A Deep Dive Into Python's Object/Data Model

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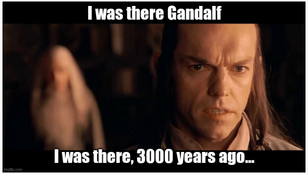
Python Guild @ Gen™

About Me

- Lead Software Engineer / Architect in Threat Labs (TIS)
- Started programming in Python around 2007 (Python 2.5)
- Writing Python code (projects up to 200k LOC)
- Writing about Python (Czech and English blogs)
- Speaking about Python and teaching it (BUT FIT)
- Hobbies: Creating slides in LaTeX
- More info on my website: https://petrzemek.net



Before we Begin

The talk is a live demo accompanied by examples:

https://github.com/s3rvac/talks/tree/master/2024-05-14-A-Deep-Dive-Into-Python-Object-Model/examples

Getting Started

- What is an object?
- What is an object model?
- The basics (classes, methods, properties, inheritance)
- Very little of Python is truly magical
- In Python, (almost) everything is an `object`
- In Python, every object has an identity, type, and value
- Objects in Python do not generally have a fixed layout
- Construction and finalization
- Multiple inheritance, MRO
- Methods vs functions

Continuing...

- The underlying storage is a `dict`
- `__dict__` vs `__slots__`
- What happens when you access an attribute of an object?
- Hooking into attribute access (`__getattr__`, `__getattribute__`)
- Descriptors: The mechanism behind regular/static/class methods and properties

...and Finishing with Metaclasses

- What is metaprogramming?
- Classes are instances of *metaclasses*
- `type`: the default metaclass
- Creating a class manually via `type()`
- The mysterious relationship between `type` and `object`
- What happens when you create and instantiate a class?
- What happens when you access an attribute of a class?
- Alternatives to metaclasses:
  - class decorators
  - `__init_subclass__`
  - `__set_name__`
  - code generation

Further Reading and Watching

- Python 3 Docs: Data model
- Python 3 Docs: Descriptors
- Python 3 Docs: Types
- eev.ee: Object models
- blog.ionelmc.ro: Understanding Python metaclasses
- marco-buttu.github.io: Python's object model
- snarky.ca: Unravelling Python's classes
- David Beazley: Python 3 Metaprogramming (video, 3 hours)
- Mark Smith: Python Types & Metaclasses Made Simple (video, 1 hour)