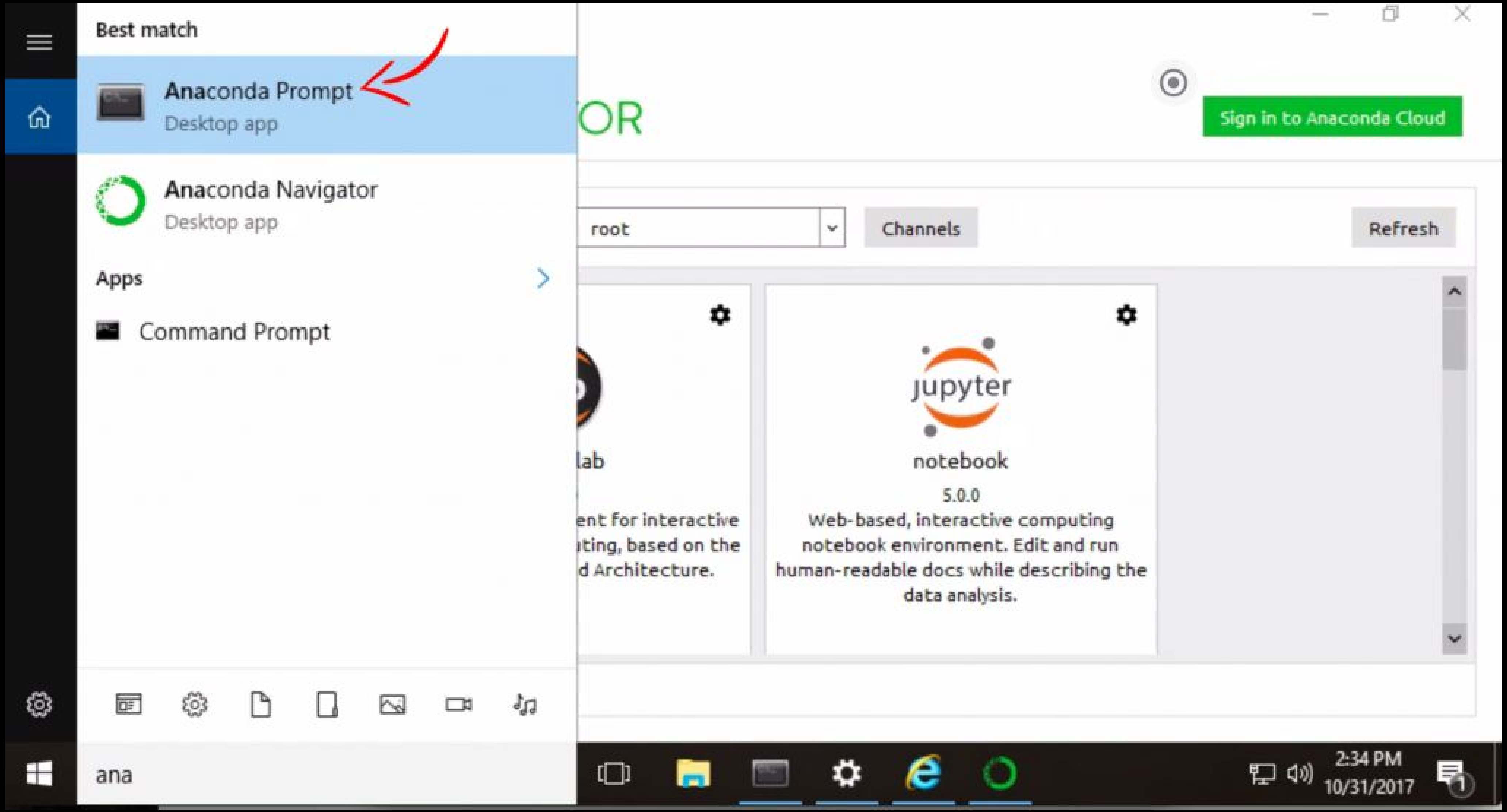
Talking to Python - Using Command line (On CloudxLab)

```
abhinav$ source activate py36
abhinav$ python3
Python 3.6.3 |Anaconda, Inc.| (default, Oct 13 2017, 12:02:49)
[GCC 7.2.0] on linux
Type "help", "copyright", "credits" or "license" for more
information.
>>> x = 1
>>> print x
1
>>> x = x + 1
>>> print x
2
>>> exit()
```

This is a good test to make sure that you have Python correctly installed. Note that quit() also works to end the interactive session.

Talking to Python - Using Command line (On Windows)

Launch Anaconda Prompt



ent for interactive
ıting, based on the
d Architecture.

Web-based, interactive computing notebook environment. Edit and run human-readable docs while describing the data analysis.

Type “python”

```
abhinav$ python
Python 3.6.3 |Anaconda, Inc.| (default, Oct 13 2017, 12:02:49)
[GCC 7.2.0] on linux
Type "help", "copyright", "credits" or "license" for more
information.
```

What Do We Say?

Elements of Python

- Vocabulary / Words - Variables and Reserved words (Chapter 2)
- Sentence structure - valid syntax patterns (Chapters 3-5)
- Story structure - constructing a program for a purpose

```
name = input('Enter file:')
handle = open(name, 'r')
text = handle.read()
words = text.split()

counts = dict()
for word in words:
    counts[word] = counts.get(word,0) + 1
bigcount = None
bigword = None

for word,count in counts.items():
    if bigcount is None or count >
bigcount:
        bigword = word
        bigcount = count
print(bigword, bigcount)
```

A short "story" about how to count words in a file in Python

```
python words.py
Enter file: words.txt
to 16
```

Reserved Words

- You cannot use reserved words as variable names / identifiers

and del for is raise assert elif from
lambda return break else global
not try class except if or while
continue exec import pass yield
def finally in print as with

Sentences or Lines

```
x = 2
x = x + 2
print(x)
```

← Assignment statement

← Assignment with expression

← Print statement

Variable　Operator　Constant　Reserved Word

Programming Paragraphs

Python Scripts

- Interactive Python is good for experiments and programs of 3-4 lines long.
- Most programs are much longer, so we type them into a file and tell Python to run the commands in the file.
- In a sense, we are "giving Python a script".
- As a convention, we add ".py" as the suffix on the end of these files to indicate they contain Python.

Writing a Simple Program

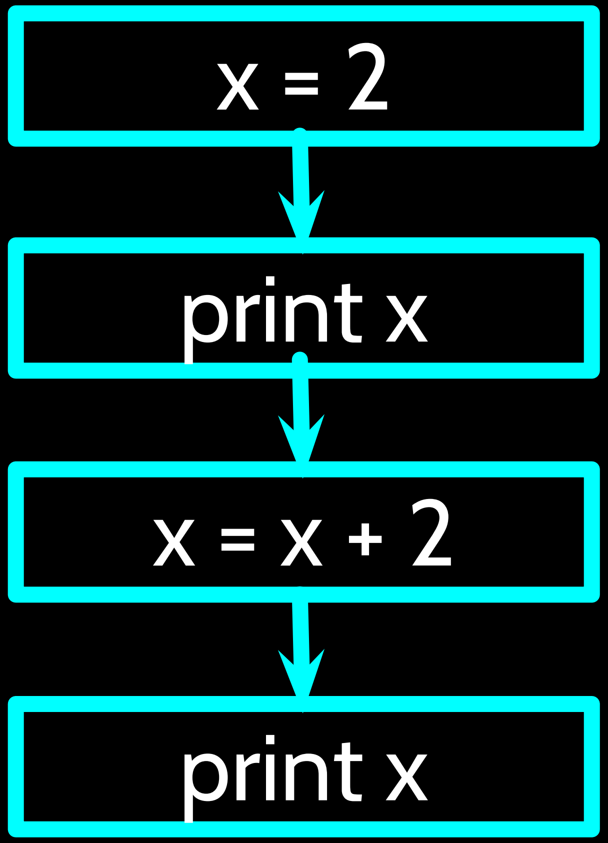
Interactive versus Script

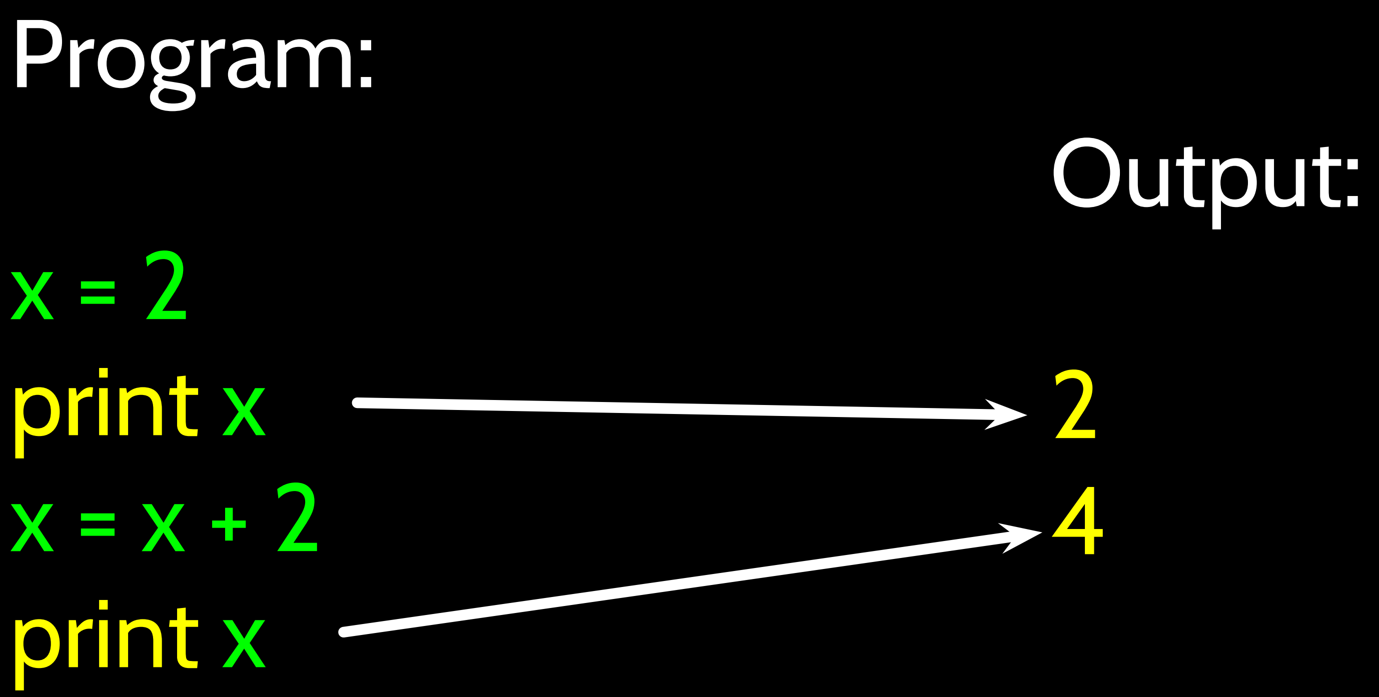
- Interactive
  - > You type directly to Python one line at a time and it responds
- Script
  - > You enter a sequence of statements (lines) into a file using a text editor and tell Python to execute the statements in the file

Program Steps or Program Flow

- Like a recipe or installation instructions, a program is a sequence of steps to be done in order.
- Some steps are conditional - they may be skipped.
- Sometimes a step or group of steps are to be repeated.
- Sometimes we store a set of steps to be used over and over as needed several places throughout the program (Chapter 4).

Sequential Steps



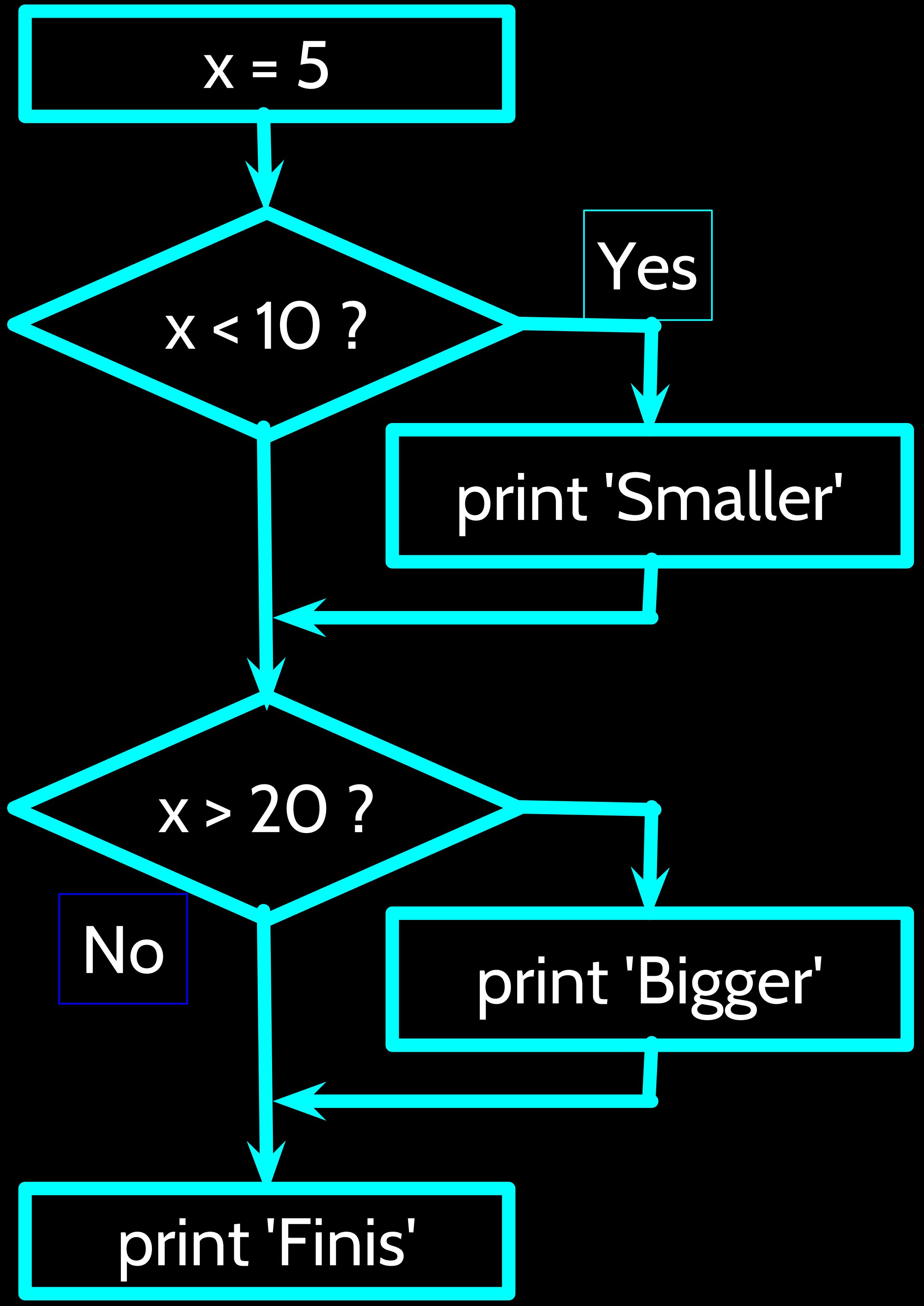


```
x = 2
print x
x = x + 2
print x
```

```
2
4
```

When a program is running, it flows from one step to the next. As programmers, we set up "paths" for the program to follow.

Conditional Steps



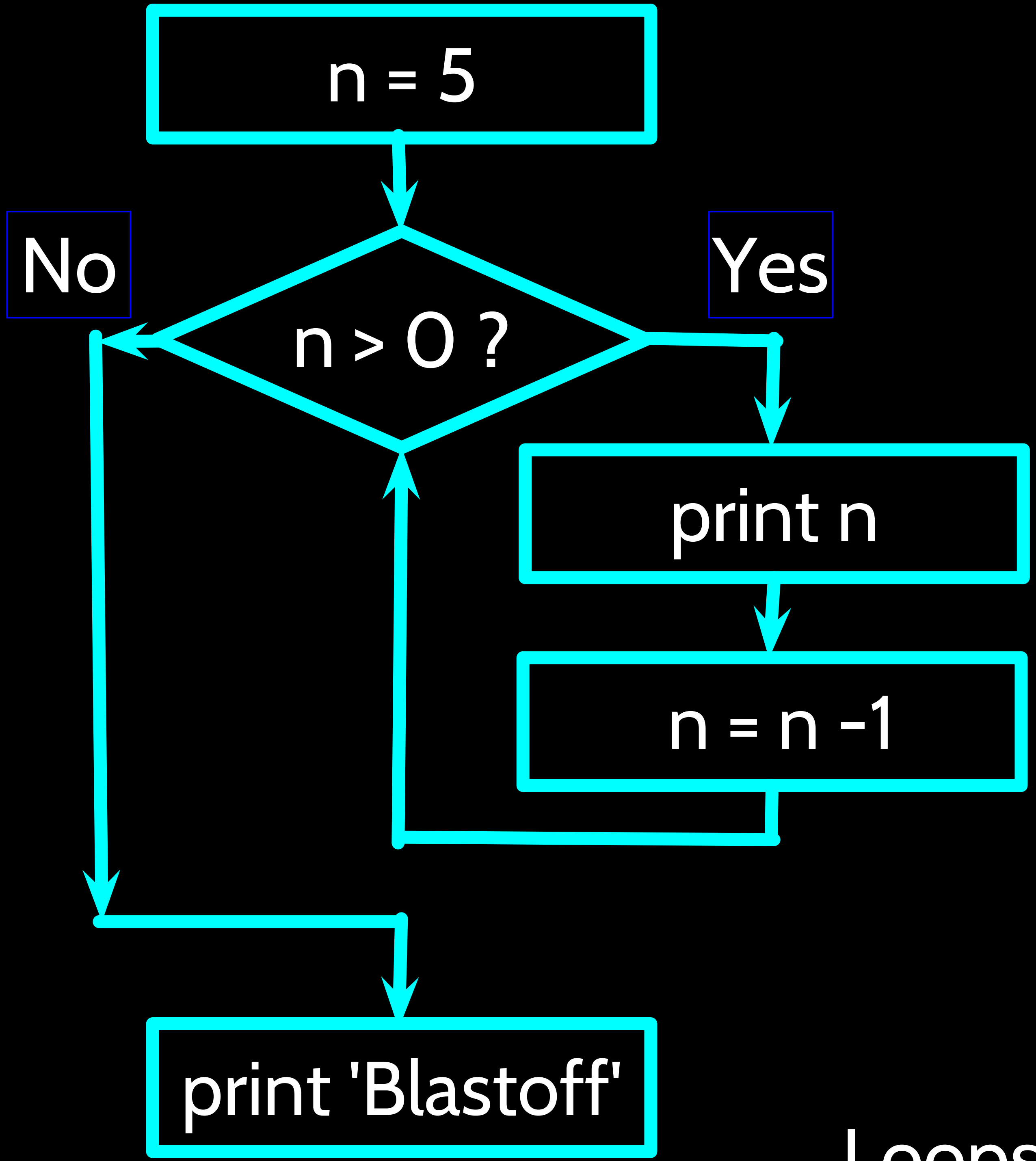
Program:

```
x = 5
if x < 10:
    print('Smaller’)
if x > 20:
     print('Bigger')

print('Finis')
```

Output:

```
Smaller
Finis
```



Repeated Steps

Program:

```
n = 5
while n > 0 :
    print n
    n = n – 1
print('Blastoff!')
```

Output:

```
5
4
3
2
1
Blastoff!
```

Loops (repeated steps) have iteration variables that change each time through a loop. Often these iteration variables go through a sequence of numbers.

```
name = input('Enter file:')
handle = open(name, 'r')
text = handle.read()
words = text.split()

counts = dict()
for word in words:
   counts[word] = counts.get(word,0) + 1
bigcount = None
bigword = None

for word,count in counts.items():
    if bigcount is None or count >
bigcount:
        bigword = word
        bigcount = count

print (bigword, bigcount)
```

Sequential

Repeated

Conditional

```
name = input('Enter file:')
handle = open(name, 'r')
text = handle.read()
words = text.split()
counts = dict()
for word in words:
   counts[word] = counts.get(word,0) + 1

bigcount = None
bigword = None
for word,count in counts.items():
    if bigcount is None or count > 
bigcount:
        bigword = word
        bigcount = count

print(bigword, bigcount)
```

A short Python "Story" about how to count words in a file

A word used to read data from a user

A sentence about updating one of the many counts

A paragraph about how to find the largest item in a list

Summary

- This is a quick overview of Chapter 1
- We will revisit these concepts throughout the course
- Focus on the big picture

Acknowledgements / Contributions