

Introduction to Python Syntax and Semantics

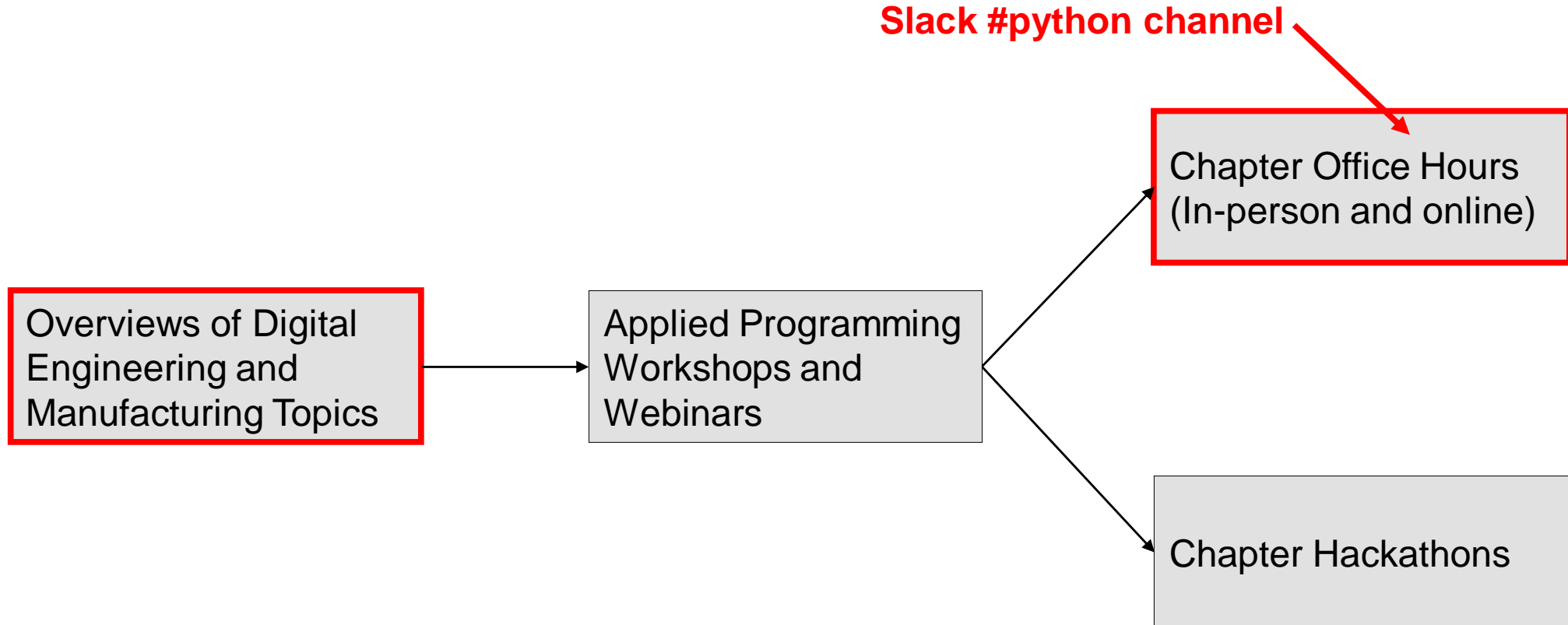
Adam J. Cook, Chair of SME Chapter 112

About the Presenter



- Adam Cook
- B.S. in Mechanical Engineering from Purdue University West Lafayette.
- Chief Technical Officer of Alliedstrand in Hammond, Indiana.
- Chair of SME Chapter 112 (Northwest Indiana and South Chicago).
- Embedded systems engineering, custom automation systems, industrial software.
- Lives in Chicago.
- Contact me at adam.j.cook@alliedstrand.com.

Chapter “Digital Initiative”



What is Python?



- High-level programming language.
- Free and open-source.
- Interpreted.
- Cross-platform.
- Extensive standard library.
- Automatic memory management.
- Designed to be highly readable, explicit and **productive**.
- Proven to be quite versatile (and popular).
- Reasonably fast for many applications.
- Already know MATLAB? You will be right at home (mostly)!

Be on the look out
for these
keywords!

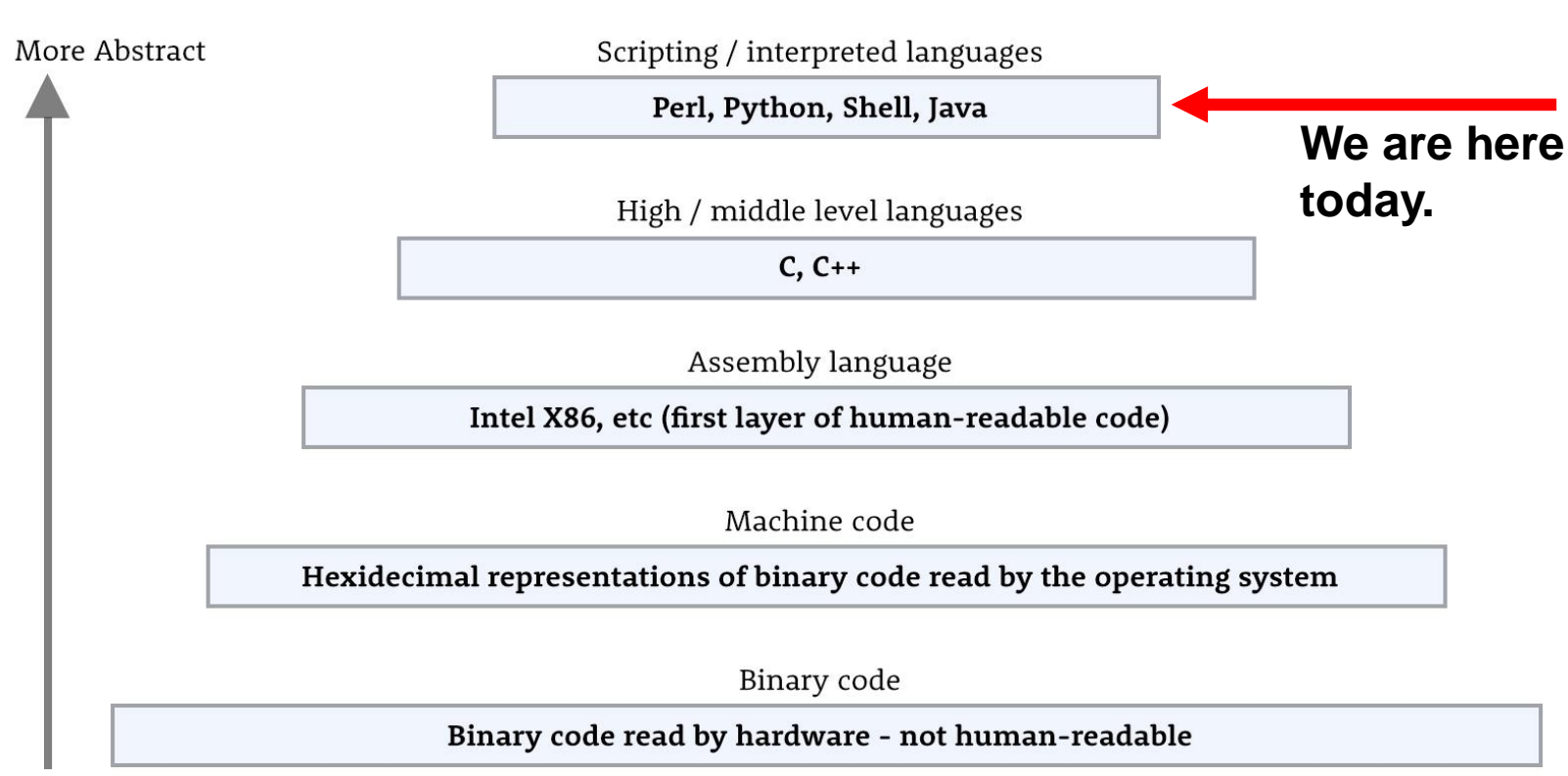


OPEN-SOURCE
DATA MODELING
DATA STRUCTURES
FUNCTIONAL
PROGRAMMING

Why is Python so approachable?

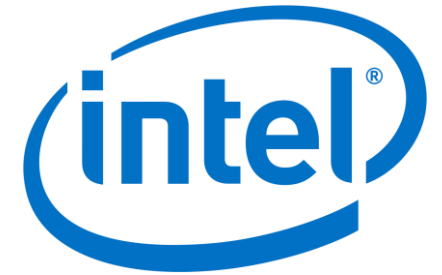
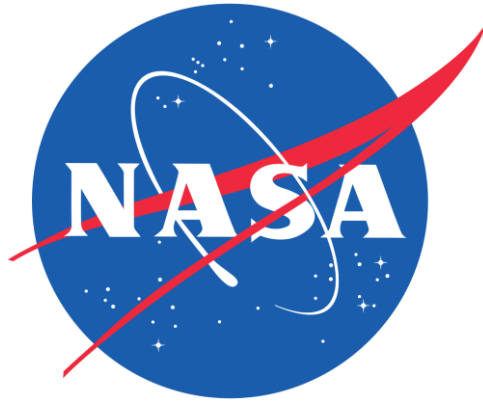


Levels of abstraction in computer programming languages



Source: <https://yellowpencil.com/blog/imagining-the-future-of-web-design/>

Who uses Python?



What kinds of problems does Python help solve?



- Data analytics.
- Machine learning and artificial intelligence.
- Robot path planning.
 - <http://shop.oreilly.com/product/0636920024736.do>
 - <https://www.packtpub.com/application-development/learning-robotics-using-python>
- Computational geometry and machine vision.
 - <https://www.youtube.com/watch?v=nb3GRgtjITw>
- Finite Elements and Computational Fluid Dynamics (CFD).
 - <http://lorenabarba.com/blog/cfd-python-12-steps-to-navier-stokes/>
- Prototyping work for embedded systems development.

DATA ANALYTICS

MACHINE LEARNING

DEEP LEARNING

**ARTIFICIAL
INTELLIGENCE**

MACHINE VISION

**EMBEDDED
SYSTEMS**

IIOT

ROBOTICS

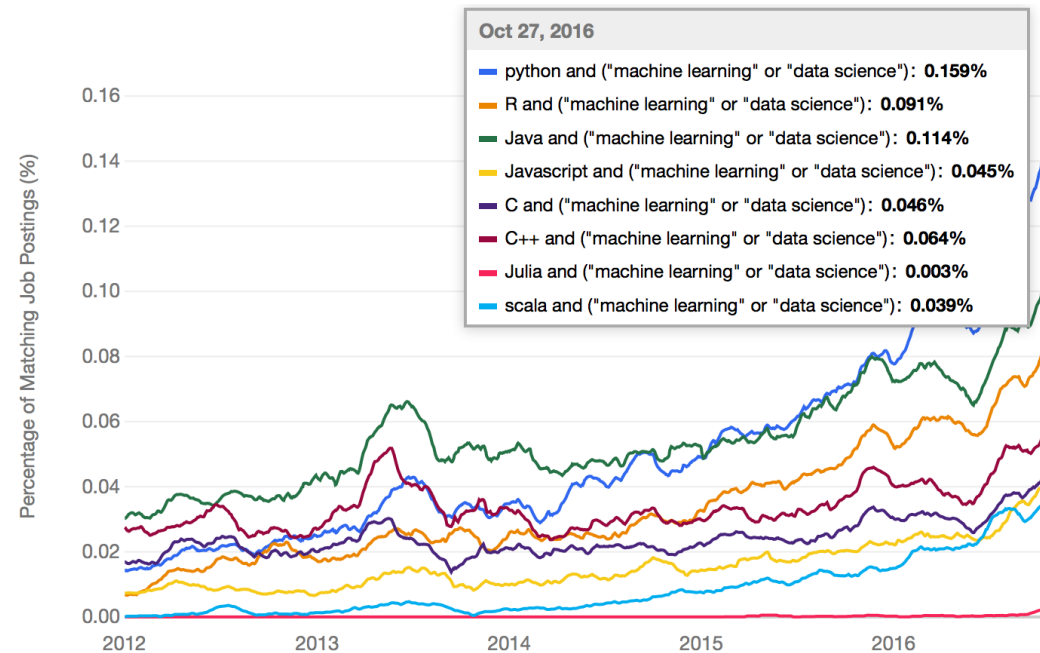
Why use Python in Manufacturing?



- Python is fast becoming one of the most popular languages in data analytics and machine learning. Coincidentally, manufacturing processes are producing more **valuable** data than ever!

Source:

https://www.ibm.com/developerworks/community/blogs/jfp/entry/What_Language_Is_Best_For_Machine_Learning_And_Data_Science?lang=en



Today's Agenda



- A brief look at some Python entry points (command line and [Jupyter](#)).
- A quick look at some Python use cases.

- This event assumes you have never programmed before. If you have keep in mind that we will be watering down a bunch.
- Programming is challenging – the following presentation will not make you into an expert. **Practice and read code.**
- **The Python interpreter is your friend.**
- For computer graphics, data analytics and machine learning applications, in particular, knowing Python is not enough.
- Today we will be going *fast*. This is the beginning of your journey. Do not try to memorize everything! **Instead, think about what kind of actual applications you want to build and let us know.** After a couple of projects, things will start clicking together.

How do you “use” Python and what does Python code look like?

CLOUD COMPUTING

MICROSOFT AZURE

**AUTODESK FUSION
360 API**

Application-Specific Suggestions



- Want to build web applications in Python? Check out [Django](#).
- Need a powerful environment for data and geometry visualizations? Check out the [Jupyter Project](#).
- Want to do numerical analysis or linear algebra? Check out [SciPy](#).
- Need to work with deep learning? See [Pytorch](#) and/or [Theano](#).
- Need to build a GUI application? See [Tkinter](#).
- Want to build a graphical simulator? Check out [Pygame](#).

**STATISTICAL
ANALYSIS**

LINEAR ALGEBRA

**SYMBOLIC
COMPUTING**

**NUMERICAL
ANALYSIS**

**COMPUTATIONAL
GEOMETRY**

**FINITE
ELEMENTS/PDE**

TENSORFLOW

CNTK

Books

- **Matthes, E. (2016).** *Python crash course: a hands-on, project-based introduction to programming.* San Francisco: No Starch Press.
- **Lee, K. D., & Hubbard, S. (2015).** *Data Structures and Algorithms with Python.* Cham: Springer International Publishing.
- **Percival, H. (2014).** *Test-driven development with Python.* O'Reilly.
- **Kiusalaas, J. (2010).** *Numerical methods in engineering with Python, Second Edition.* Cambridge University Press.
- **Solem, J. E. (2012).** *Programming Computer Vision with Python: Tools and Algorithms for Analyzing Images.*
- **Raschka, S. (2015).** *Python machine learning: unlock deeper insights into machine learning with this vital guide to cutting-edge predictive analytics.* Birmingham (U.K.): Packt Publishing.
- **VanderPlas, J. (2017).** *Python data science handbook: Essential tools for working with data.* Sebastopol, CA: O'Reilly.
- **Klein, P. N. (2013).** *Coding the matrix: linear algebra through applications to computer science.* Newton, MA: Newtonian Press.

Videos

- [Sarah Guido - Hands-on Data Analysis with Python - PyCon 2015](#)
- [Jake VanderPlas - Machine Learning with Scikit-Learn \(I\) - PyCon 2015](#)
- [Olivier Grisel - Machine Learning with Scikit-Learn \(II\) - PyCon 2015](#)
- [**Jessica McKellar: A hands-on introduction to Python for beginning programmers - PyCon 2014**](#)
- [Programming Foundations with Python on Udacity](#)
- [**Computational Geometry in Python – PyCon 2016**](#)

Websites

- [Stack Overflow](#)
- [Python 3 API Documentation](#)
- [The Zen of Python](#)
- [**Robot Operating System**](#)
- [**Open Source Computer Vision \(OpenCV\)**](#)
- [SciPy](#)
- [scikit-learn](#)
- [**Awesome Python on GitHub**](#)

Data Analytics with Anaconda (mostly)

Where can I get this slide deck and code?



<http://bit.ly/2uzCQqR>

(actually, go ahead and bookmark this link – this web page will be updated constantly with new content)

Thank you!



Thanks for attending!

Special thanks to our hosting partner – GreenCow Coworking. Check them out at greencow.space!

Suggestions? Feedback? Comments? Complaints? Contact us below!

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Chair of SME Chapter 112

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