Exploring and Using the Python Ecosystem

Adam J. Cook, Chair of SME Chapter 112

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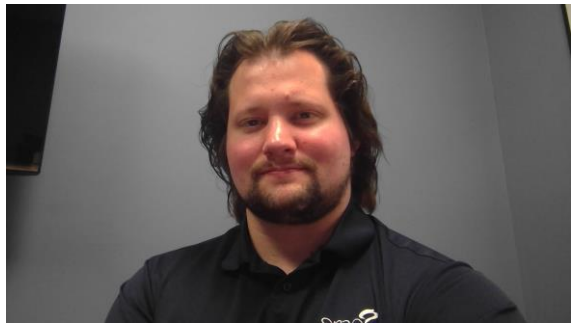
About the Presenter



- 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.

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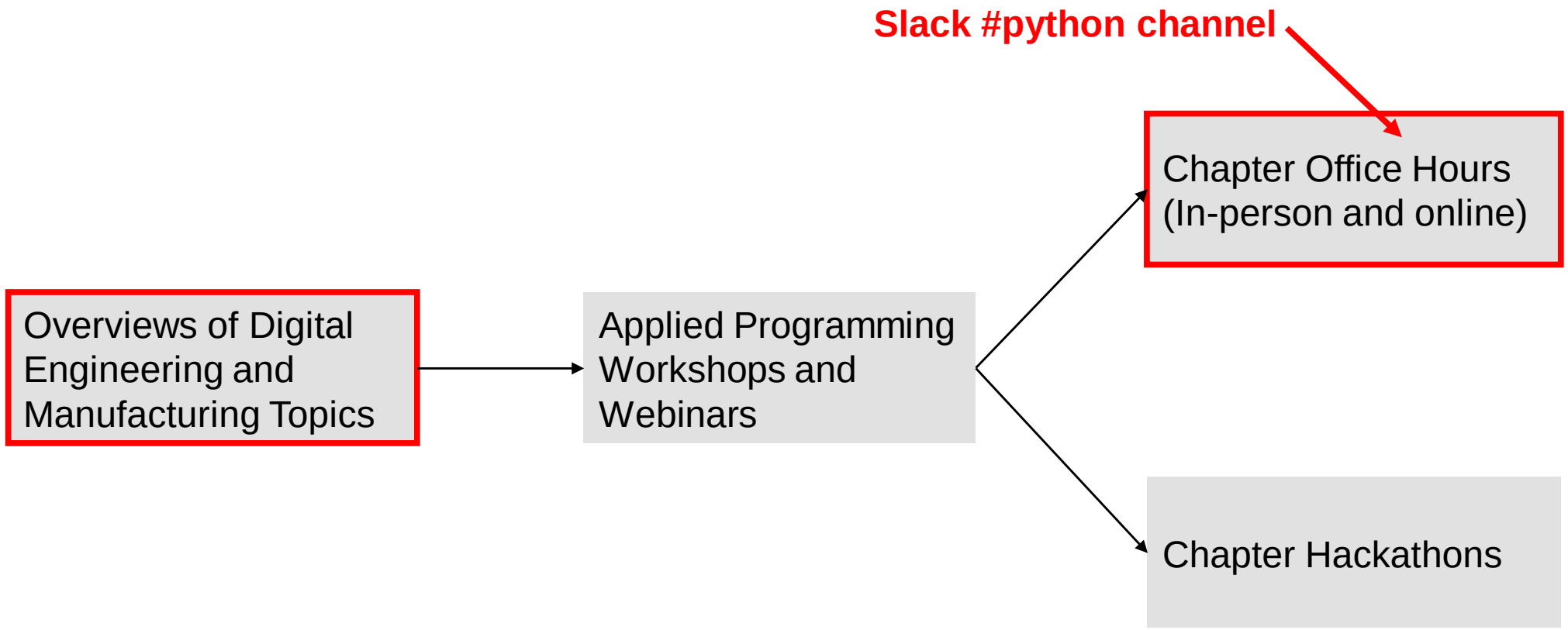
Chapter “Digital Initiative”

Slides and code:
http://bit.ly/2uzCQqR



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What is Python?

Slides and code:
http://bit.ly/2uzCQqR

- High-level programming language.
- Free and open-source.
- Cross-platform.
- **Extensive standard library.**
- Designed to be highly readable, explicit and **productive**.
- Proven to be quite versatile (and popular).

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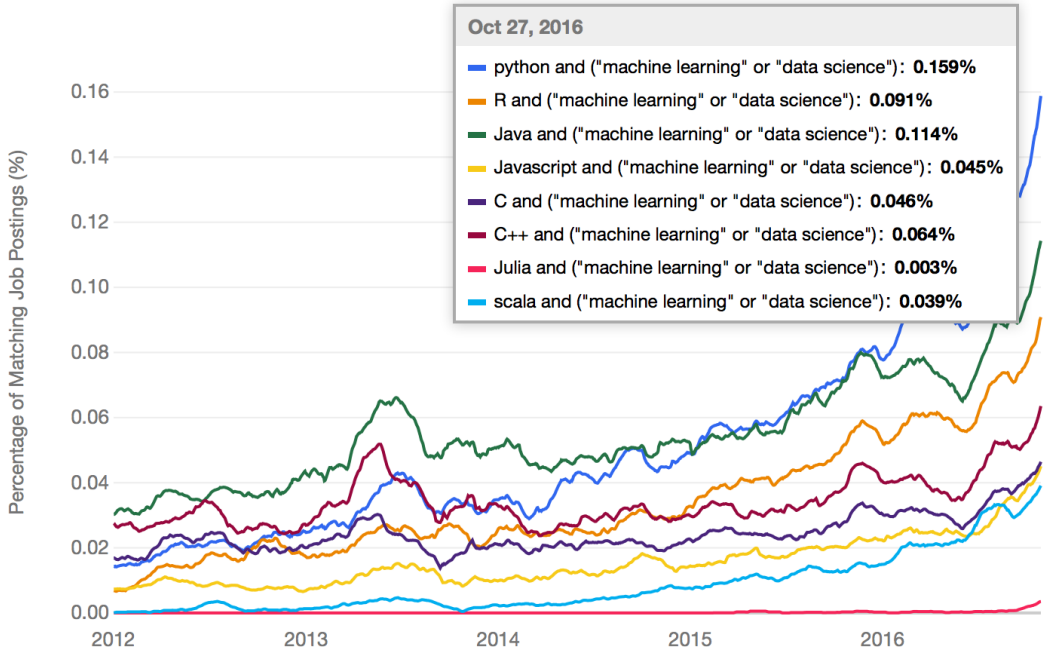
Why use Python in Manufacturing?

Slides and code:
http://bit.ly/2uzCQqR

- 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



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Today's Agenda

Slides and code:
http://bit.ly/2uzCQqR

- Look at PyPI (also called pip) and how it can help you.
- Brief overview of the Anaconda Python distribution and why you might want to use it (for data science, you should really just use it).
- **Super** high-level overview of data science/analytics. This is important. Data can be **tricky** and **deceptive**.
- Small recap of where we are in these Python webinars.

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Caveats and Warnings

Slides and code:
http://bit.ly/2uzCQqR

- This event assumes you are a novice. If you have keep in mind that we will be watering down a bunch.
- Programming and data analytics is challenging – the following presentation will not make you into an expert. **Practice and read code.**
- For data analytics and machine learning applications, in particular, knowing Python is **not enough**.
- We are starting to get **advanced** now. Application architecture patterns are difficult. Data problems are very deep and a very active area of research. The industry is **extremely** fluid. **Do not try to memorize everything!**
- We are going to talk today at a **high-level**. Let us know if you want to break down things into separate webinars.
- **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.

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Demonstration

Slides and code:
http://bit.ly/2uzCQqR

Let's take a look at pip!
(we will use the code from http://bit.ly/2w62Sk4)

```
> pip install <package name>
```

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Other Resources

Slides and code:
http://bit.ly/2uzCQqR

There is another great resource called [Awesome Python](#).

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Python vs. Anaconda

Slides and code:
http://bit.ly/2uzCQqR

Anaconda
(think of it as “Python Plus”)

Contains the following out-of-the-box:

- SciPy
- Jupyter
- Other Continuum tools

Python

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SciPy, NumPy, Matplotlib, Jupyter…and bears, oh my!

- SciPy – umbrella package containing NumPy, Matplotlib and SymPy.
  - NumPy – provides sophisticated N-dimensional array handling
  - Matplotlib – provides powerful 2D plotting functionality for data and result visualizations
  - SymPy – provides symbolic mathematics functionality (computer algebra system)
- Jupyter – interactive, web browser-based “notebook” which allows you to share Python code, run experiments and capture results.

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Demonstration

Slides and code:
http://bit.ly/2uzCQqR

Let’s take a look at Jupyter!
(we will use the code from http://bit.ly/2wlz56p)

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Word Soup

Slides and code:
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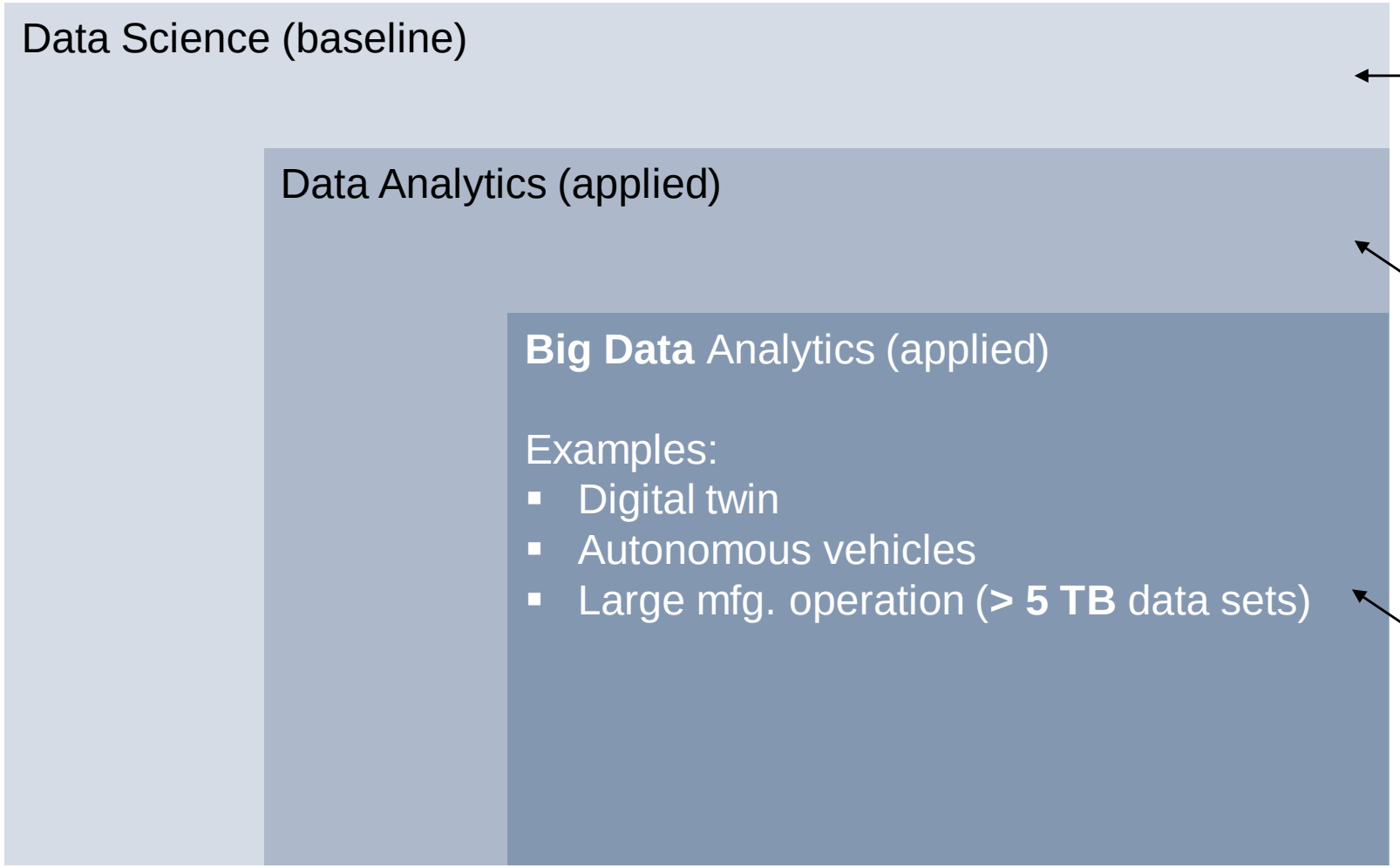

- Calculus
- Statistics
- SQL
- Unstructured data
- Machine learning

- Python
- PostgreSQL
- Algorithm design
- Data visualization
- Data wrangling

- Java/C#/C++/JavaScript
- Hadoop
- Computational parallelism (Python is **not** good here)
- MapReduce
- Distributed systems

Big Data is **hard** (really hard)! **Make sure you need it!**

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SQL

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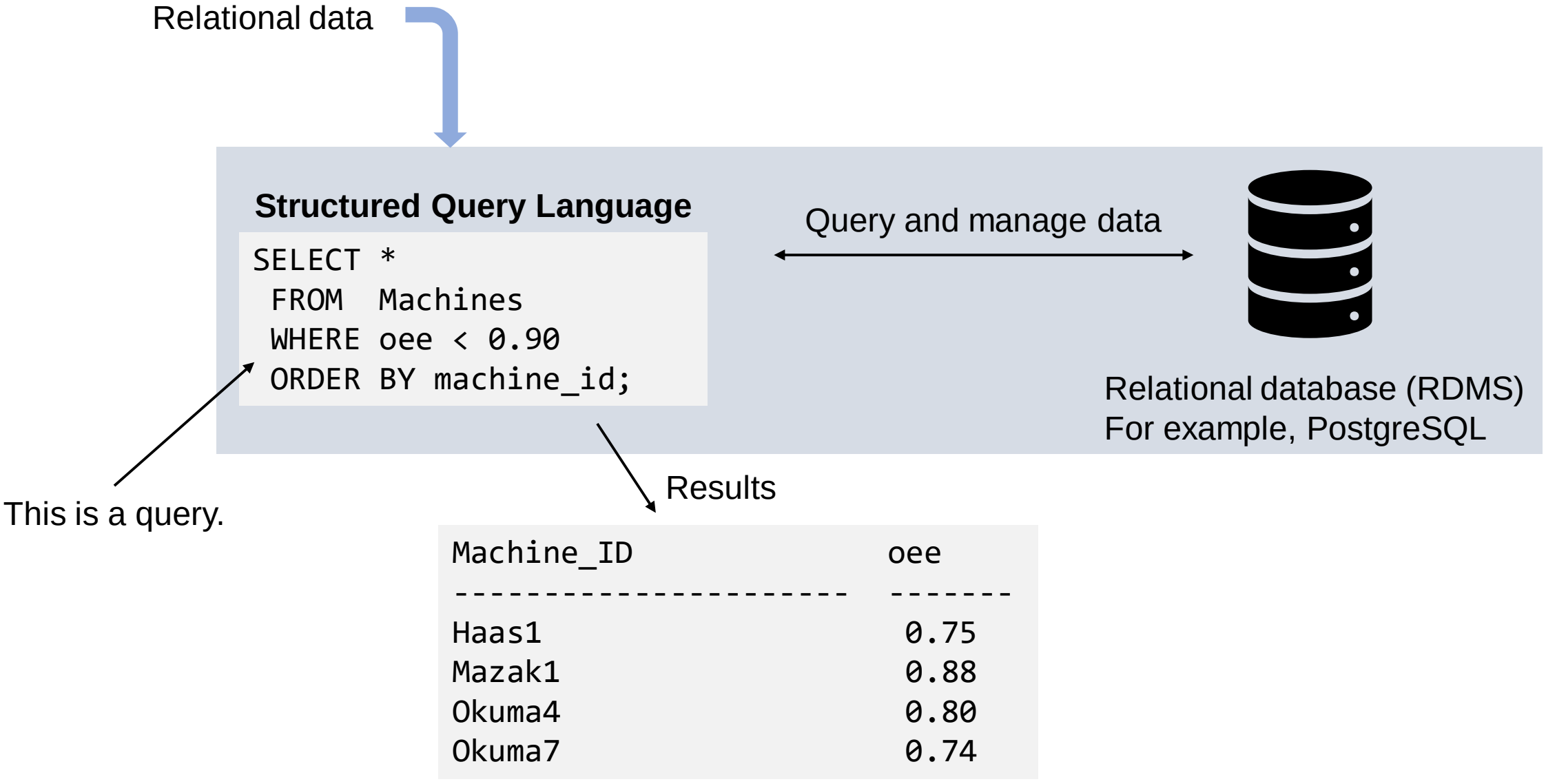

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Python “hiding” SQL

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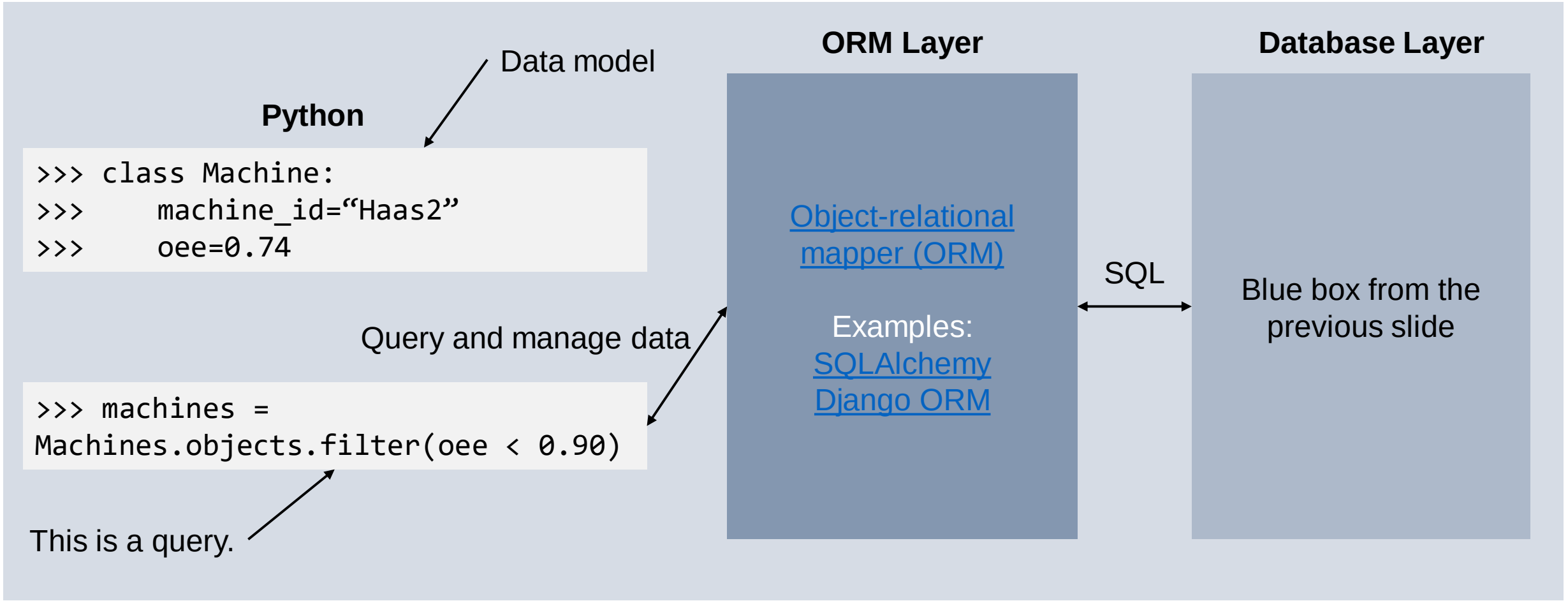

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Python “hiding” everything

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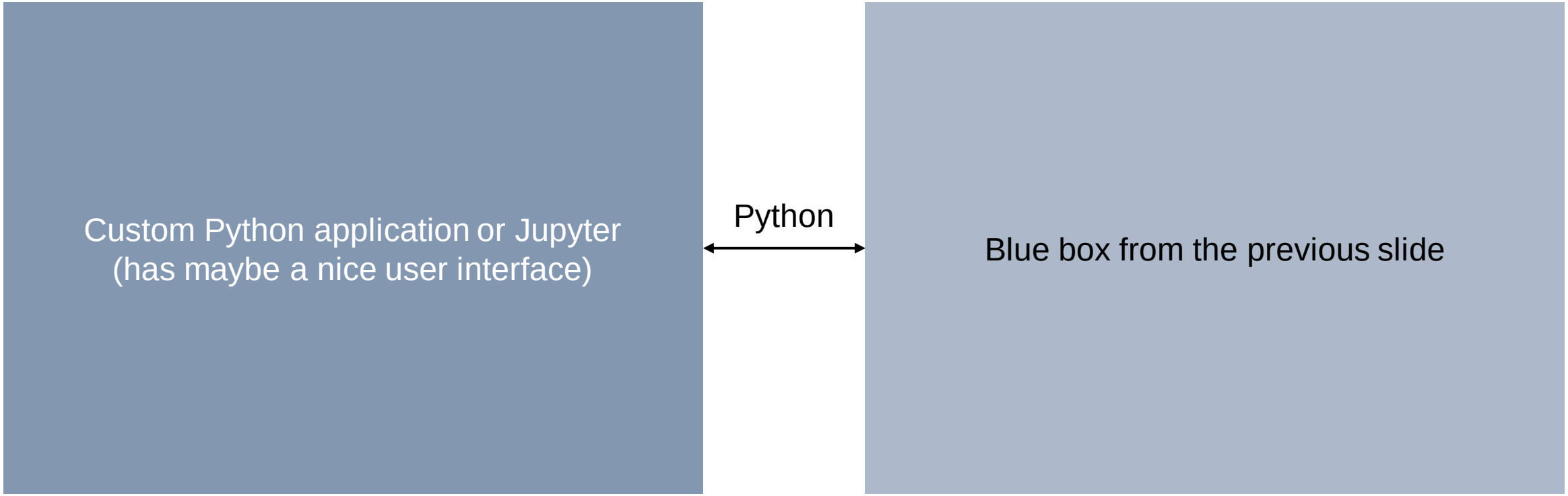

Key word: **Abstractions!**

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MapReduce

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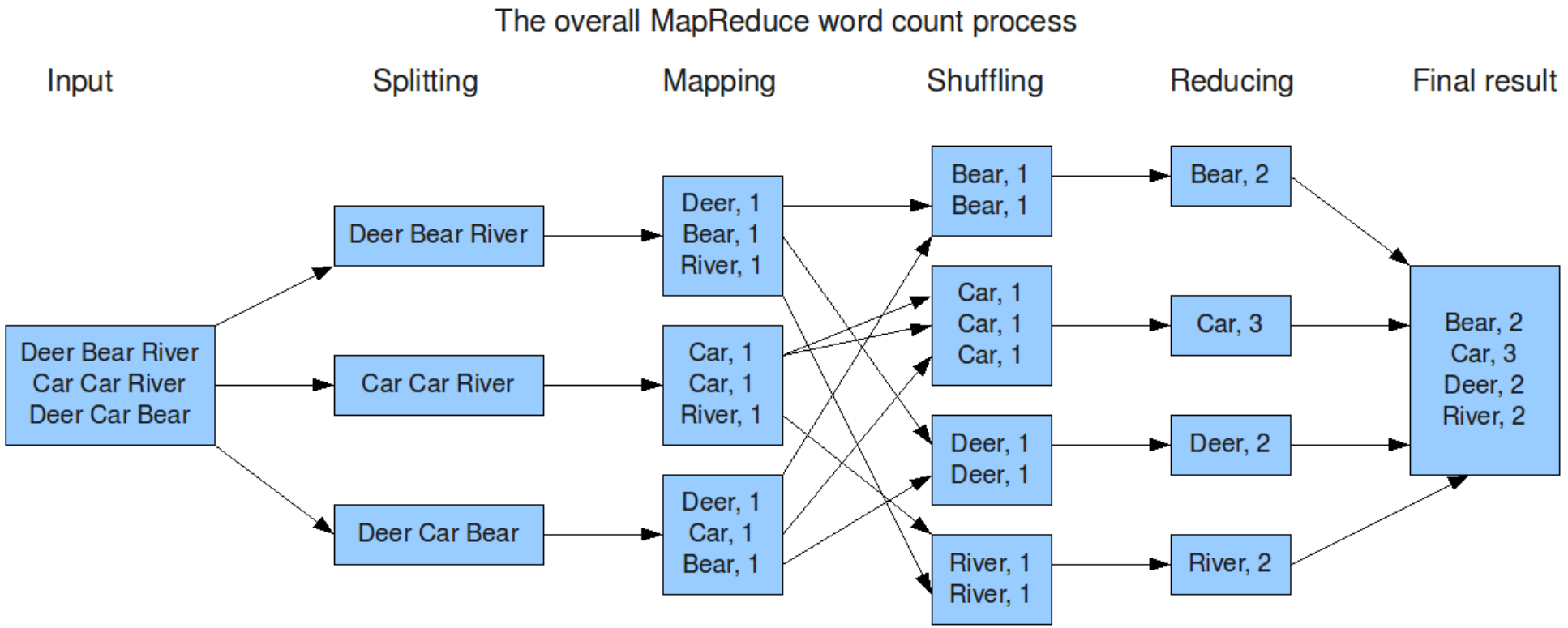

Source: http://datascienceguide.github.io/

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Hadoop

Slides and code:
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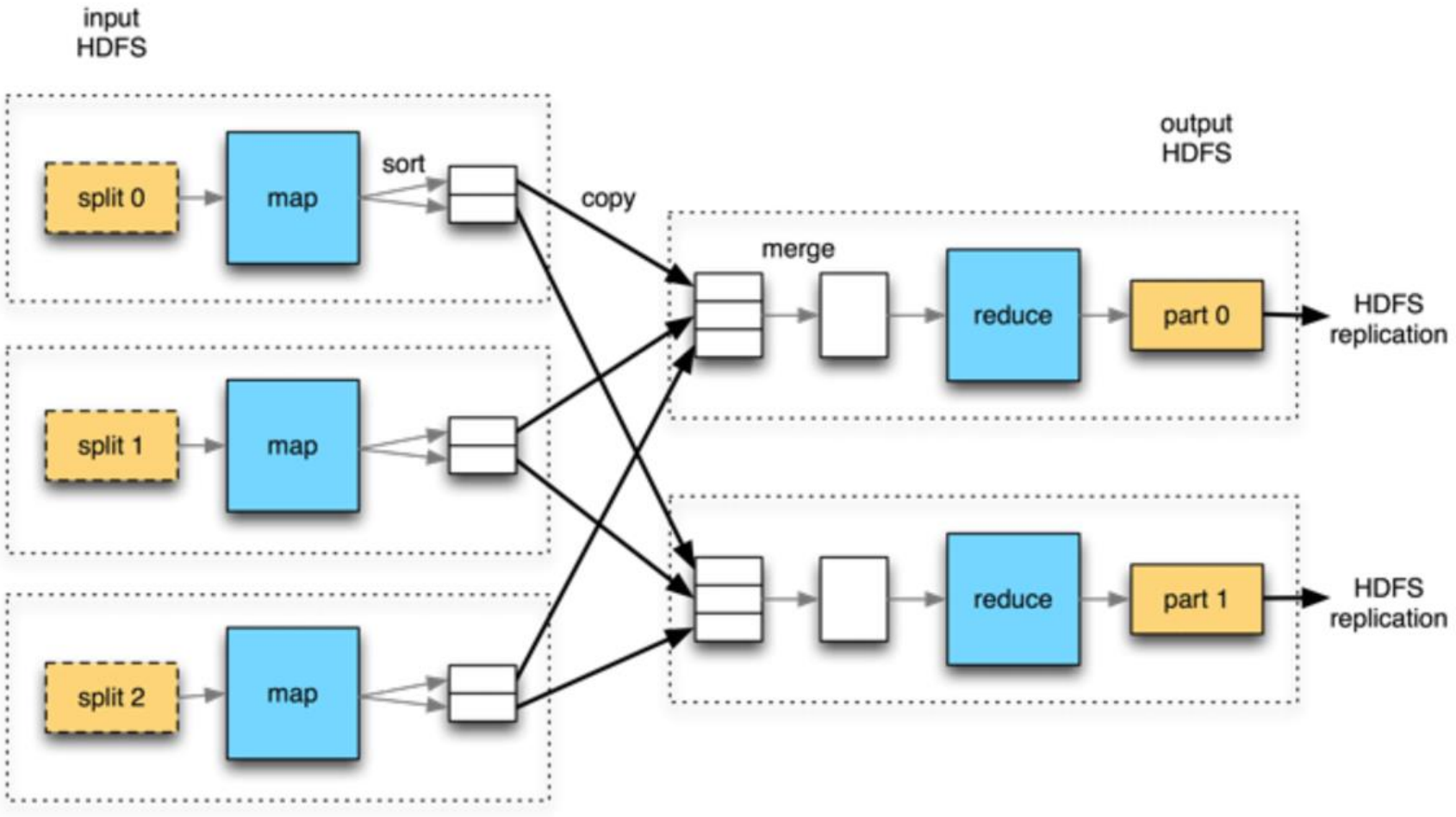
Hadoop consists of two (2) parts:

1. Hadoop Distributed File System (HDFS)
2. Processing Part (MapReduce)



Source: http://ubm.io/2vipYqj

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Big Data and Python

Slides and code:
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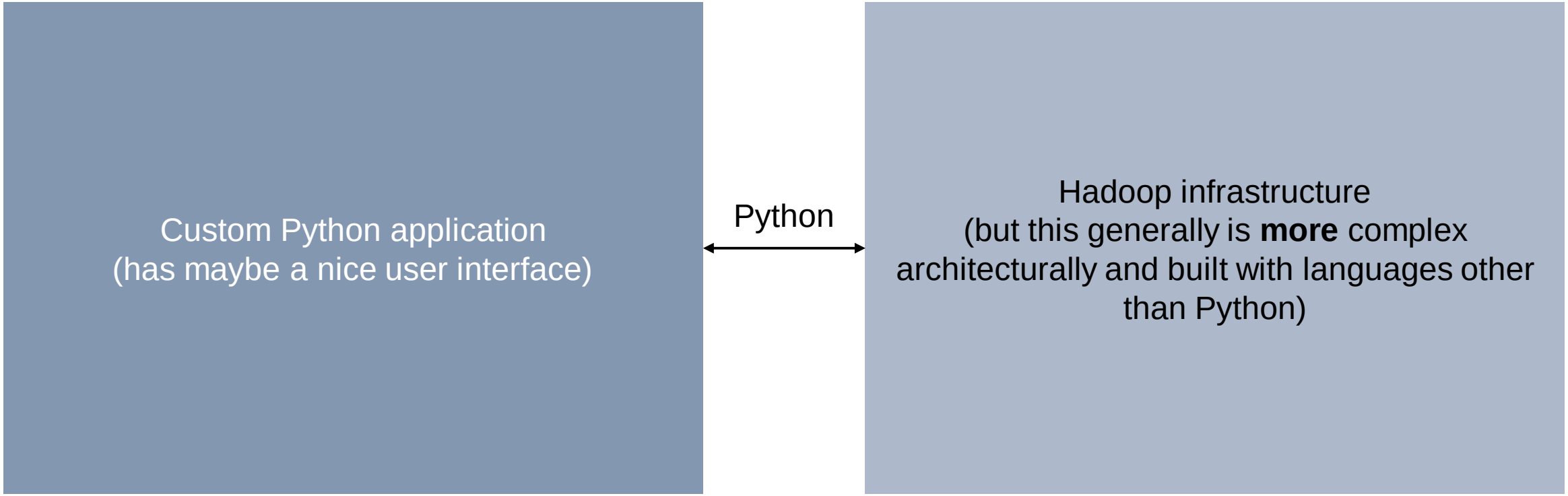

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If you are not sure, then you do not need Big Data.
(just use PostgreSQL)

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What does this all have to do with Python?

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Data Sanity

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- Data can (and it will, at times) lie to you.
- Think about data delivery – particularly if it is arriving from human sources.
- Data anomalies will occur. How do you address them?
- Are you collecting the right data and, more importantly, enough **relevant** data?
- Careful of biases (i.e. confirmation bias). **Be scientific!**

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Resources

Slides and code:
http://bit.ly/2uzCQqR

Books

- 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

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Online Course

Slides and code:
http://bit.ly/2uzCQqR

http://bit.ly/2danP4n
(Applied Data Science with Python Specialization – University of Michigan)

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Next Webinar

Slides and code:
http://bit.ly/2uzCQqR

Machine Learning with scikit-learn (mostly)

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Where can I get this slide deck and code?

Slides and code:
http://bit.ly/2uzCQqR

http://bit.ly/2uzCQqR
(actually, go ahead and bookmark this link – this web page will be updated constantly with new content)

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Python-ish Feedback Received So Far

Slides and code:
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Cloud Computing

M2M

Big Data

Regular Expressions

Statistics

Data Analytics

IIoT

Machine Vision

Data Visualization

Siemens NX Python API

Machine Learning

CAE

Deep Learning

Realtime (Streaming) Data

Computational Geometry

Embedded Systems

Robotics

Linear Algebra

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Deeper Look at Machine-to-Machine (M2M)

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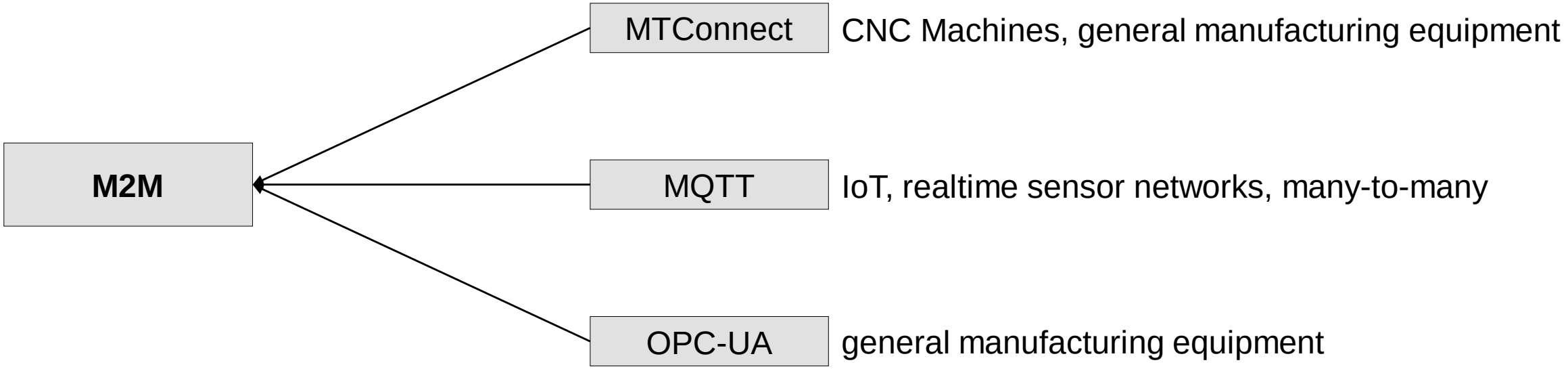

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Another Example of a Basic Learning Path

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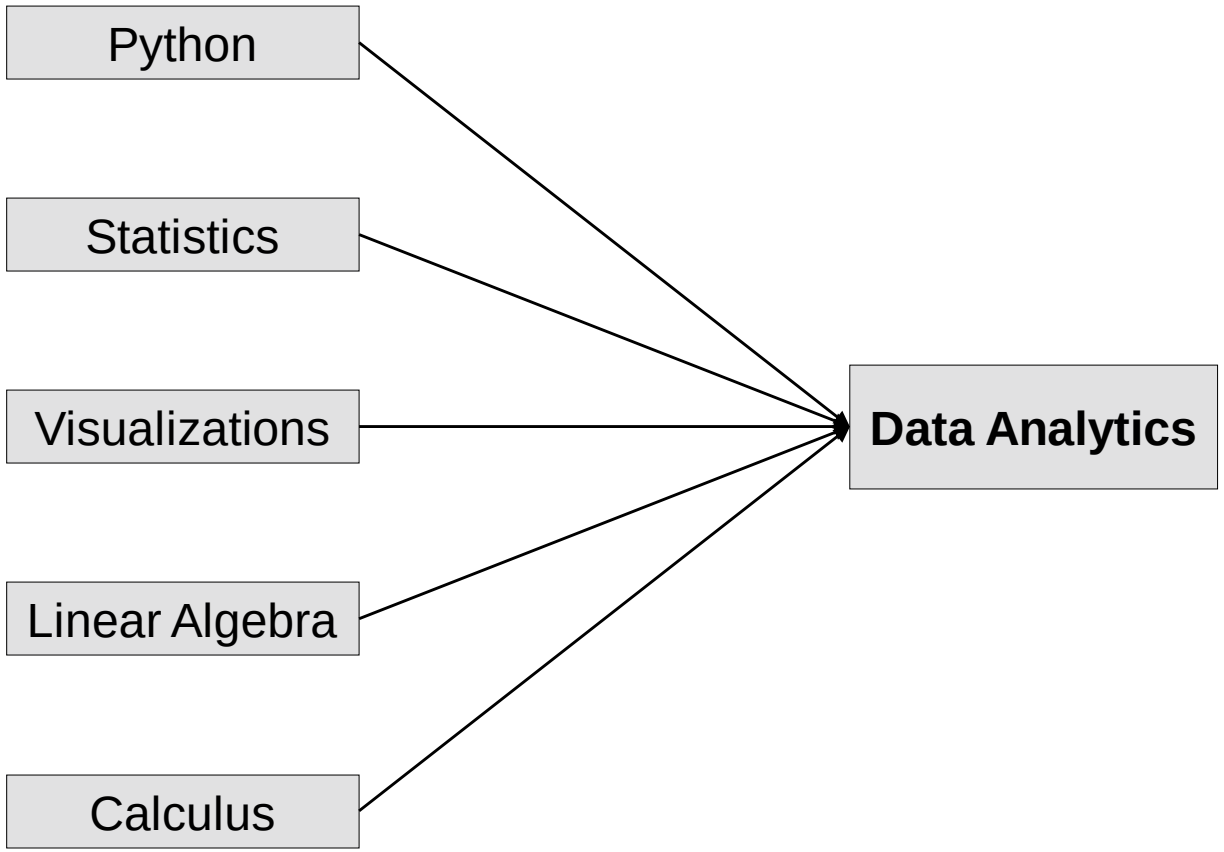

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Call for Feedback

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Please provide us with feedback!

Want to Keep the Conversation Going?

Slides and code:
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We have a Slack channel! Send me an invite request at my e-mail address. (we are working on an automatic invite link)

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Thank you!

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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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