



Consistent importing

Jan Bielecki

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Jan Bielecki

Senior Full Stack Developer



2015

First Python code
(internship)



2019

Using Python
professionally



2021

Python modelling in
energy industry



Scan for full presentation
[consistent_importing.pdf](#)



Ørsted

Global leader in offshore wind



Ørsted vs All
~10.2/~83 GW
(~12%)



Offshore vs All
~83 GW/ 19 TW
(~0.4%)



Rightsizing
~8000 (2025)
~6000 (2027)



Scan for full presentation
[consistent_importing.pdf](#)

I. Why am I talking about this?



**Why are you
telling me this?**

Re-exporting definitions through `__init__.py`

```
# model/geometry/node.py
class Node: ...
# model/geometry/__init__.py
from .node import Node, function_a
from .edge import Edge, function_b
# model/__init__.py
from .geometry import Node, Edge, function_a, function_b
from .other_module import SomeOtherClass
# gui/__init__.py
from model import Node, Edge, function_a, function_b, SomeOtherClass
```

✓ Pros:

- Encapsulation/Single entry point
- Short imports
- **Acyclic package dependencies**

✗ Cons:

- Maintenance overhead
- IDE is confused
- Hard to automate consistency

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- Encapsulation/Single entry point
- Short imports
- **Acyclic package dependencies**

✗ Cons:

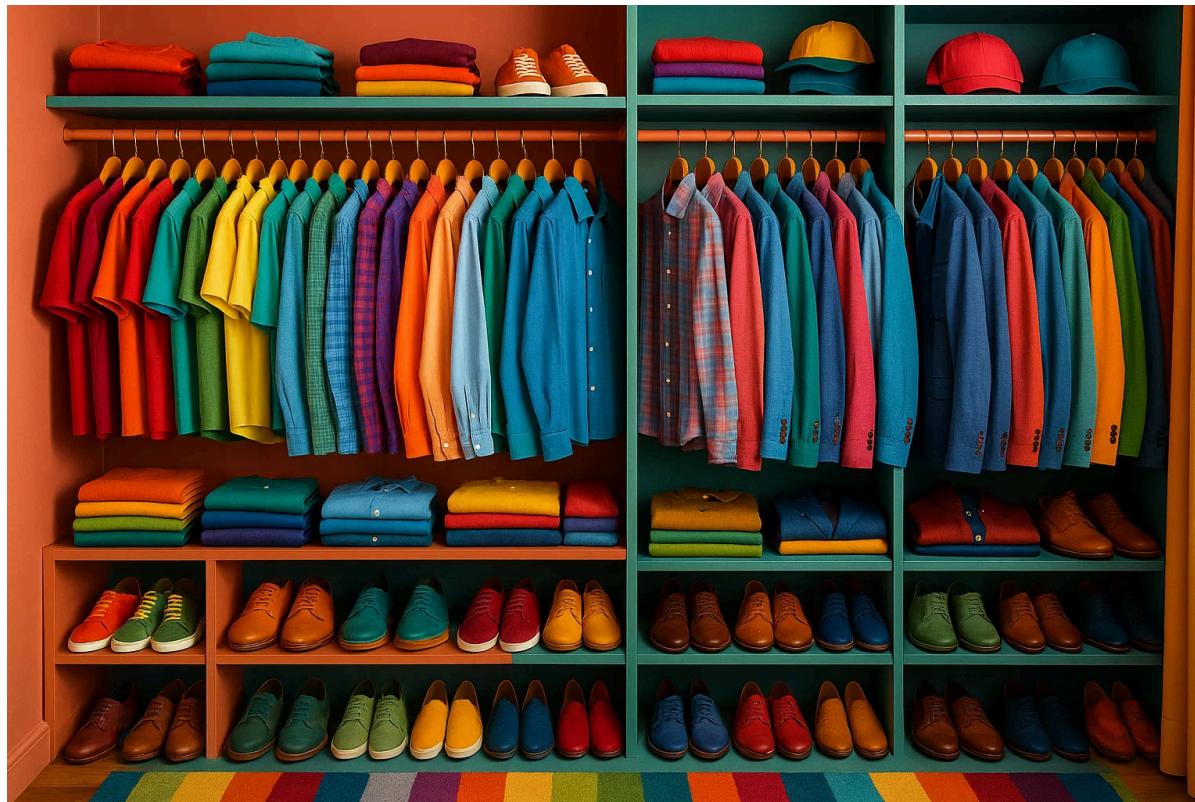
- Maintenance overhead
- IDE is confused
- Hard to automate consistency

Consistency reduces decision fatigue



"... the more decisions you make throughout the day, the worse you are at making them."

Python importing without consistency



II. How importing in Python works?



Python interpreter

```
(base) jan@jan-Inspiron-3543:~/consistent_importing$ python
Python 3.12.8 [GCC 11.2.0] on linux
>>> def hello_world() -> None:
...     print("Hello from hello_world function!")
...
>>> hello_world()
Hello from hello_world function!
>>> exit()
(base) jan@jan-Inspiron-3543:~/consistent_importing$ python
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Python module

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Python 3.12.8 [GCC 11.2.0] on linux
>>> import my_module
Hello from my_module!
>>> dir(my_module) # properties and methods of the object
[..., '__name__', '__package__', '__spec__', 'hello_world']
>>> my_module.hello_world()
Hello from hello_world function!
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Python module

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Python package

```
main.py
gui
  __init__.py
  plots
    __init__.py
    graph
      __init__.py
model
  __init__.py
  geometry
    node.py
    edge.py
    __init__.py
```

sys.path

```
(.venv) ~\consistent_importing> python
>>> import sys
>>> print(sys.path)
[
    '',
    'C:\\\\Desktop\\\\projects\\\\consistent_importing',
    'C:\\\\Local\\\\Programs\\\\Python\\\\Python313\\\\DLLs',
    'C:\\\\Local\\\\Programs\\\\Python\\\\Python313\\\\Lib',
    'C:\\\\Desktop\\\\projects\\\\consistent_importing\\\\.venv\\\\Lib\\\\site-packages',
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    ...
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```

sys.path manipulation (execute a module vs execute a script)

```
(.venv) ~\consistent_importing> python -m src.gui_model.main
[
    '~\\consistent_importing',
    ...
    '~\\consistent_importing\\.venv'
]
Success!
(.venv) ~\consistent_importing> python src\gui_model\main.py
[
    '~\\consistent_importing\\src\\gui_model',
    ...
    '~\\consistent_importing\\.venv'
]
Success!
```

```
# src\gui_model\main.py

from pprint import pprint

pprint(sys.path)
print("Success!")
```

sys.path manipulation (execute a module vs execute a script)

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sys.path manipulation (if the previous approach is not enough)

```
(.venv) ~\consistent_importing> PYTHONPATH="/example:anything-can-be-here" python
>>> import sys; print(sys.path)
['',
 '/example',
 '/home/projects/consistent_importing/anything-can-be-here'
 '/home/projects/consistent_importing/.venv/lib/python3.12/site-packages',
 ...]
>>> sys.path.append(True); print(sys.path)
['',
 '/example',
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```

Package vs Namespace Package

```
—my_package (/some/path)
|   __init__.py
|   plot
|   __init__.py
|   model
|   __init__.py
...
—my_package (/some/another_path)
|   __init__.py
|   plot
|   __init__.py
|   computation
|   __init__.py
...
...
```

```
(.venv) ~\consistent_importing> python
>>> import sys
>>> sys.path
[
    '/some/path',
    '/some/another_path'
]
>>> import my_package.model
hello from path.my_package.model
>>> import my_package.computation
Traceback (most recent call last):
  File "", line 1, in 
    import my_package.computation
ModuleNotFoundError: No module named 'my_package.computation'
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Traceback (most recent call last):
  File "", line 1, in 
    import my_package.computation
ModuleNotFoundError: No module named 'my_package.computation'
```

Package vs Namespace Package

```
—my_package (/some/path)
|   __init__.py
|   plot
|   __init__.py
|   model
|   __init__.py
...
—my_package (/some/another_path)
|   __init__.py
|   plot
|   __init__.py
|   computation
|   __init__.py
...
...
```

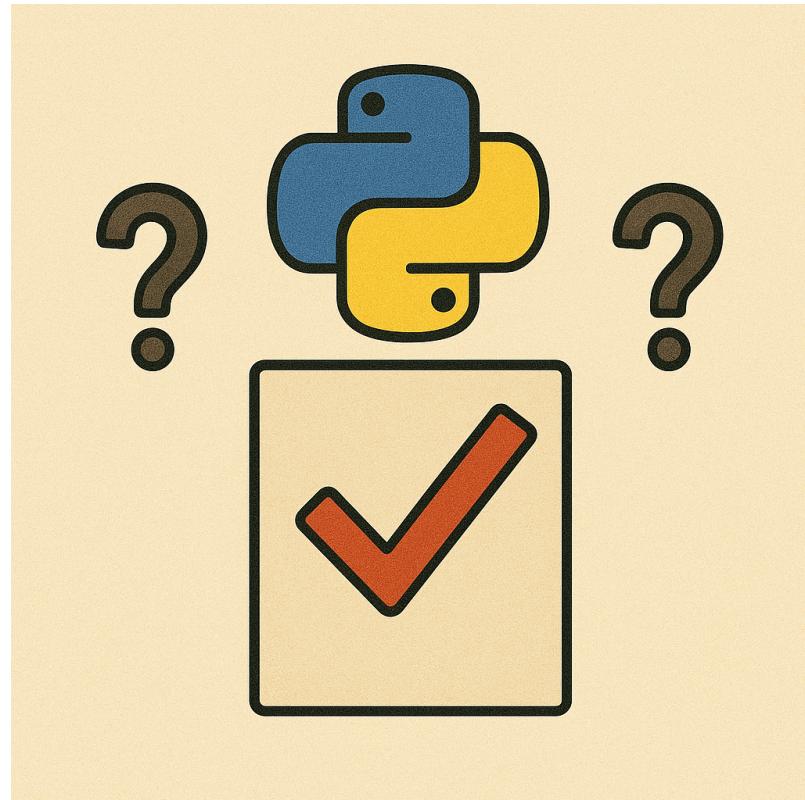
```
(.venv) ~\consistent_importing> python
>>> import sys
>>> sys.path
[
    '/some/path',
    '/some/another_path'
]
>>> import my_package.model
hello from path.my_package.model
>>> import my_package.computation
Traceback (most recent call last):
  File "", line 1, in 
    import my_package.computation
ModuleNotFoundError: No module named 'my_package.computation'
```

Package vs Namespace Package

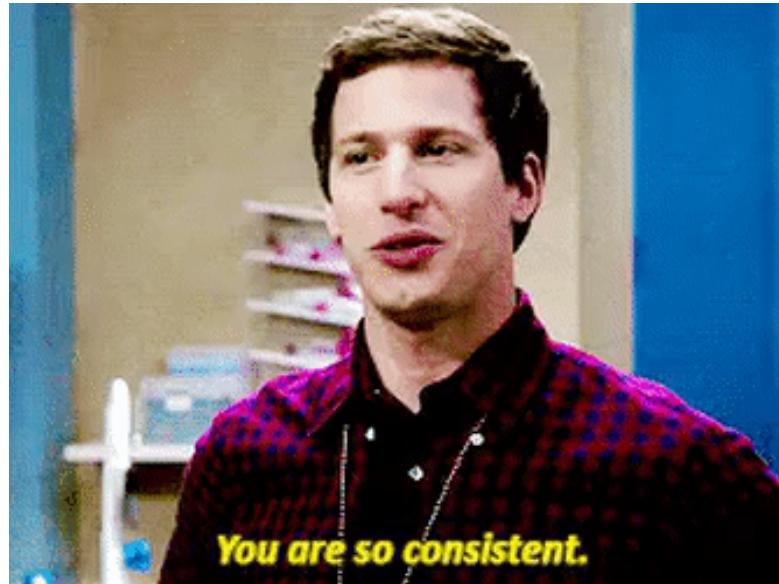
```
—my_package (/some/path)
|   __init__.py
|   plot
|   __init__.py
|   model
|   __init__.py
...
—my_package (/some/another_path)
|   __init__.py
|   plot
|   __init__.py
|   computation
|   __init__.py
...
...
```

```
(.venv) ~\consistent_importing> python
>>> import sys
>>> sys.path
[
    '/some/path',
    '/some/another_path'
]
>>> import my_package.model
hello from path.my_package.model
>>> import my_package.computation
Traceback (most recent call last):
  File "", line 1, in 
    import my_package.computation
ModuleNotFoundError: No module named 'my_package.computation'
```

III. What is the best importing strategy?

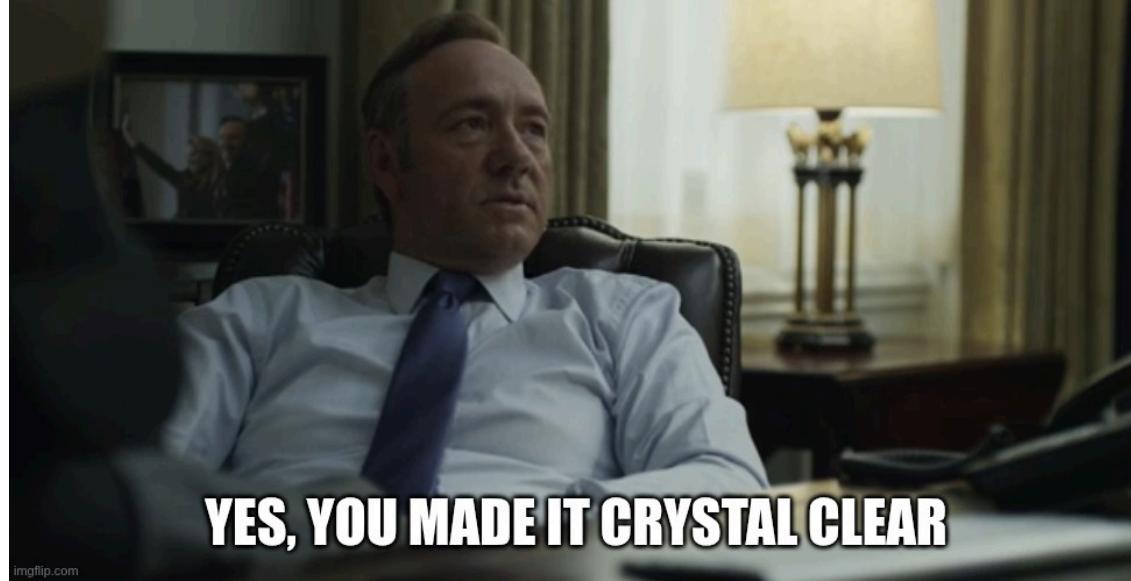


1. (PEP) Sort imports



Benefit: Consistent order of import statements

2. (PEP) Place imports at the top of a file

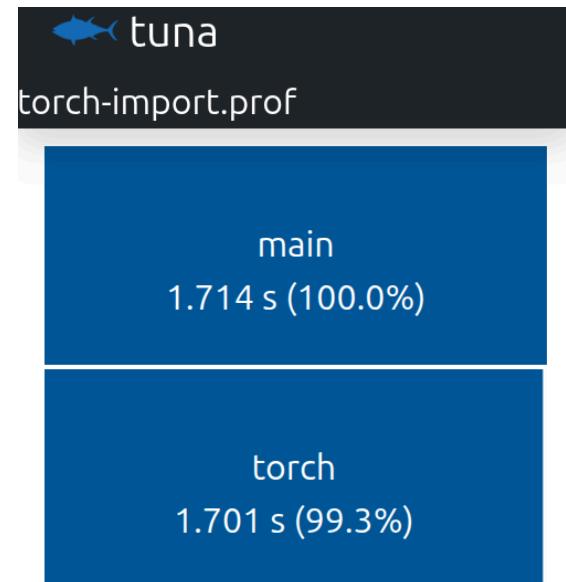


Benefit: Being crystal clear about created dependencies

2. (EXCEPTION) Lazy imports of heavy modules

```
python -X importtime -c 'import torch' 2> torch-import.prof  
uvx tuna torch-import.prof
```

```
# src/evaluation.py  
  
def evaluate_model(model: Model) -> None:  
    import torch # noqa: PLC0415  
    ...  
  
# src/_main_.py  
  
from src.evaluation import evaluate_model  
  
def main() -> None:  
  
    if do_evaluate:  
        evaluate_model(model)  
    ...
```



Benefit: Reduction of startup time at some conditions

2. (EXCEPTION) Use TYPE_CHECKING for heavy types

```
# src/model.py
from typing import TYPE_CHECKING

# lazy import to reduce startup time
if TYPE_CHECKING:
    import torch

class Model:
    def add_module(self, module: "torch.Module") -> None:
        print(f"Adding module: {module}")
    ...
```

Benefit: Reduction of startup time at some conditions

3. (PEP) Absolute imports

- Absolute imports are recommended, as they are usually more readable and tend to be better behaved (or at least give better error messages) if the import system is incorrectly configured (such as when a directory inside a package ends up on `sys.path`):

```
import mypkg.sibling
from mypkg import sibling
from mypkg.sibling import example
```

However, explicit relative imports are an acceptable alternative to absolute imports, especially when dealing with complex package layouts where using absolute imports would be unnecessarily verbose:

```
from . import sibling
from .sibling import example
```

Standard library code should avoid complex package layouts and always use absolute imports.

Benefit: More informative and less ambiguous

4. Avoid using Namespace Packages

```
my_package (/some/path)
├── __init__.py
└── plot
    ├── __init__.py
    └── model
        └── __init__.py
...
my_package (/some/another_path)
├── __init__.py
└── plot
    ├── __init__.py
    └── computation
        └── __init__.py
...
```

```
(.venv) ~\consistent_importing> python
>>> import sys
>>> sys.path
[
    '/some/path',
    '/some/another_path'
]
>>> import my_package.model
hello from path.my_package.model
>>> import my_package.computation
Traceback (most recent call last):
  File "", line 1, in 
    import my_package.computation
ModuleNotFoundError: No module named 'my_package.computation'
```

Benefit: Avoid uncertain behavior of namespace packages

5. (PEP) Avoid using wildcard imports

```
1 # base_implementation.py
2 def fast_add(a: float, b: float) -> float:
3     return a + b
4
5 def fast_multiply(a: float, b: float) -> float:
6     return a * b
7
8 # cython_accelerated_implementation.py (optional module)
9 def fast_add(a: float, b: float) -> float: ...
10
11 # public_api.py
12 from base_implementation import * # noqa: F403
13
14 try: # (cython_accelerated_implementation.py could be missing)
15     from cython_accelerated_implementation import * # noqa: F403
16 except ImportError:
17     pass
18
19 # main.py
20 from public_api import fast_add
21 from public_api import fast_multiply
```

Benefit: Avoid ambiguity and namespace pollution

5. (PEP) Avoid using wildcard imports

```
1 # base_implementation.py
2 def fast_add(a: float, b: float) -> float:
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Benefit: Avoid ambiguity and namespace pollution

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16 except ImportError:
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18
19 # main.py
20 from public_api import fast_add
21 from public_api import fast_multiply
```

Benefit: Avoid ambiguity and namespace pollution

6. (PEP) Imports should be grouped

```
1 # standard library imports
2 import filecmp
3 import shutil
4 from pathlib import Path
5
6 # related third party imports
7 import pandas as pd
8 import pytest
9 import numpy as np
10
11 # local application/library specific imports
12 from common.constants import current_version
13 from common.constants import default_model_type
14 from dashboard.model.model import Model
15 from dashboard.model.model import ModelType
16 from source.db import DB
17 from source.connector.adapter import TimeSeriesAdapter
```

Benefit: Immediate visual separation of different types of dependencies

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1 # standard library imports
2 import filecmp
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```

Benefit: Immediate visual separation of different types of dependencies

7. (PEP) Import one definition per line



```
1 import filecmp
2 import shutil
3 from pathlib import Path
4
5 import pandas as pd
6 import pytest
7 import numpy as np
8
9 from common.constants import current_version
10 from common.constants import default_model_type
11 from dashboard.model.model import Model
12 from dashboard.model.model import ModelType
13 from source.db import DB
14 from source.connector.adapter import TimeSeries
```

Benefit: Reduction of version control conflicts

7. (PEP) Import one definition per line



```
1 import filecmp
2 import shutil
3 from pathlib import Path
4
5 import pandas as pd
6 import pytest
7 import numpy as np
8
9 from common.constants import current_version
10 from common.constants import default_model_type
11 from dashboard.model.model import Model
12 from dashboard.model.model import ModelType
13 from source.db import DB
14 from source.connector.adapter import TimeSeries
```

Benefit: Reduction of version control conflicts

8. Direct imports from the defining module

```
# pkg_a/module_a.py
```

```
class ClassA:  
    pass
```

```
# pkg_b/module_b.py
```

```
from pkg_a.module_a import ClassA
```

```
class ClassB:  
    def compare(self, other: ClassA) -> bool:  
        return str(self) == str(other)
```

```
# main.py
```

```
from pkg_b.module_b import ClassA  
from pkg_b.module_b import ClassB
```

```
class_b_instance = ClassB()  
class_a_instance = ClassA()  
print(class_a_instance)  
print(class_b_instance)
```

Benefit: Being explicit about dependencies ("Explicit is better than implicit")

8. (EXCEPTION) Encapsulation (or "convenience imports")

```
main.py
os_ops
|   windows
|   |   __init__.py
|   |   path.py
|   |   ...
|   |
|   linux
|   |   __init__.py
|   |   path.py
|   |
|   __init__.py
```

```
# os_ops/__init__.py

import os

if os.name == 'nt':
    from ._windows.path import copy_file
elif os.name == 'posix':
    from ._linux.path import copy_file
else:
    raise OSError(f"Unsupported OS: {os.name}")
```

```
# main.py
from os_ops import copy_file

copy_file(
    "source.txt",
    "destination.txt"
)
```

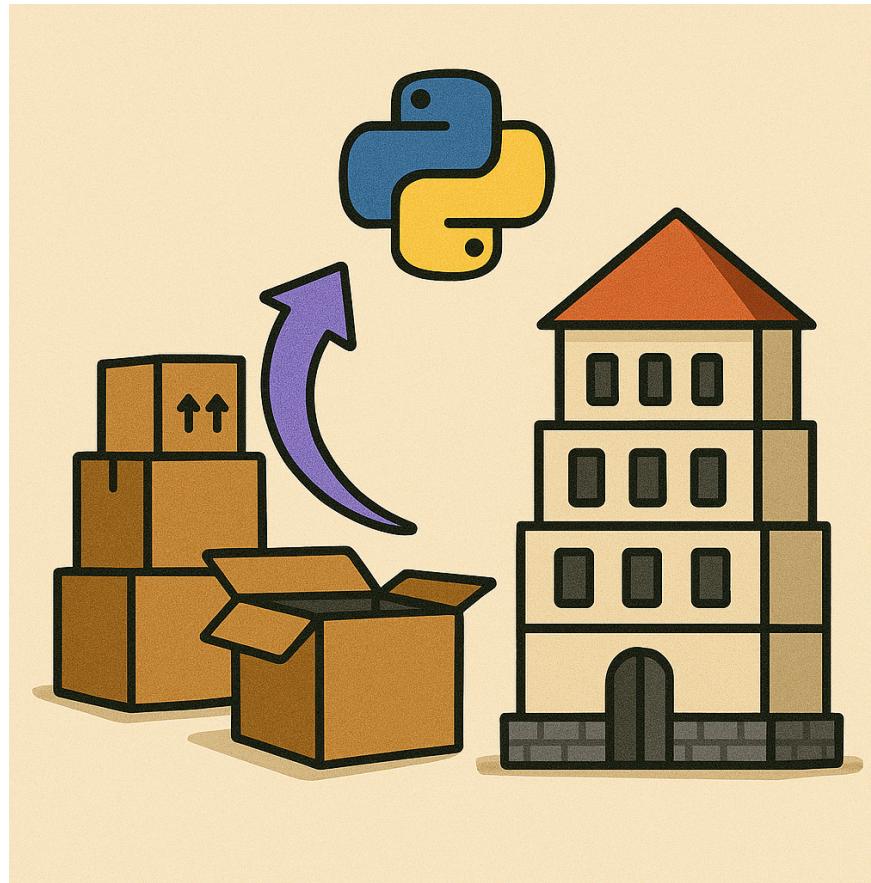
Benefits: Proxy advantages, short imports

9. Follow Acyclic Dependencies Principle (ADP)

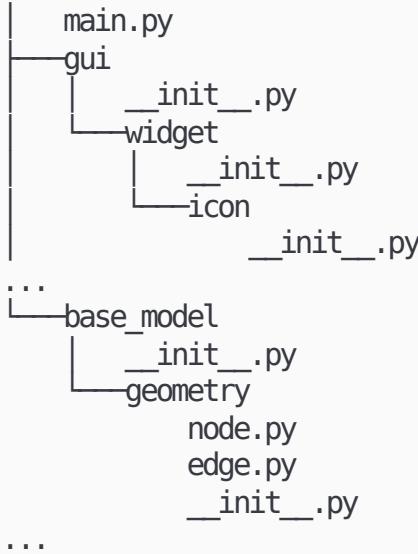


Benefits: Loose coupling

IV. Following Acyclic Dependencies Principle (ADP)



Why to care about clean modular structure?

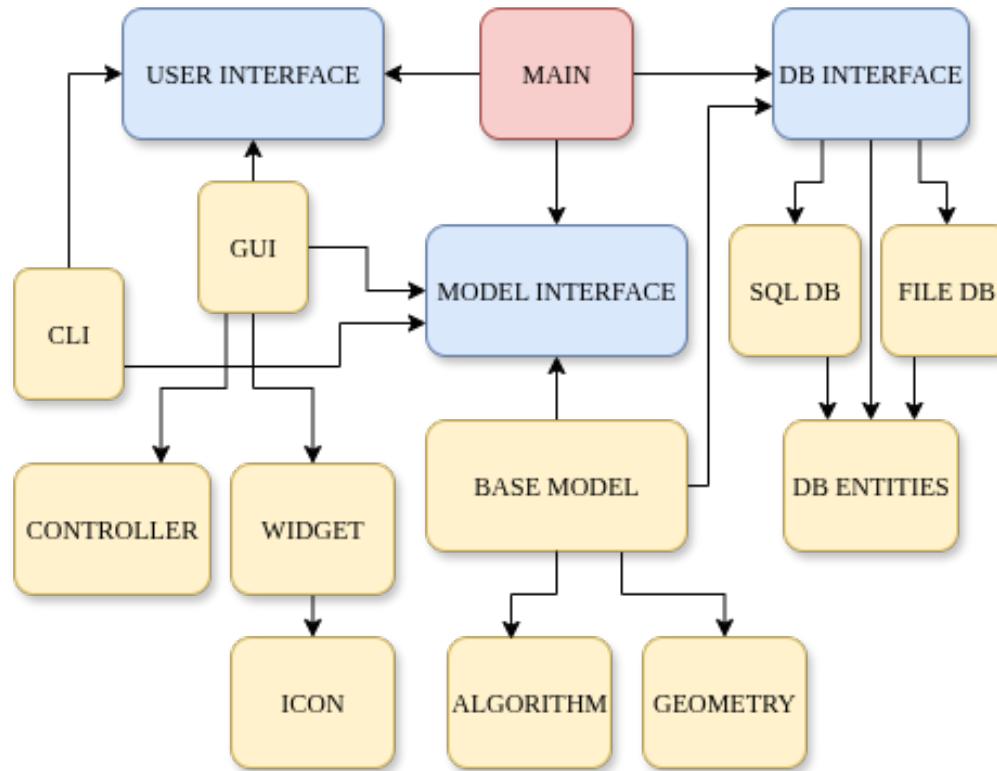


```
# running tests inside a specific package
python -m pytest base_model/geometry
```

```
# linting a specific package
ruff check gui/widget/icon
```

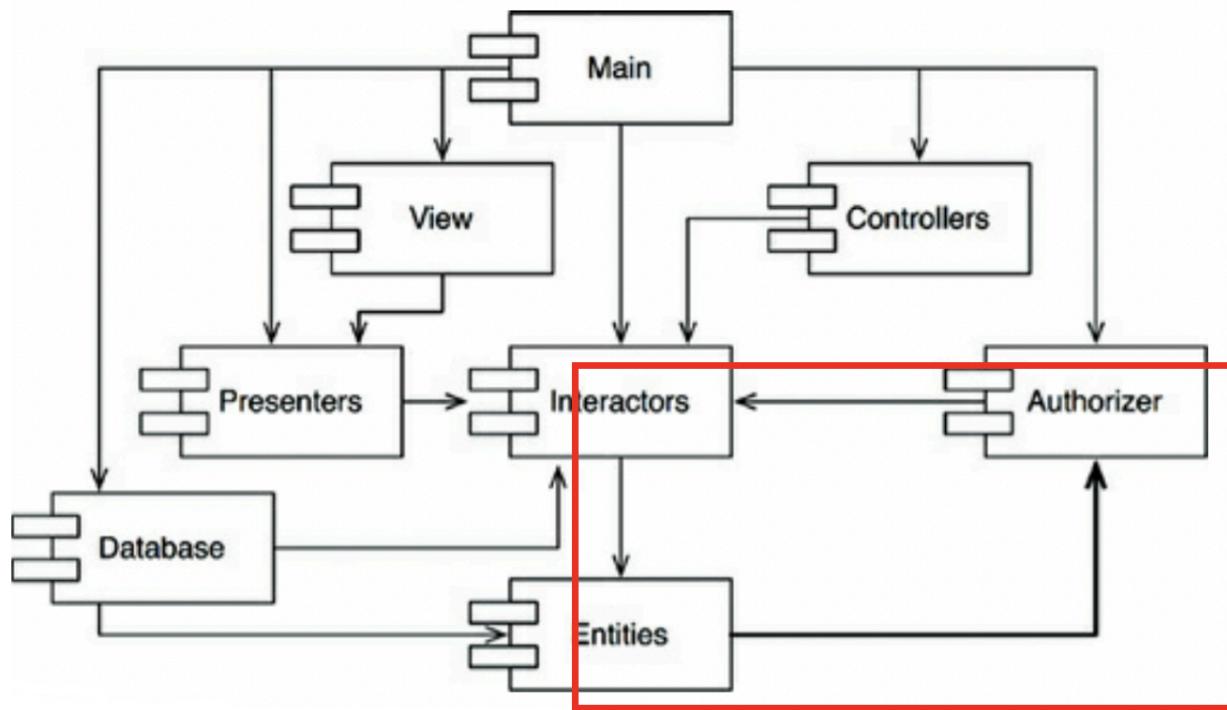
Benefit: Individual package as a separated component ("divide and conquer")

Why to care about clean modular structure?



Benefit: Make the code easier to understand, increased maintainability

Why to care about clean modular structure?



Benefit: Easier to change one component without affecting another because of loose coupling

Python circular imports. A bug or a feature?

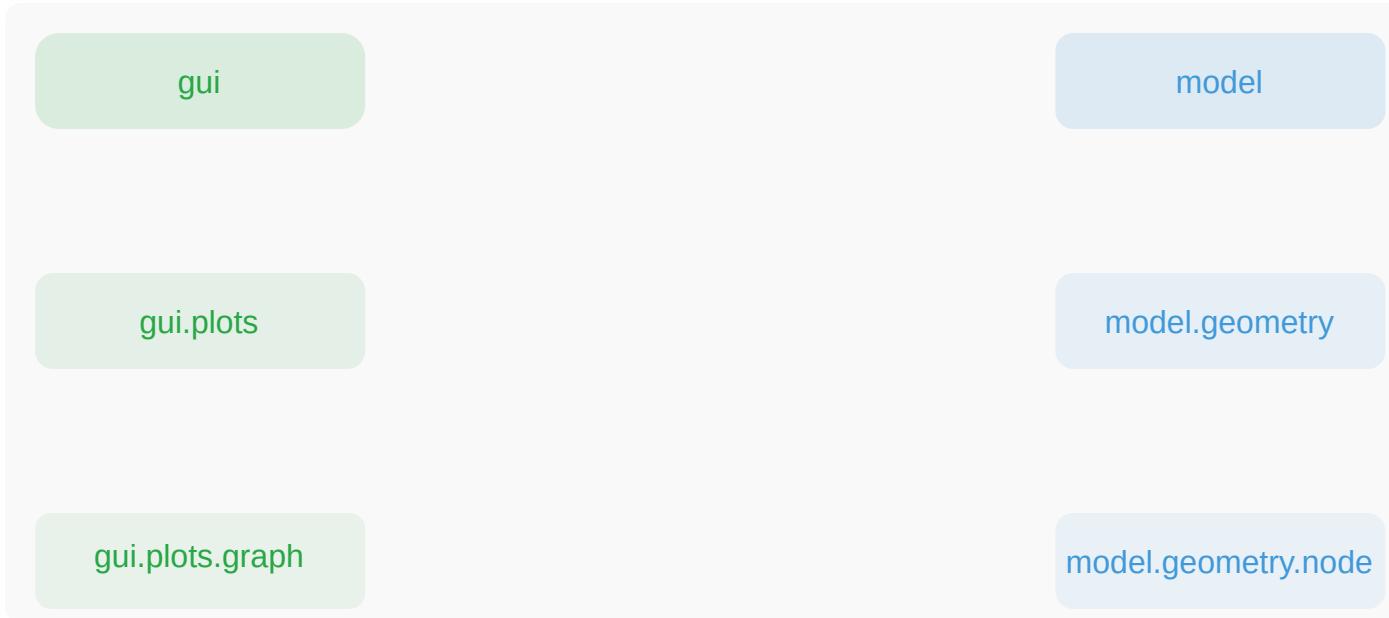
```
File "gui/__init__.py", line 1, in
  from model import Node
File "model/__init__.py", line 1, in
  from .geometry import Node
File "model/geometry/__init__.py", line 3, in
  from gui import Graph
~~~~~  
ImportError: cannot import name 'Graph' from partially initialized module 'gui'
(most likely due to a circular import) (/gui/__init__.py)
```

Circular imports most of the time signal a design issue, but sometimes are used intentionally for plugin systems or late binding.

Re-exporting definitions through `__init__.py`

```
# model/geometry/node.py
class Node: ...
# model/geometry/__init__.py
from .node import Node, function_a
from .edge import Edge, function_b
# model/__init__.py
from .geometry import Node, Edge, function_a, function_b
from .other_module import SomeOtherClass
# gui/__init__.py
from model import Node, Edge, function_a, function_b, SomeOtherClass
```

Circular dependencies between packages



Lets consider packages "model" and "gui" having some subpackages (no imports yet)

Circular dependencies between packages



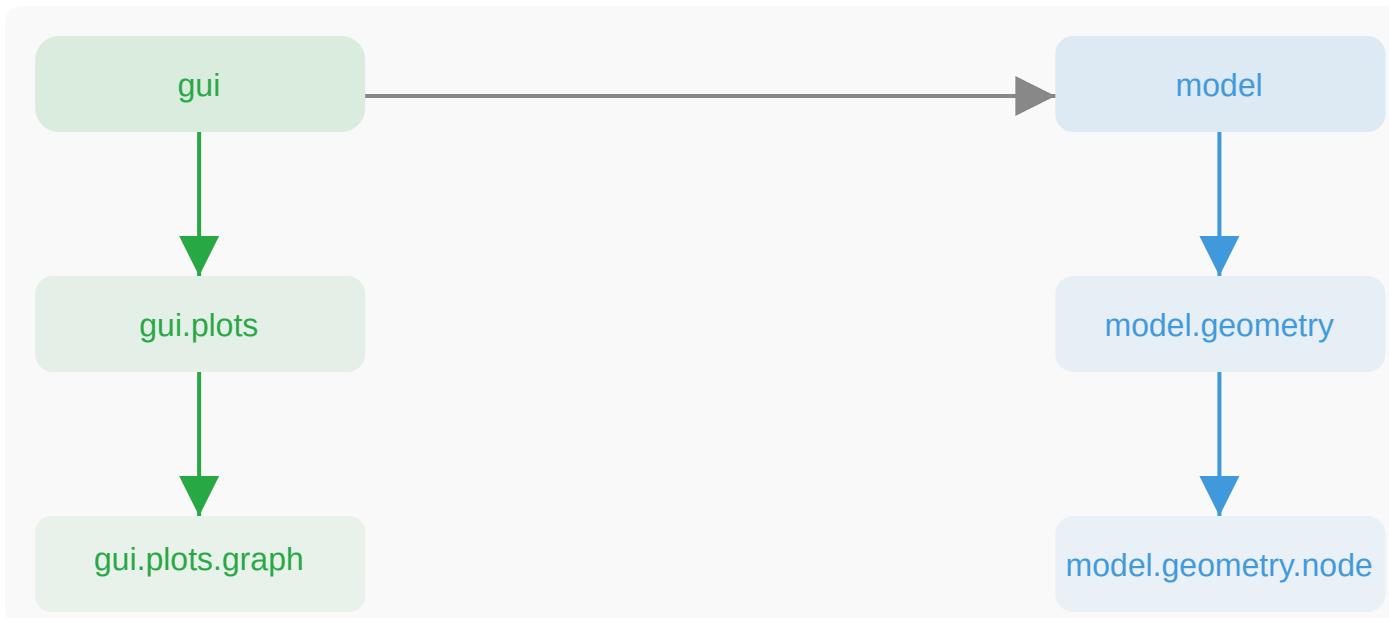
Package "gui" imports Node class from package "model" (module "model.geometry.node").

Circular dependencies between packages



Package "gui" imports Node class from module "model.geometry.node".
Packages "model" and "gui" re-exporting everything through `__init__.py`.

Circular dependencies between packages



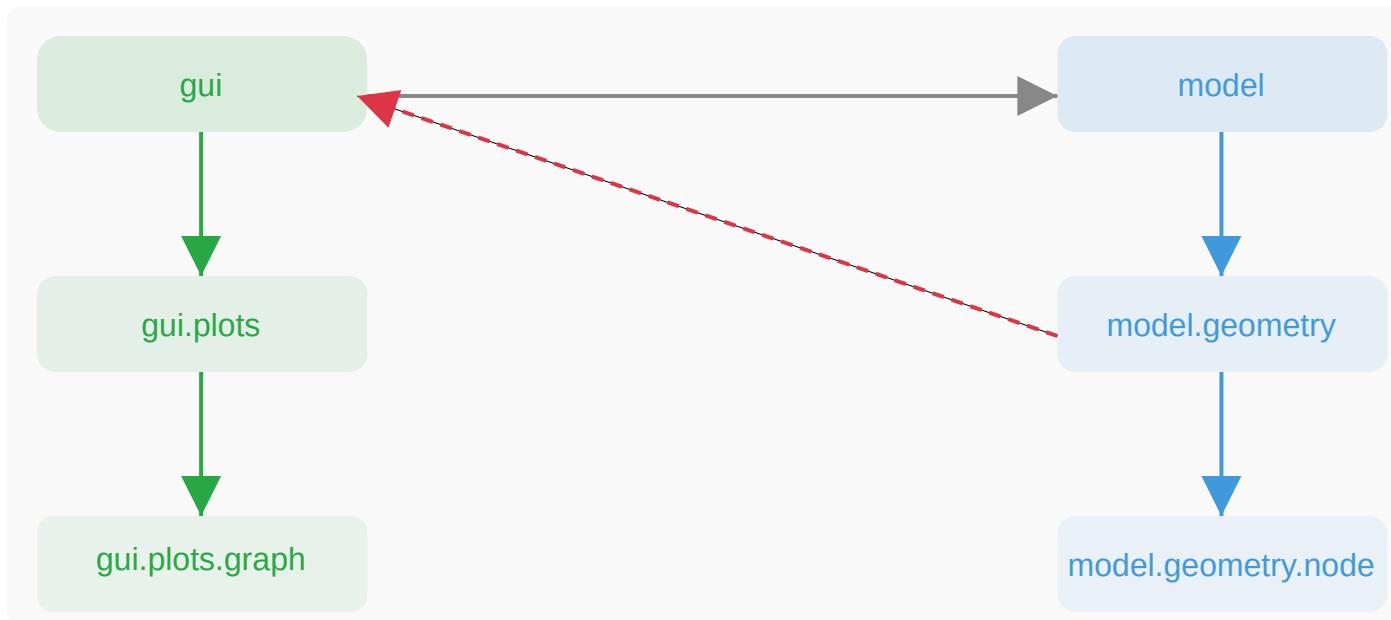
Package "gui" imports Node class from package "model". Packages "model" and "gui" re-exporting everything through `__init__.py`.

Circular dependencies between packages



Attempting to add a dependency from "model" to "gui" directly from the module "gui.plots.graph".

Circular dependencies between packages



Attempting to add a dependency from "model" to "gui", using re-exported entity, creates a circular dependency.

Circular dependencies between packages

```
# model/geometry/node.py
class Node: ...

# model/geometry/__init__.py
from .node import Node

# model/__init__.py
from .geometry import Node

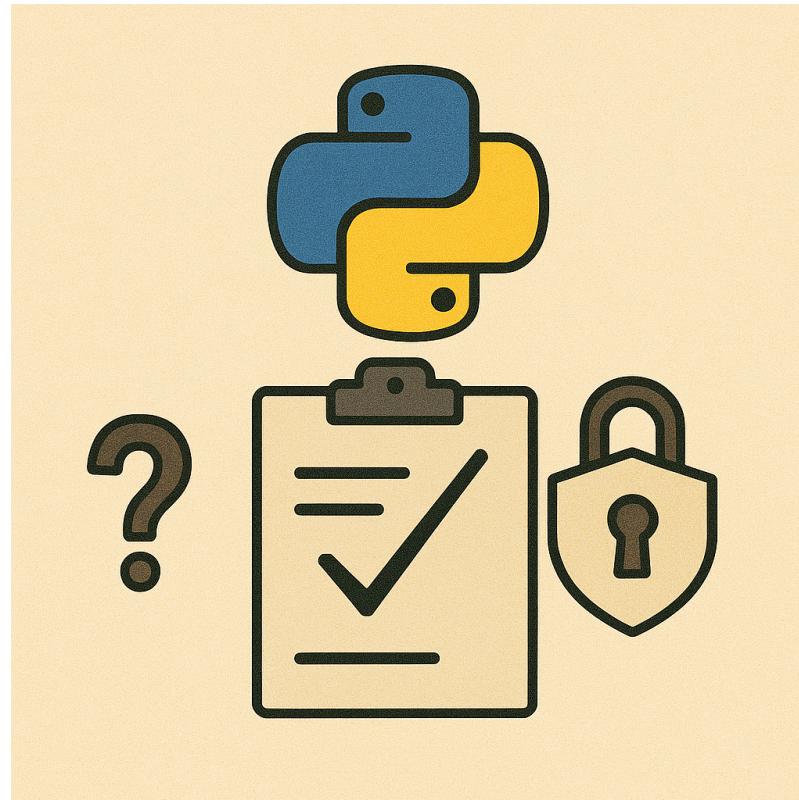
# gui/__init__.py
from model import Node

# model/geometry/__init__.py
from gui import Graph
```

```
File "gui/__init__.py", line 1, in
    from model import Node
File "model/__init__.py", line 1, in
    from .geometry import Node
File "model/geometry/__init__.py", line 3, in
    from gui import Graph
^^^^^^^^^^^^^^^^^^^^^^^^^
```

```
ImportError: cannot import name 'Graph' from partially initialized module 'gui'
(most likely due to a circular import) (/gui/__init__.py)
```

V. How can we enforce the selected strategy in CI?



Ruff

```
from functools import partial
import sys

import pandas as pd
from pydantic import BaseModel
from pydantic import Field

from my_another_package.graph import Graph
from my_another_package.graph import Node
from my_package.model import model
```

```
1 # ruff.toml
2 [lint]
3 select = [
4     "I", # isort                                     (1)
5     "PLC0415", # import-outside-top-level           (2)
6     "TID252", # relative-imports                   (3)
7     "INP001", # implicit-namespace-package         (4)
8     "F403", # undefined-local-with-import-star-usage (5)
9 ]
10 [lint.isort]
11 known-first-party = ["my_another_package"] #      (6)
12 force-single-line = true #                      (7)
13 only-imports-from-defining-module = true # (WIP) (8)
```

Ruff

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6     "TID252", # relative-imports                   (3)
7     "INP001", # implicit-namespace-package         (4)
8     "F403", # undefined-local-with-import-star-usage (5)
9 ]
10 [lint.isort]
11 known-first-party = ["my_another_package"] #      (6)
12 force-single-line = true #                      (7)
13 only-imports-from-defining-module = true # (WIP) (8)
```

Ruff

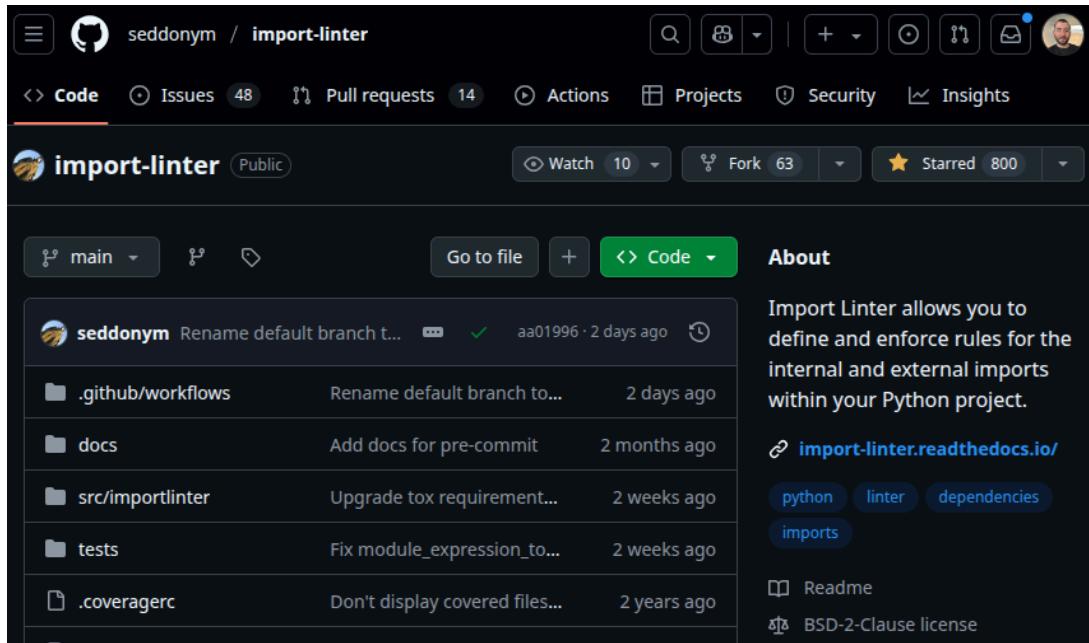
```
from functools import partial
import sys

import pandas as pd
from pydantic import BaseModel
from pydantic import Field

from my_another_package.graph import Graph
from my_another_package.graph import Node
from my_package.model import model
```

```
1 # ruff.toml
2 [lint]
3 select = [
4     "I", # isort                                     (1)
5     "PLC0415", # import-outside-top-level           (2)
6     "TID252", # relative-imports                   (3)
7     "INP001", # implicit-namespace-package         (4)
8     "F403", # undefined-local-with-import-star-usage (5)
9 ]
10 [lint.isort]
11 known-first-party = ["my_another_package"] #      (6)
12 force-single-line = true #                      (7)
13 only-imports-from-defining-module = true # (WIP) (8)
```

Import Linter



"Import Linter allows you to define and enforce rules for the internal and external imports within your Python project."

Import Linter - Forbidden modules

```
[importlinter]
root_package = mypackage

[importlinter:contract:1]
name = GUI cannot be imported from other packages
type = forbidden
source_modules =
    mypackage.model
    mypackage.db
forbidden_modules =
    mypackage.gui
```

```
(mypackage) jan@jan-Inspiron-3543:~$ lint-imports
```

```
=====
Import Linter
=====
```

```
Analyzed 134 files, 699 dependencies.
-----
```

```
GUI cannot be imported from other packages KEPT
```

```
Contracts: 1 kept, 0 broken.
```

Import Linter - Layers

```
[importlinter]
root_package = my_package

[importlinter:contract:1]
name = Hierarchical architecture
type = layers
layers =
    mypackage.gui
    mypackage.model
    mypackage.db
```

```
(my_package) jan@jan-Inspiron-3543:~$ lint-imports
```

```
=====
```

```
Import Linter
```

```
=====
```

```
Analyzed 134 files, 699 dependencies.
```

```
-----
```

```
Hierarchical architecture KEPT
```

```
Contracts: 1 kept, 0 broken.
```

Import Linter - Acyclic dependencies

```
pip install import-linter@git+https://github.com/K4liber/import-linter@issue/221_tree_contract
```

```
# .importlinter

[importlinter]
root_package = django

[importlinter:contract:1]
name=Acyclic dependecies
type=acyclic
packages=
    django
consider_package_dependencies = true
group_by_family = true
```

```
(django) jan@jan-Inspiron-3543:~$ lint-imports --verbose
```

Import Linter - Acyclic dependencies

```
Number of dependency cycles found for a contract 'Acyclic dependecies': 252
Package level cycles: 148
Module level cycles: 104
```

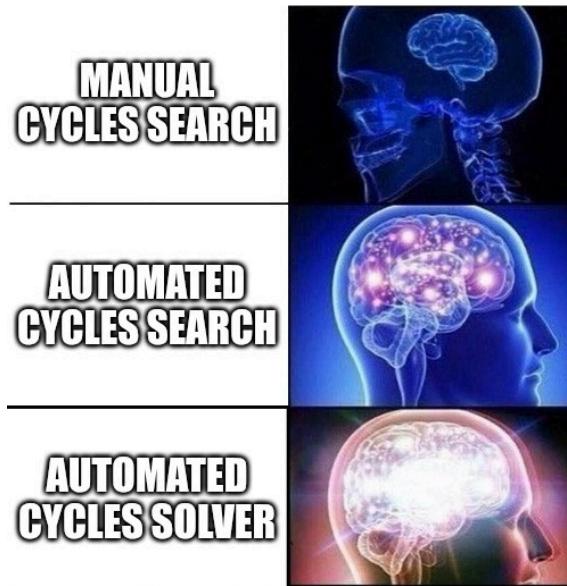
...

```
Package django contains a (package) dependency cycle:
```

1. django.conf depends on django.views:
 - django.conf.urls -> django.views.defaults (l. 2)
2. django.views depends on django.template:
 - django.views.defaults -> django.template (l. 9)
3. django.template depends on django.urls:
 - django.template.defaulttags -> django.urls (l. 468)
4. django.urls depends on django.conf:
 - django.urls.resolvers -> django.conf.urls (l. 744)

...

Import Linter - Cycles solver



Show cycle breakers using "minimum weighted feedback arc set" algorithm

Summary

1. Importing in Python can be done in many different ways
2. Choosing one, consistent way, will reduce decision fatigue
3. Clean modular structure of your Python code matters
4. Following Acyclic Dependencies Principle (ADP) leads to a better software design
5. Using tools like Ruff and Import Linter facilitate checks automation

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