Python Programming Paradigm

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Introduction

```
>>> Python
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
NameError: name 'Python' is not defined
>>>
```

- Python
  - Is a modern, general-purpose, object-oriented, high-level programming language
    - Dynamic
    - Expressive
    - Interpreted

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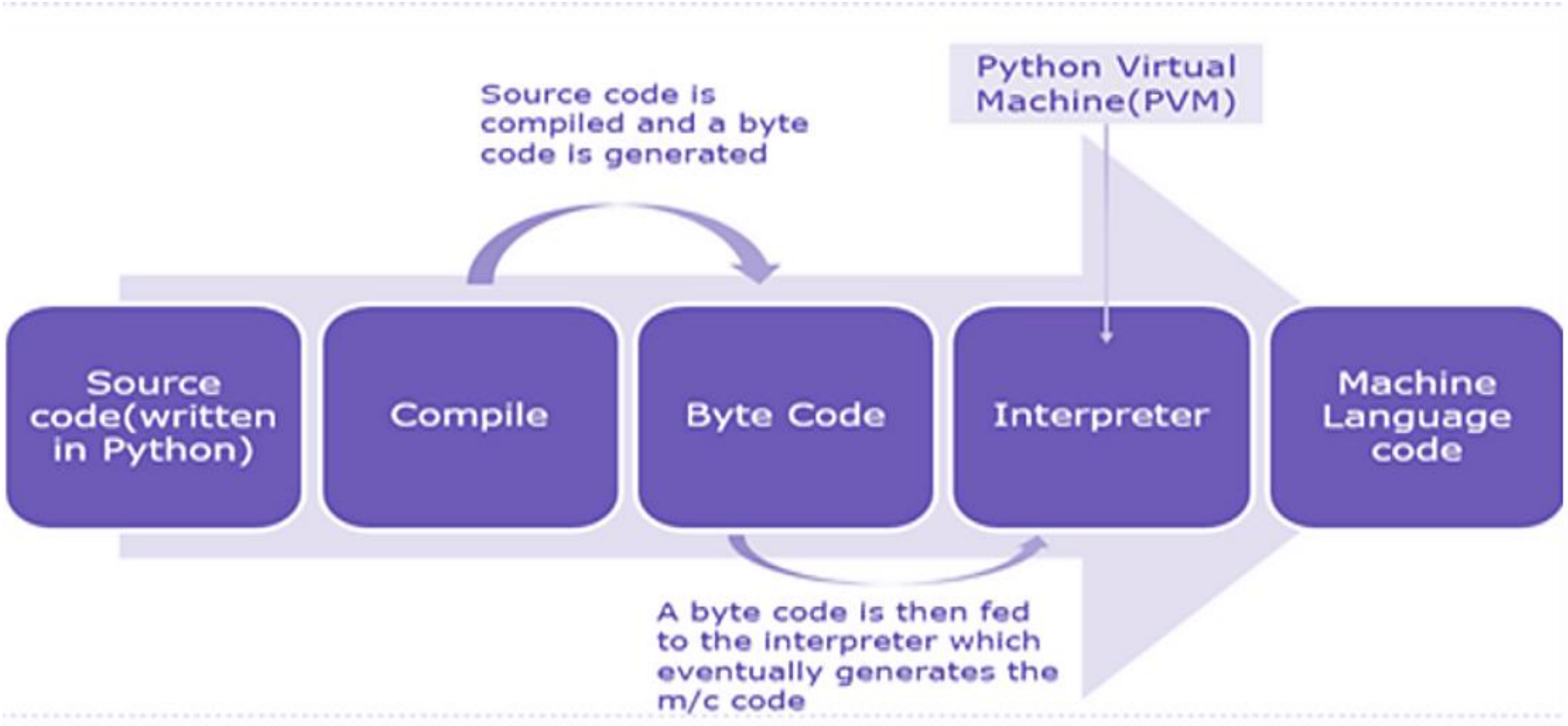
Python Interpreters

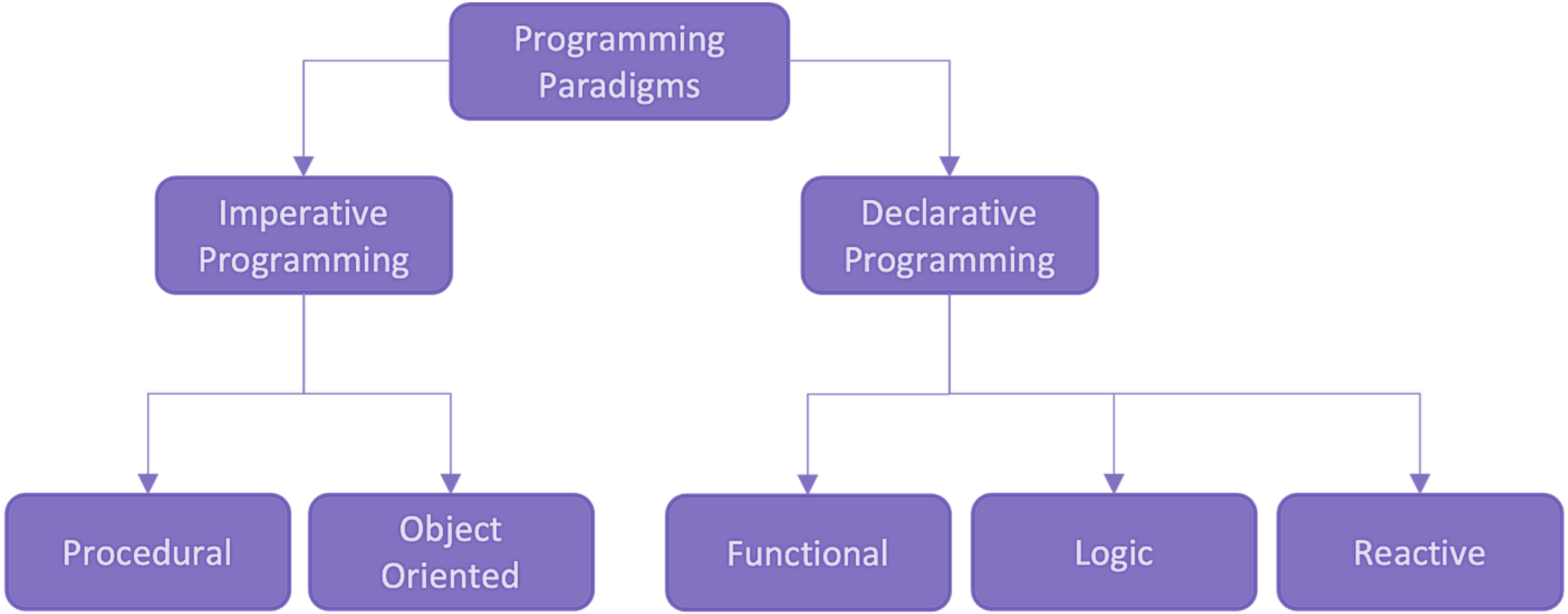
- Interpreter
  - Python is not just interpreted but (compiled + interpreted) | compilation process is hidden from the user
  - e.g. .py → .pyc or .pyo format



Python implementations

- Interpreters define the implementations
- Cpython
  - Original python implementation
  - You downloaded from Python.org
- Jython
  - Designed to run on Java platforms
- IronPython
  - Open-source integrated with .NET framework
- Stackless Python
  - Written in C and Python
- PyPy
  - Written in Python
  - Interpreter specifically in Rpython
  - Rpython: restricted subset of python language (used for implementing dynamic language interpreters)
  - Uses just-in-time compiler, so faster than Cpython

Programming paradigm



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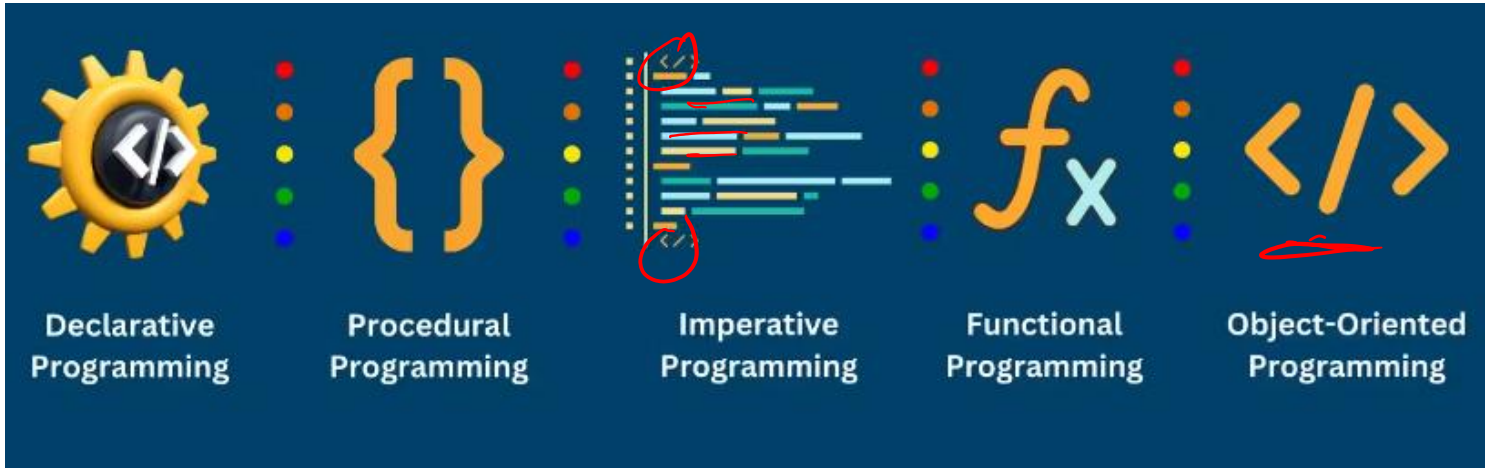
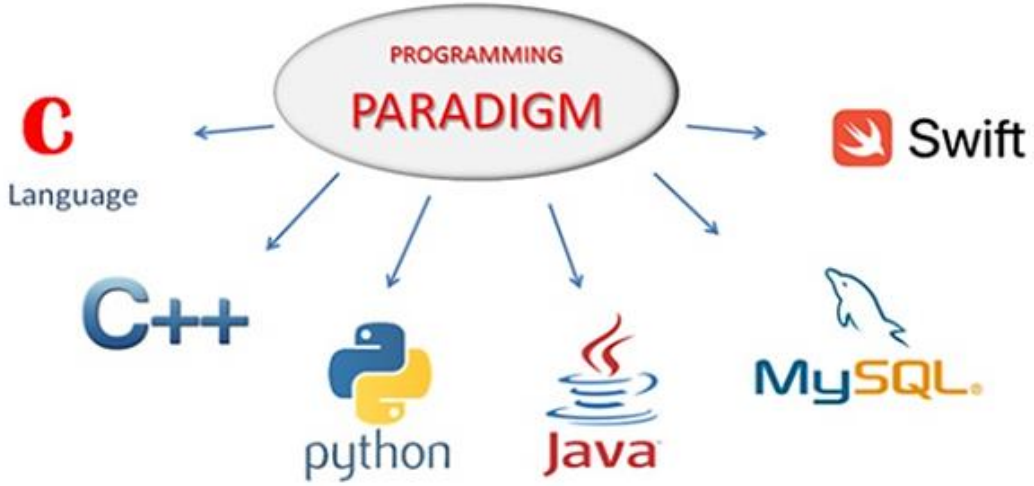
Programming paradigm

Paradigm	Imperative	Declarative
Operation	Defines HOW tasks should be accomplished	Defines WHAT tasks should be accomplished
Computation	Defines the control flow and states changes	Defines only the logic
Mutating Variables	Very usual	Unusual and not recommended
Advantages	Easy to learn notation; Machine architecture compliant	Easy to optimize codes; High abstraction level
Disadvantages	Hard debugging; Vulnerable to data race	Unfamiliar notation; Less customizable codes
Popular Derived Paradigms	Procedural; Object-oriented	Functional; Logic

Programming paradigm

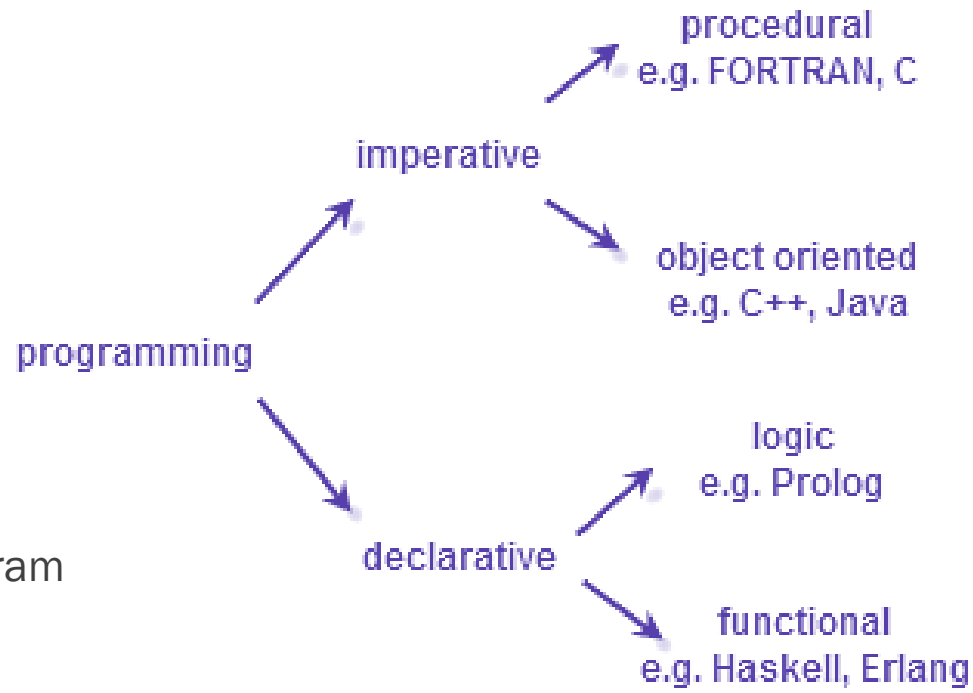




Ref: robiul.dev

Programming paradigm

- Imperative
  - Low level specifications are given (algo details, machine management steps)
  - Efficiency is primary concern
  - **HOW** to execute: Sequence of commands (imperatives)
  - e.g. Fortran, Cobol, C, Pascal



- Declarative
  - Paradigm: Is a style of building structure & elements of a program
  - Declarative: expresses the logic of a computation without describing its control flow
  - Focus is on **WHAT**: what the program should accomplish
  - e.g SQL, Prolog, Makefiles, Functional programming

Python

- A multi-paradigm programming language
  - invented by Guido Van Rossum
  - 1990 in Netherlands

Programming

- Imperative
  - Procedural
    - Statements are structured into procedures
    - Modularized
- Functional
- Object Oriented

```
def stringc(characters):
    string =''
    for char in characters:
        string=string+char
    return string
```

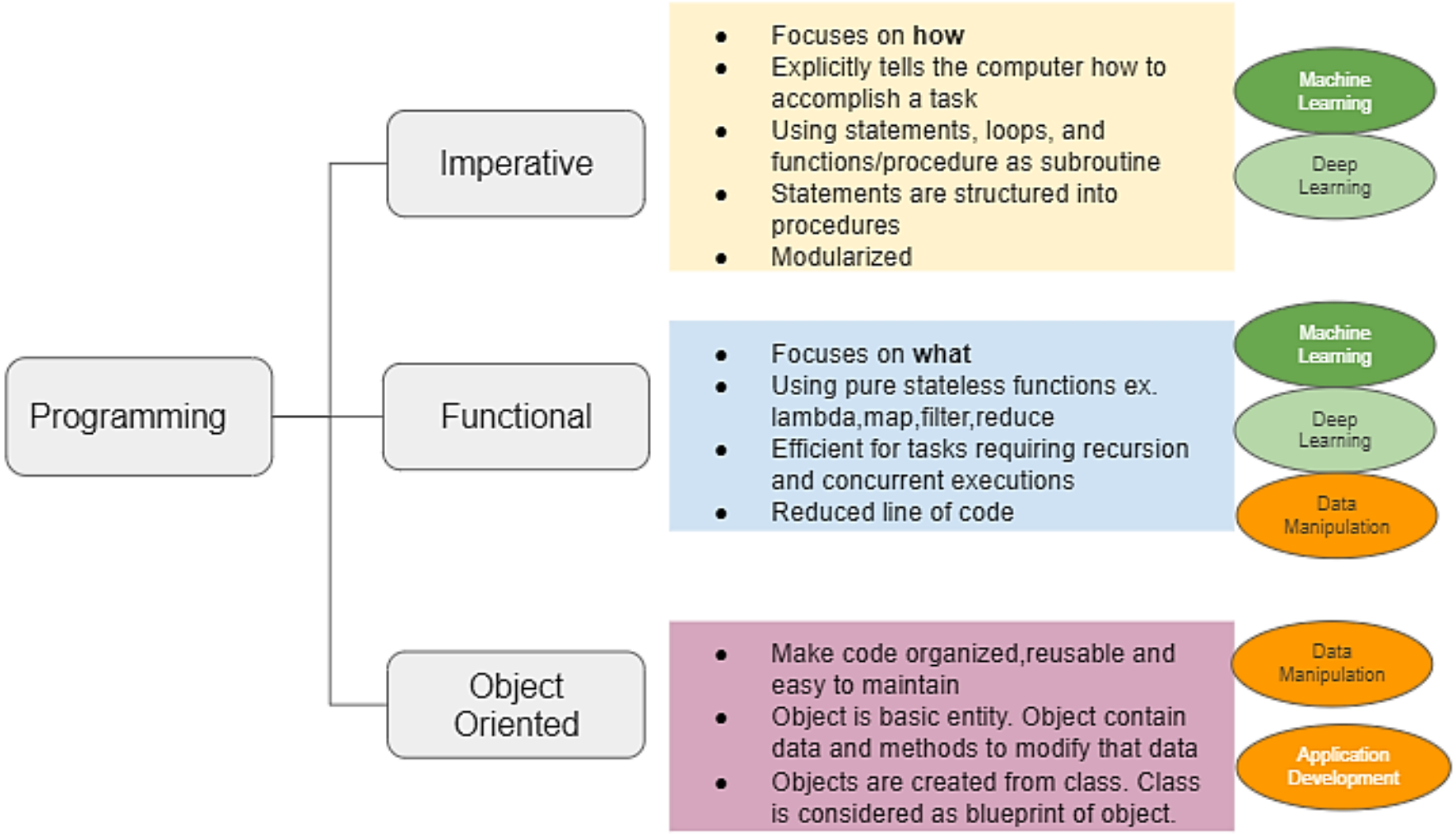
```
stringc(['s','a','n','r','u','s','h','a'])
```

```
'sanrusha'
```

Like imperative programming step by step clear instructions in forms of statements and loop, but structured into a method.

Method is executed with appropriate argument.

Python



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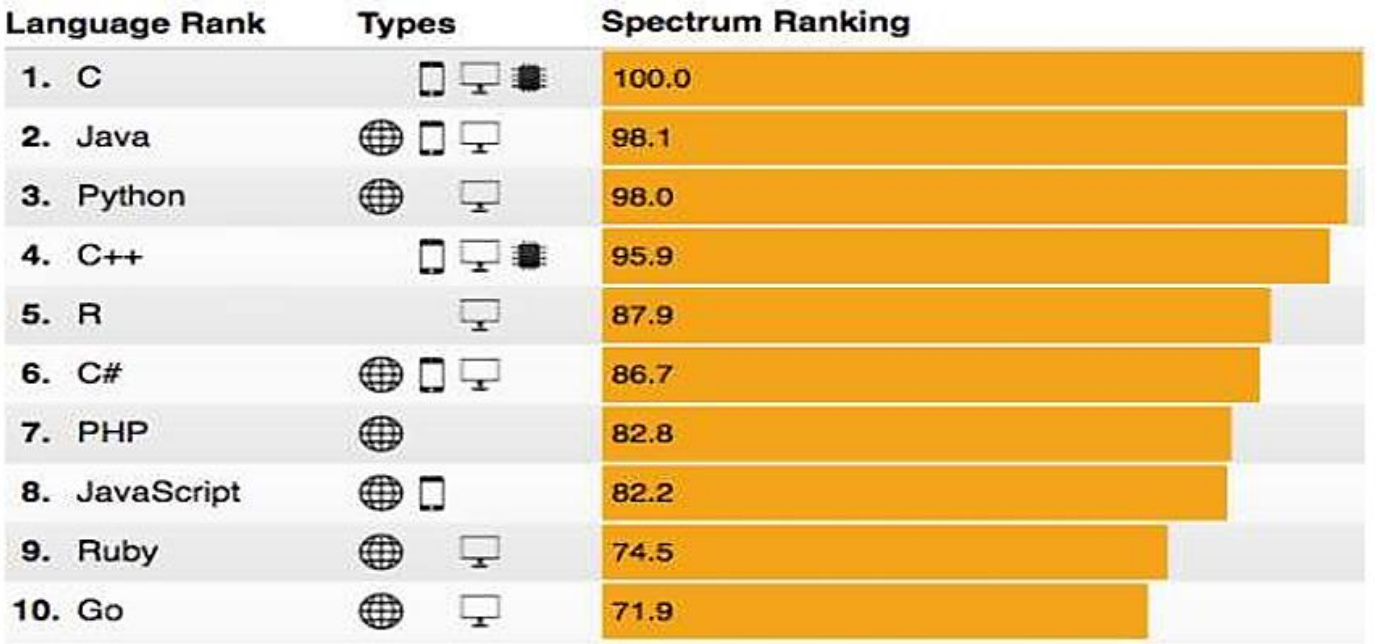
Ranking

- Programming language ranking
  - Use programming paradigm features
  - Actively used by SW designers
  - Overall 12 metrics used and 48 programming languages considered
    - Top 10 list 2016



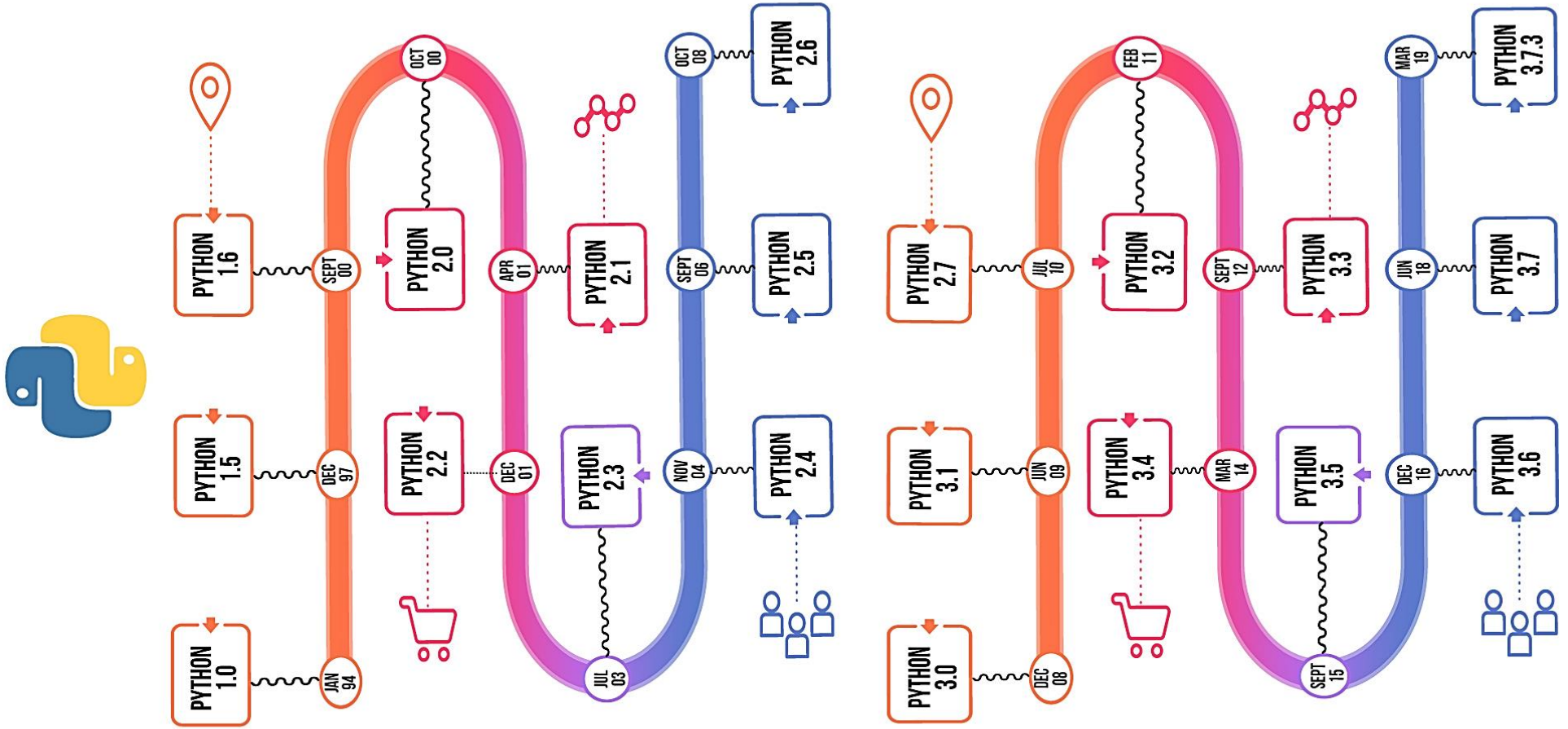
"The Programming Paradigm domain is the kernel in any software design. The Programming Languages and any software design cannot be developed without the role of Programming Paradigms."

Ref: spectrum.ieee.org
Ref: MS Samuel, "An insight into programming paradigms…", Journal of applied tech & innovation, 2017

Programming paradigms

Programming Language	Main Programming Paradigm(s)
Java	Object-Oriented, Imperative, Event-driven with GUI, Concurrent, Functional, Generic, & Reflection
C	Imperative (Procedural and Structural)
C++	Imperative, Object-Oriented
Python	Imperative, Object-Oriented, Functional, Event-Driven with GUI, Concurrent, Reflection, & Meta programming
C#	Object-Oriented, Imperative, Event-Driven with GUI, Functional, Concurrent, Generic, & Reflection
R	Functional, Object-Oriented, Event-Driven with GUI, Imperative, Reflective, & Array
PHP	Imperative, Object-Oriented, Event-Driven with GUI, Functional, & Reflection
Java Script	Scripting

Python



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