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Young Won Lim 7/26/24

Package (1)

modules are

files containing Python <u>statements</u> and <u>definitions</u>, like <u>function</u> and <u>class</u> <u>definitions</u>.

to <u>bundle multiple</u> modules together, create a package.

a package is basically a directory with several Python files (modules) and a special file <u>__init__.py</u>

inside of the Python path, every directory contains <u>__init__.py</u>, will be treated as a package by Python.

https://python-course.eu/python-tutorial/packages.php

Submodules in a package

packages are a way of <u>structuring</u> Python's module namespace by using "dotted module names".

A.B stands for a submodule named **B** in a package named **A**.

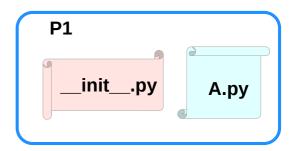
two different packages like **P1** and **P2** can both have modules with the <u>same name</u>, let's say **A**, for example.

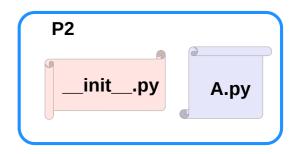
The submodule **A** of the package **P1** and the submodule **A** of the package **P2** can be totally different.

4

P1.A P2.A

A package is imported <u>like</u> a "normal" module.





https://python-course.eu/python-tutorial/packages.php

Creating a package

to create a package, we need a directory.

the name of this directory will be the name of the package,

assume we want to create "simple_package" package

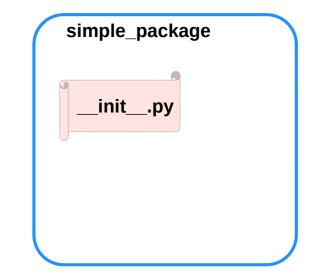
must create directory "simple_package" and this directory needs to contain the "<u>___init___.py</u>" file

this file can be <u>empty</u>, or can contain valid Python <u>code</u>.

this code will be <u>executed</u> when a package is <u>imported</u>,

so it can be used to initialize a package,

e.g. to make sure that some other modules are <u>imported</u> or some values <u>set</u>.



https://python-course.eu/python-tutorial/packages.php

Examples of creating a package (1)

put all of the Python files which will be the submodules into the directory for a package.

create two simple files a.py and b.py

a.py:

submodule a

def bar(): print("Hello, function 'bar' from module 'a' calling")

b.py:

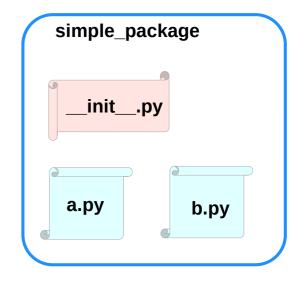


def foo():
 print("Hello, function 'foo' from module 'b' calling")

an <u>empty file</u> with the name __init__.py inside of simple package directory

init.py:

empty file



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Examples of creating a package (2)

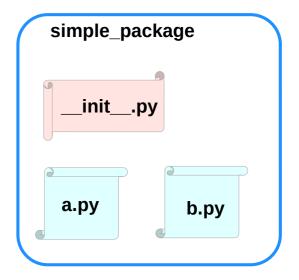
import simple_package from the interactive Python shell,

assuming that the directory **simple_package** is

either in the directory from which you call the shell or

that it is contained in the search path or

environment variable "PYTHONPATH" (from your operating system):



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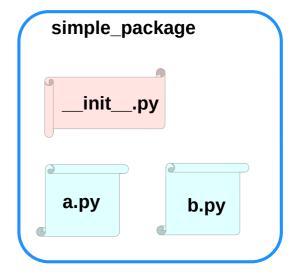
Examples of creating a package (3)

import simple_package simple_package/a

NameError Traceback (most recent call last) <ipython-input-3-347df8a711cc> in <module> ----> 1 simple_package/a NameError: name 'a' is not defined

simple_package/b

NameError Traceback (most recent call last) <ipython-input-4-e71d2904d2bd> in <module> ----> 1 simple_package/b NameError: name 'b' is not defined



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Examples of creating a package (4)

the package simple_package has been <u>loaded</u> but <u>neither</u> the module "a" <u>nor</u> the module "b" has been <u>loaded</u>

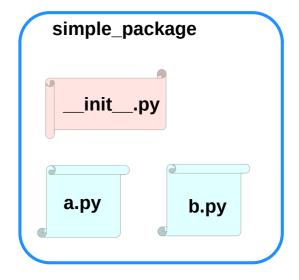
<u>can't access</u> neither "a" nor "b" by solely <u>importing</u> <u>simple_package</u>.

must import the modules a and b as follows

from simple_package import a, b

a.bar() b.foo()

Hello, function 'bar' from module 'a' calling Hello, function 'foo' from module 'b' calling



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Examples of creating a package (5)

to <u>automatically load</u> these modules.

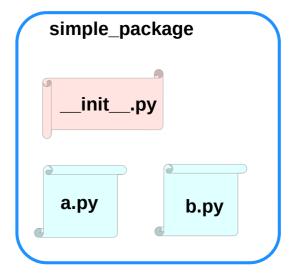
add the following lines to the file __init__.py:

import simple_package.a
import simple_package.b

Then

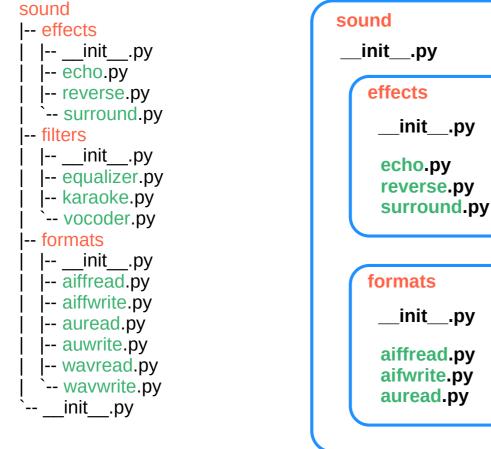
import simple_package
simple_package.a.bar()
simple_package.b.foo()

Hello, function 'bar' from module 'a' calling Hello, function 'foo' from module 'b' calling



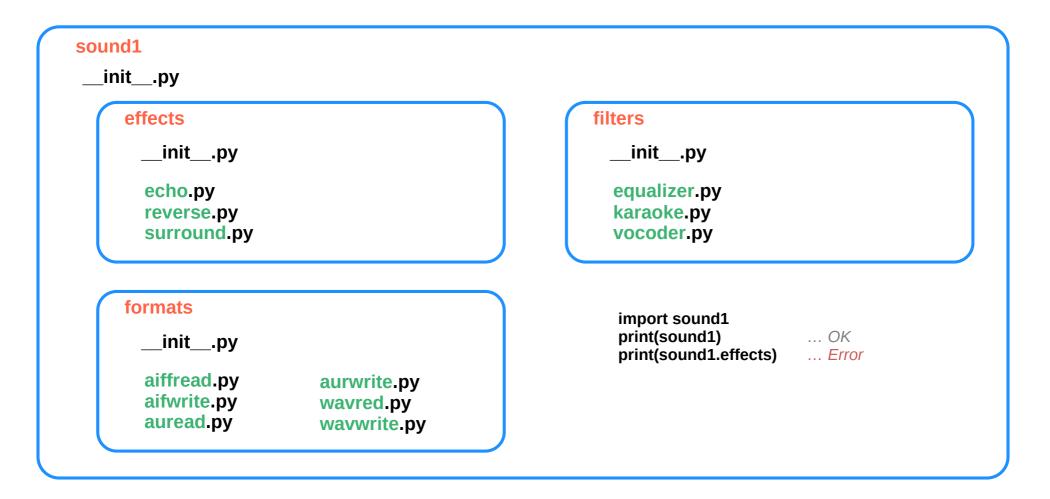
https://python-course.eu/python-tutorial/packages.php

Package Examples (1)

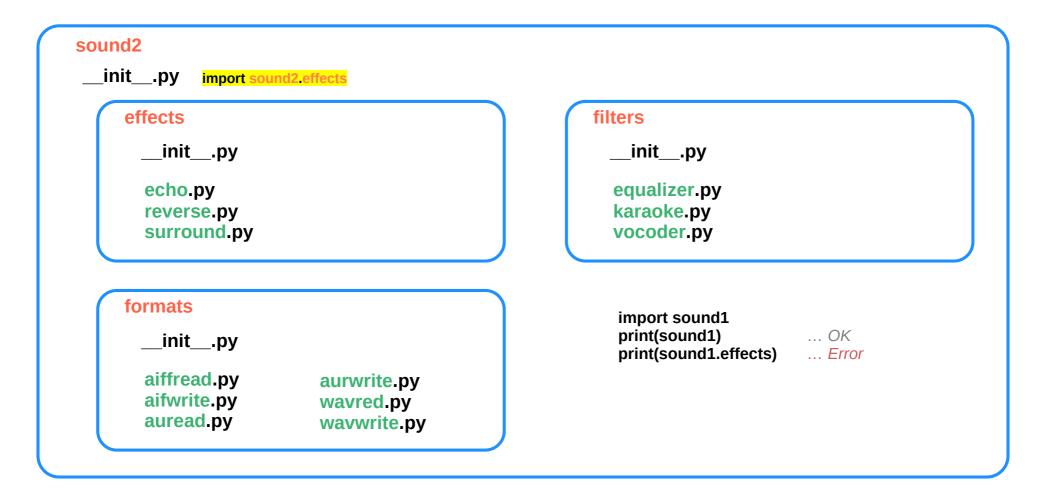


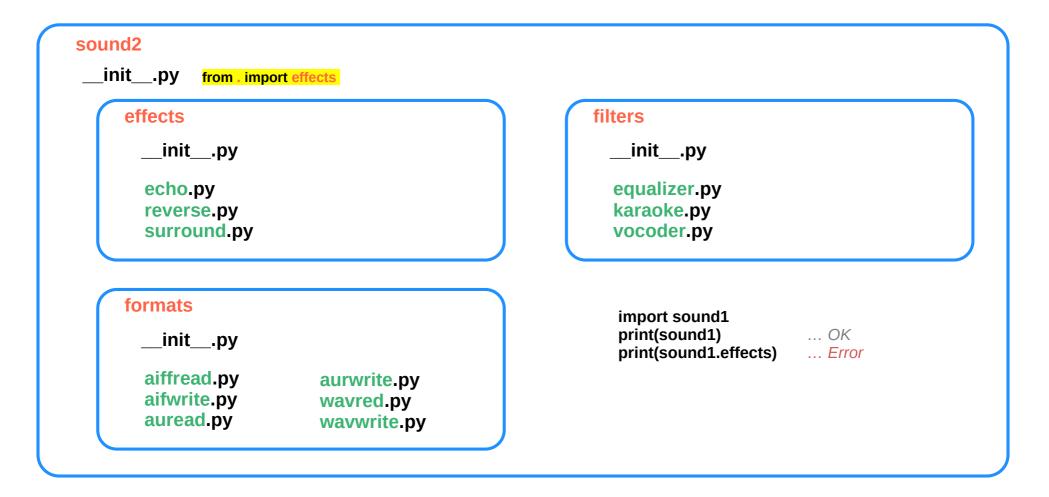
effects	filters		
initpy	initpy		
echo.py reverse.py surround.py	equalizer.py karaoke.py vocoder.py		
formats			
initpy			
aiffread.py aurwrite.py aifwrite.py wavred.py			

https://python-course.eu/python-tutorial/packages.php

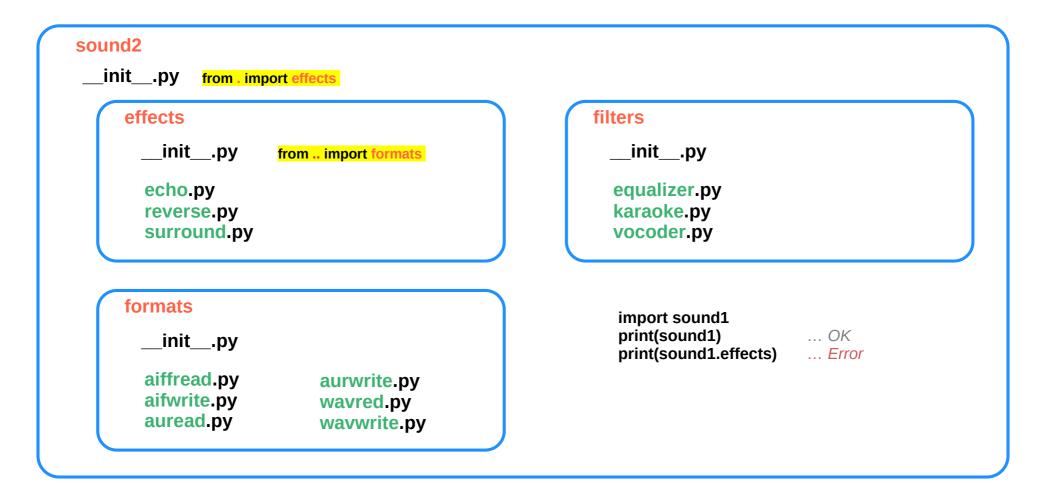


https://python-course.eu/python-tutorial/packages.php

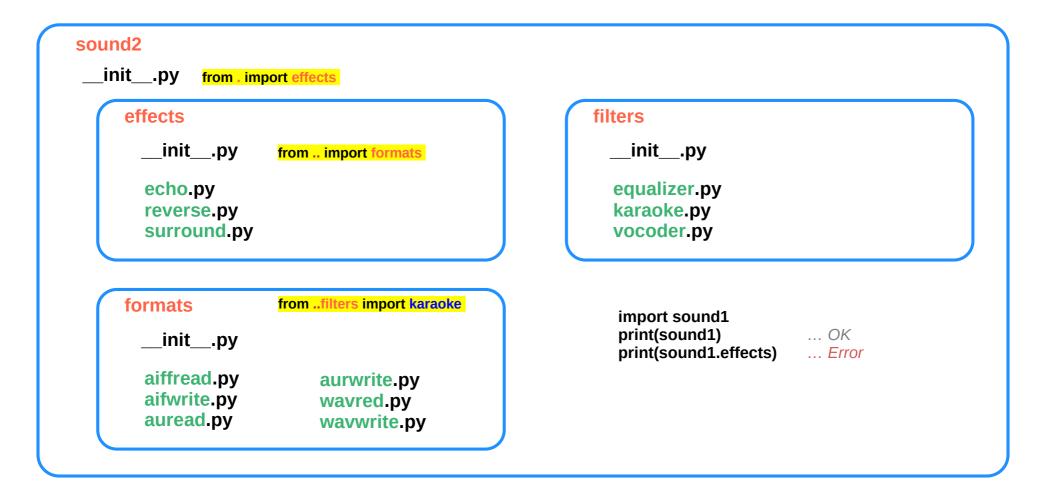




https://python-course.eu/python-tutorial/packages.php



https://python-course.eu/python-tutorial/packages.php



https://python-course.eu/python-tutorial/packages.php

Package sound1 (1)

__init__.py print("sound1 package is getting imported!")

effects/__init__.py
print("effects package is getting imported!")

effects/echo.py

def func1():

print("Function func1 has been called!") print("Module echo.py has been loaded!")

effects/reverse.py

def func1():

print("Function func1 has been called!") print("Module reverse.py has been loaded!")

effects/surround.py

def func1():
 print("Function func1 has been called!")

sound

-- effects -- filters

- -- formats
- --__init__.py

filters/__init__.py

print("filters package is getting imported!")

filters/equalizer.py

def func1():

print("Function func1 has been called!") print("Module equalizer.py has been loaded!")

filters/karaoke.py

def func1():

print("Function func1 has been called!") print("Module karaoke.py has been loaded!")

filters/vocoder.py

def func1():

print("Function func1 has been called!") print("Module vocoder.py has been loaded!")

If we import the package sound1 by using the statement **import sound1**, Only the package sound1 is imported but none of the <u>subpackages</u> will be imported effects, filters and formats

because the file <u>__init__.py</u> <u>doesn't</u> contain any code for importing <u>subpackages</u>:

import sound1print(sound1)... OKprint(sound1.effects)... Error

formats/__init__.py
print("formats package is getting imported!")

formats/aiffread.py

def func1():

print("Function func1 has been called!") print("Module aiffread.py has been loaded!")

formats/aiffwrite.py

def func1():

print("Function func1 has been called!") print("Module aiffwrite.py has been loaded!")

formats/auread.py

def func1():

print("Function func1 has been called!") print("Module auread.py has been loaded!")

formats/auwrite.py

def func1():

print("Function func1 has been called!") print("Module auwrite.py has been loaded!")

formats/wavread.py

def func1():

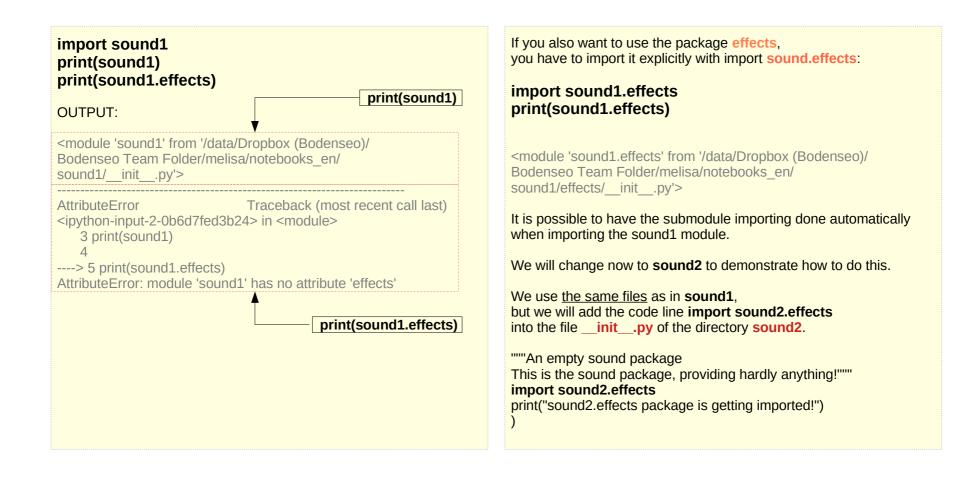
print("Function func1 has been called!") print("Module wavread.py has been loaded!")

formats/wavwrite.py

def func1():

print("Function func1 has been called!") print("Module wavwrite.py has been loaded!")

Package sound1 (2)



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__init__.py print("sound2 package is getting imported!") import sound2.effects

effects/__init__.py
print("effects package is getting imported!")

effects/echo.py

def func1():

print("Function func1 has been called!") print("Module echo.py has been loaded!")

effects/reverse.py

def func1():

print("Function func1 has been called!") print("Module reverse.py has been loaded!")

effects/surround.py

def func1():

print("Function func1 has been called!")

sound

- -- effects
- -- filters
- -- formats
- --__init__.py

filters/__init__.py

print("filters package is getting imported!")

filters/equalizer.py

def func1():

print("Function func1 has been called!") print("Module equalizer.py has been loaded!")

filters/karaoke.py

def func1():

print("Function func1 has been called!") print("Module karaoke.py has been loaded!")

filters/vocoder.py

def func1():

print("Function func1 has been called!") print("Module vocoder.py has been loaded!")

import sound2.effects

in __init__.py of the package sound2

when the package sound2 is imported, the subpackage effects will also be automatically loaded:

import sound2

sound2 package is getting imported! effects package is getting imported!

formats/__init__.py print("formats package is getting imported!")

formats/aiffread.py def func1();

print("Function func1 has been called!") print("Module aiffread.py has been loaded!")

formats/aiffwrite.py

def func1():

print("Function func1 has been called!") print("Module aiffwrite.py has been loaded!")

formats/auread.py

def func1():

print("Function func1 has been called!") print("Module auread.py has been loaded!")

formats/auwrite.py

def func1():

print("Function func1 has been called!") print("Module auwrite.py has been loaded!")

formats/wavread.py

def func1():

print("Function func1 has been called!") print("Module wavread.py has been loaded!")

formats/wavwrite.py

def func1():
 print("Function func1 has been called!")

print("Module wavwrite.py has been loaded!")

__init__.py print("sound3 package is getting imported!") from . import effects

effects/__init__.py
print("effects package is getting imported!")

effects/echo.py

def func1():

print("Function func1 has been called!")
print("Module echo.py has been loaded!")

effects/reverse.py

def func1():

print("Function func1 has been called!")
print("Module reverse.py has been loaded!")

effects/surround.py

def func1():
 print("Function func1 has been called!")

sound

- -- effects
- -- filters
- -- formats
- |-- __init__.py

filters/__init__.py

print("filters package is getting imported!")

filters/equalizer.py

def func1():

print("Function func1 has been called!") print("Module equalizer.py has been loaded!")

filters/karaoke.py

def func1():

print("Function func1 has been called!") print("Module karaoke.py has been loaded!")

filters/vocoder.py

def func1():

print("Function func1 has been called!") print("Module vocoder.py has been loaded!")

Instead of using an absolute path we could have imported the effects package relative to the sound2 package.

import sound2.effects # absolute path

from . import effects # relative path

import sound3

sound3 package is getting imported! effects package is getting imported!

formats/__init__.py print("formats package is getting imported!")

formats/aiffread.py def func1();

print("Function func1 has been called!") print("Module aiffread.py has been loaded!")

formats/aiffwrite.py

def func1():

print("Function func1 has been called!") print("Module aiffwrite.py has been loaded!")

formats/auread.py

def func1():

print("Function func1 has been called!") print("Module auread.py has been loaded!")

formats/auwrite.py

def func1():

print("Function func1 has been called!") print("Module auwrite.py has been loaded!")

formats/wavread.py

def func1():

print("Function func1 has been called!") print("Module wavread.py has been loaded!")

formats/wavwrite.py

def func1():

print("Function func1 has been called!") print("Module wavwrite.py has been loaded!")

__init__.py print("sound4 package is getting imported!") from . import effects

effects/__init__.py print("effects package is getting imported!") from .. import formats

effects/__init__.py
print("effects package is getting imported!")

effects/echo.py

def func1():
 print("Function func1 has been called!")
print("Module echo.py has been loaded!")

effects/reverse.py

def func1():

print("Function func1 has been called!")
print("Module reverse.py has been loaded!")

effects/surround.py def func1(): print("Function func1 has been called!")

sound I-- effects

- -- filters
- -- formats
- |-- __init__.py

filters/__init__.py

print("filters package is getting imported!")

filters/equalizer.py

def func1():

print("Function func1 has been called!") print("Module equalizer.py has been loaded!")

filters/karaoke.py

def func1():

print("Function func1 has been called!") print("Module karaoke.py has been loaded!")

filters/vocoder.py

def func1():

print("Function func1 has been called!") print("Module vocoder.py has been loaded!")

import sound4

sound4 package is getting imported! effects package is getting imported! formats package is getting imported!

in the __init__.py file of sound4 directory

from . import effects

in the __init__.py file of effects directory

from .. import formats

formats/__init__.py print("formats package is getting imported!")

formats/aiffread.py def func1();

print("Function func1 has been called!") print("Module aiffread.py has been loaded!")

formats/aiffwrite.py

def func1():

print("Function func1 has been called!") print("Module aiffwrite.py has been loaded!")

formats/auread.py

def func1():

print("Function func1 has been called!") print("Module auread.py has been loaded!")

formats/auwrite.py

def func1():

print("Function func1 has been called!") print("Module auwrite.py has been loaded!")

formats/wavread.py

def func1():

print("Function func1 has been called!") print("Module wavread.py has been loaded!")

formats/wavwrite.py def func1():

print("Function func1 has been called!") print("Module wavwrite.py has been loaded!")

__init__.py print("sound5 package is getting imported!") from . import effects

effects/__init__.py print("effects package is getting imported!") from .. import formats

effects/__init__.py
print("effects package is getting imported!")

effects/echo.py def func1():

print("Function func1 has been called!") print("Module echo.py has been loaded!")

effects/reverse.py

def func1():

print("Function func1 has been called!")
print("Module reverse.py has been loaded!")

effects/surround.py

def func1():

print("Function func1 has been called!")

sound

-- effects

- -- filters
- -- formats
- -- __init__.py

filters/__init__.py print("filters package is getting imported!")

filters/equalizer.py

def func1():

print("Function func1 has been called!") print("Module equalizer.py has been loaded!")

filters/karaoke.py

def func1():

print("Function func1 has been called!") print("Module karaoke.py has been loaded!")

filters/vocoder.py

def func1():

print("Function func1 has been called!") print("Module vocoder.py has been loaded!")

import karaoke module from filters package when we import the effects package.

from ..filters import karaoke
into the __init__.py file of formats directory

can access the functions of karaoke :

sound5.filters.karaoke.func1()

Function func1 has been called!

formats/__init__.py print("formats package is getting imported!") from ..filters import karaoke

formats/aiffread.py

def func1():

print("Function func1 has been called!") print("Module aiffread.py has been loaded!")

formats/aiffwrite.py

def func1():
 print("Function func1 has been called!")
print("Module aiffwrite.py has been loaded!")

formats/auread.py

def func1():

print("Function func1 has been called!") print("Module auread.py has been loaded!")

formats/auwrite.py

def func1():

print("Function func1 has been called!") print("Module auwrite.py has been loaded!")

formats/wavread.py

def func1():

print("Function func1 has been called!") print("Module wavread.py has been loaded!")

formats/wavwrite.py

def func1():
 print("Function func1 has been called!")
print("Module wavwrite.py has been loaded!")



__init__.py print("sound5 package is getting imported!") from . import effects

effects/__init__.py print("effects package is getting imported!") from .. import formats

effects/__init__.py
print("effects package is getting imported!")

effects/echo.py def func1():

print("Function func1 has been called!") print("Module echo.py has been loaded!")

effects/reverse.py

def func1():

print("Function func1 has been called!")
print("Module reverse.py has been loaded!")

effects/surround.py

def func1():
 print("Function func1 has been called!")

sound

- -- effects
- -- filters
- -- formats
- -- __init__.py

filters/__init__.py print("filters package is getting import

print("filters package is getting imported!")

filters/equalizer.py

def func1():

print("Function func1 has been called!") print("Module equalizer.py has been loaded!")

filters/karaoke.py

def func1():

print("Function func1 has been called!") print("Module karaoke.py has been loaded!")

filters/vocoder.py

def func1():

print("Function func1 has been called!") print("Module vocoder.py has been loaded!")

import karaoke module from filters package when we import the effects package.

from ..filters import karaoke
into the __init__.py file of formats directory

can access the functions of karaoke :

sound5.filters.karaoke.func1()

Function func1 has been called!

formats/__init__.py print("formats package is getting imported!") from ..filters import karaoke

formats/aiffread.py

def func1():

print("Function func1 has been called!") print("Module aiffread.py has been loaded!")

formats/aiffwrite.py

def func1():
 print("Function func1 has been called!")
print("Module aiffwrite.py has been loaded!")

formats/auread.py

def func1():

print("Function func1 has been called!") print("Module auread.py has been loaded!")

formats/auwrite.py

def func1():

print("Function func1 has been called!") print("Module auwrite.py has been loaded!")

formats/wavread.py

def func1():

print("Function func1 has been called!") print("Module wavread.py has been loaded!")

formats/wavwrite.py

def func1():
 print("Function func1 has been called!")
print("Module wavwrite.py has been loaded!")

Package sound6 (1)

add a module (file) **foobar** (filename: **foobar.py**) to the **sound** directory.

might expect to import this way all the submodules and subpackages of the package.

from sound6 import *

sound package is getting imported!

Yet, if we check with the **dir** function, we see that neither the module **foobar** nor the subpackages **effects**, **filters** and **formats** have been imported:

for mod in ['foobar', 'effects', 'filters', 'formats']: print(mod, mod in dir())

foobar False effects False filters False formats False

https://python-course.eu/python-tutorial/packages.php

Package sound7 (1)

to give an explicit index of the **subpackages** and **modules** of a packages, which should be imported.

can define a list named __all__. as the <u>list</u> of **module** and **package names** to be imported when **from package import** * is encountered.

__all__ = ["formats", "filters", "effects", "foobar"]

to the __init__.py file of the sound directory.

from sound7 import *

sound package is getting imported! formats package is getting imported! filters package is getting imported! effects package is getting imported! foobar module is getting imported Even though it is already apparent that all the modules have been imported, we can check with **dir** again:

for mod in ['foobar', 'effects', 'filters', 'formats']: print(mod, mod in dir())

foobar True effects True filters True formats True

if we use * in a subpackage:

from sound.effects import *
sound package is getting imported!
effects package is getting imported!

dir()

1	_builtins	· · ·	_doc	,	_loader_	 _name_	,
	package_	, ,	_spec	;']			

Like expected the modules inside of effects have <u>not</u> been imported automatically.

https://python-course.eu/python-tutorial/packages.php

Package sound8 (1)

So we can add the following <u>all</u> list into the <u>init</u> file of the package **effects**:

We have to add to the __init__.py files of the directories **filters**, **formats** and **effects** corrrespondingly the following lines of code:

__all__ = ["equalizer", "__init__", "karaoke", "vocoder"]
__all__ = ["aiffread", "aiffwrite", "auread", "auwrite",
"wavread", "wavwrite"]
__all__ = ["echo", "surround", "reverse"]

Now we get the intended result:

from sound8 import *

sound package is getting imported! formats package is getting imported! filters package is getting imported! effects package is getting imported! foobar module is getting imported

from sound8.effects import *

Module echo.py has been loaded! Module surround.py has been loaded! Module reverse.py has been loaded!

from sound8.filters import *

Module equalizer.py has been loaded! Module karaoke.py has been loaded! Module vocoder.py has been loaded!

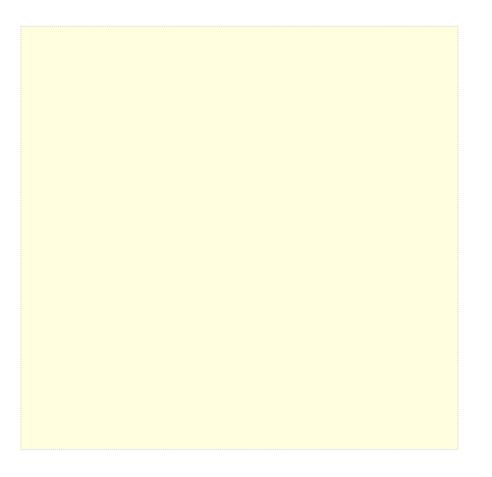
from sound8.formats import *

Module aiffread.py has been loaded! Module aiffwrite.py has been loaded! Module auread.py has been loaded! Module auwrite.py has been loaded! Module wavread.py has been loaded! Module wavwrite.py has been loaded!

Although certain modules are designed to export only names that follow certain patterns when you use import, it is still considered bad practice. The recommended way is to import specific modules from a package instead of using

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Package **sound6** (3)



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