Packages (1A)

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Modules and Packages

a module in Python is a single file
that contains Python code
– functions, statements, variables, and classes.

a self-contained unit of code
can be imported and used
in other programs or modules.

a package, is a collection of modules
organized in a directory

can group multiple related modules together
under a common namespace,

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Working with Modules

modules can be imported and used
in other programs, modules, and packages.

can make smaller, manageable, and logical units.

improve organization, reusability, and maintainability.

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Creating a simple module

put a number of related functions, variables, and classes
in one module, and give the module any name we want

To create a module in Python,
open up an IDE or text editor, create a file,
and give it a descriptive name and a **.py** extension.

For this example, let's call it **sample.py**
and enter in the following code:

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Creating a simple module

```
# sample.py

sample_variable  = "This is a string variable in the sample.py module"

# A function in the module
def say_hello(name):
    return f"Hello, {name}  welcome to this simple module."

# This is another function in the module
def add(a, b):
    return f"The sum of {a} + {b} is = {a+b}"

print(sample_variable)
print(say_hello("aaa"))
print(add(2, 3))
```

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Creating a simple module

contains a variable named **sample_variable**
whose value is the string
"This is a string variable in the sample.py module".

this module also contains two function definitions.

the **say_hello()** function takes in a **name** parameter,
and it returns a welcome message if we pass a name to it.

The **add()** function returns the sum of two numbers
a, **b** that have been passed to it.

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Creating a simple module

To run

python sample.py

python3 sample.py

This is a string variable in the sample.py module
Hello, aaa welcome to this simple module.
The sum of 2 + 3 is = 5

For one-off module usage, we can run it as a standalone,
but most modules are made to be used in other modules
or other parts of a Python program.

So to use variables, functions, and classes
from one module in another module
we have to import the module.

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Using the **import** statement

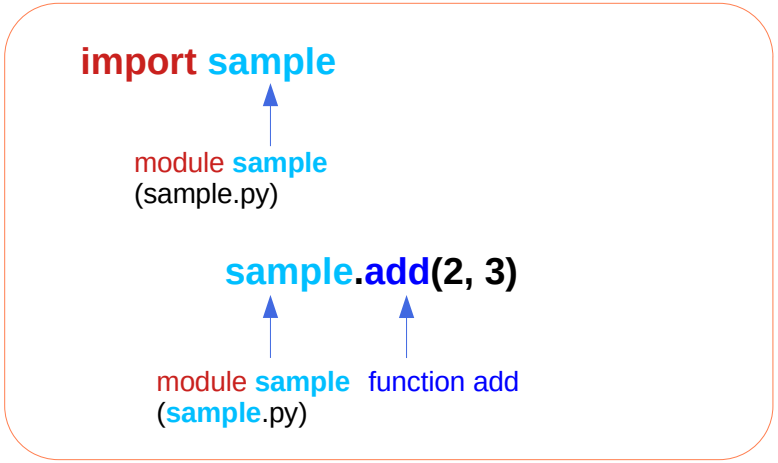
can use the import statement
to make the contents of one module available
for use in another module.

to use the contents of **sample.py** in another module,
we just import it:

```
# another_module.py

import sample

print(sample.sample_variable)
print(sample.say_hello("John"))
print(sample.add(2, 3))
```




```
# sample.py

sample_variable  = "This is a string variable in the sample.py module"

# A function in the module
def say_hello(name):
    return f"Hello, {name}  welcome to this simple module."

# This is another function in the module
def add(a, b):
    return f"The sum of {a} + {b} is = {a+b}"

print(sample_variable)
print(say_hello("aaa"))
print(add(2, 3))
```

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Using the **import** statement

shows how to import the functions from the **sample.py** module,
making them available for use in the **another_module.py**.

```
# another_module.py

import sample

print(sample.sample_variable)
print(sample.say_hello("John"))
print(sample.add(2, 3))
```

when we import a module,
we don't include the .py extension;

module **sample**
(**sample**.py)

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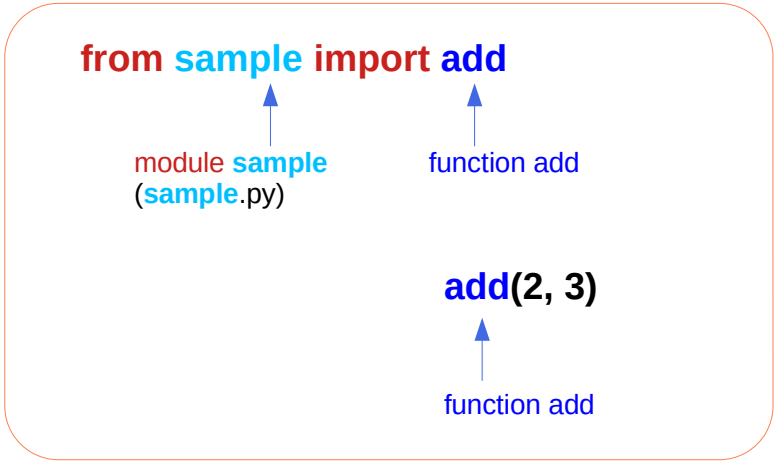
Using the **from** statement

can also use the **from** keyword
to import specific functions or variables.

can specify the functions or variables
we want to use, using the **from** keyword:




```
# another_module.py

from sample import add

print(add(10, 4))
```

specifically imported the add() function
from the sample module.

a module has a large number of
functions and variables defined in it 1
and we don't want to use all of them.

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Using the **from** statement

Another benefit of using the from keyword is that we'll run the imported function without namespacing it or prefixing it with the name of its parent module.

Instead, we'll use the function like we've defined it in the file where we're using it.

add(2, 3)

function add

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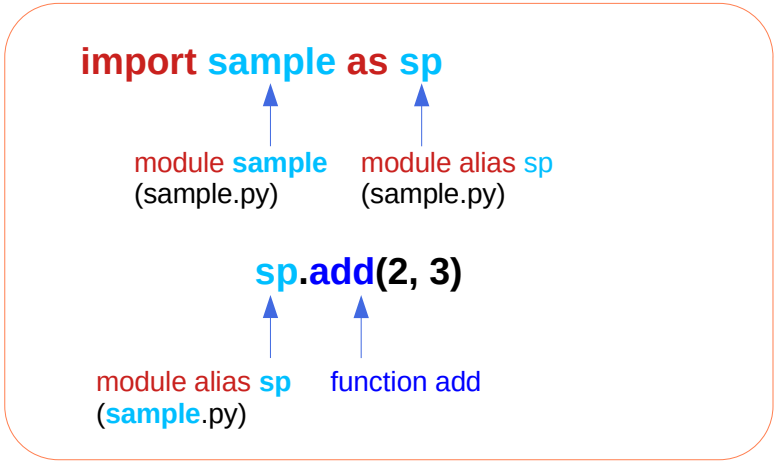
Using the **as** statement (1-1)

can use **as** to provide an alias or
an alternate name for the module.

```
# another_module.py

import sample as sp

result = sp.add(5, 5)
print(result)
print(sp.say_hello("Jason"))
```




```
result = sample.add(5, 5)
print(result)
print(sample.say_hello("Jason"))
```

```
# sample.py

sample_variable  = "This is a string variable in the sample.py module"

# A function in the module
def say_hello(name):
    return f"Hello, {name}  welcome to this simple module."

# This is another function in the module
def add(a, b):
    return f"The sum of {a} + {b} is = {a+b}"

print(sample_variable)
print(say_hello("aaa"))
print(add(2, 3))
```

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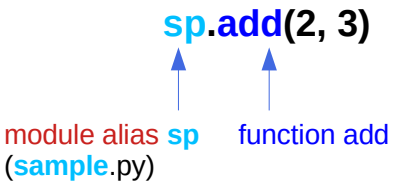
Using the **as** statement (1-2)

This code shows an import of the sample module,
where the module is being given an alternate name **sp**.

So using **sp** is just the same as calling sample.

Therefore, using the alias,
we have access to the variables and functions,
in the same way we could if we were using the original name.



At times, we may define module names
that are quite long or unreadable.

Python provides a way of giving the module imports an alternate or alias,
which we can use to refer to them in the modules we're importing them into.

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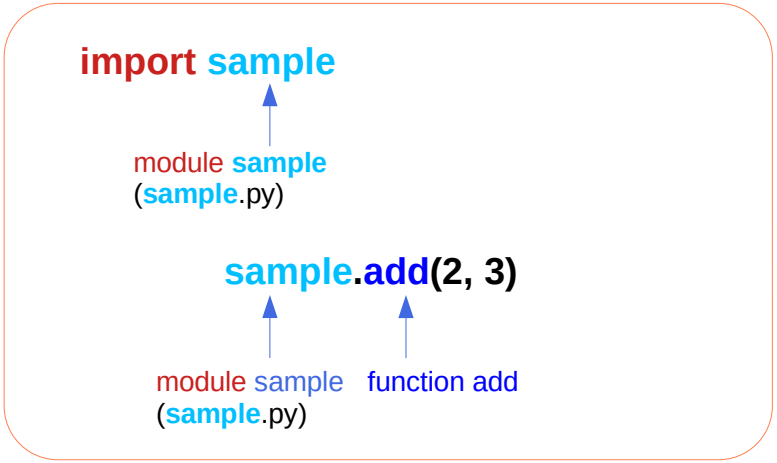
Three import examples

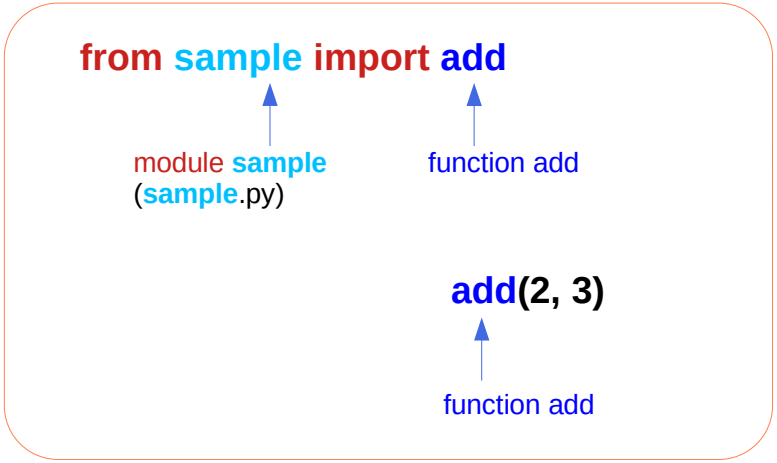
Using those three methods, we're able to use
the variables or functions from one module
in another module,
enhancing the readability of our application
where we don't need to put the code in one file.

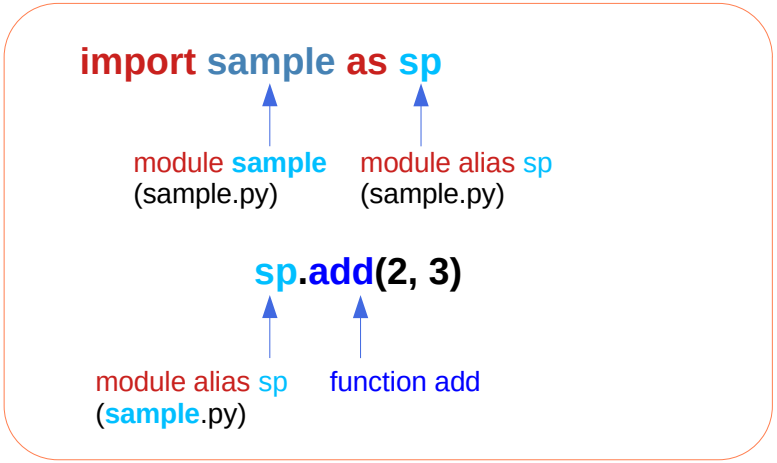
```
import sample

from sample import add

import sample as sp
```







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Naming modules

While naming our modules, it's good practice
to use lowercase letters and
separate words with underscores.

If a module name might cause a name clash
with a Python built-in keyword or
module from a third-party library,
consider using a different name or
adding a prefix that's relevant to the project.

remember that names are
case-sensitive in Python

Overall, using modules lets us
create and organize our code
in a readable and maintainable way.

common Python standard library modules.

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Package

A package in Python is a way of
organizing related modules into a directory.

to group modules that serve a common purpose
or are part of the same component.

when structuring larger projects or libraries.

modules are individual files containing Python code:
put related functions, classes, and variables within a single file.

In contrast, packages are directories
that contain multiple modules or subpackages.

by grouping related modules
a higher level of organization
more structured and maintainable projects.

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Building and managing packages (1)

While packages organize related code modules in one directory,
just putting the modules in a directory doesn't make it a package.

For Python to identify a directory as a package or a subpackage,
the directory must contain a special file named __init__.py.

This file notifies Python that the directory containing it
should be treated as a package or a subpackage.

This file could be empty, and most of the time it is,
but it can also contain initialization code,
and it plays a vital role in Python's package structure
and import mechanisms.

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Building and managing packages (2)

So using __init__.py tells Python
that we are intentionally creating a package,
thereby helping it differentiate between a package
and an ordinary directory.

Packages can have a hierarchical structure,
meaning we can create subpackages within our packages
to further organize our code.

This enables finer and more controlled separation
of components and functionality.

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Building and managing packages (3)

Consider the following example:

```
my_package/
├── __init__.py
├── module1.py
└── subpackage/
    ├── __init__.py
    ├── submodule1.py
    └── submodule2.py
```

my_package is the main package,
subpackage is a subpackage within **my_package**.

Both directories have an __init__.py file.

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Creating packages and sub-packages (1-1)

To create a package,
first create a directory
then we create an __init__.py file.
and create our modules in the directory
along with any subpackages.

```
calculator/
├── __init__.py
├── add.py
├── subtract.py
└── multiply.py
```

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```python
# add.py

def add(a, b):
    """
    adds two numbers and returns the result.

    :param a: First number.
    :param b: Second number.
    :return: Sum of a and b.
    """
    return a + b
```

```python
# subtract.py

def subtract(a, b):
    """
    subtracts two numbers and returns the result.

    :param a: First number.
    :param b: Second number.
    :return: Difference of a and b.
    """
    return a - b
```

Importing from packages - absolute import

Absolute imports are used
to directly import modules or subpackages
from the top-level package,

specify the full path to the module or package
we want to import.

importing the **add** module from the **calculator** package:

```
calculator/
├── __init__.py
├── add.py
├── subtract.py
└── multiply.py
```

```
from calculator.add import add
```

package **calculator**

module **add** (**add**.py)

function add

an external module **calculate.py**

imports the **add**() function
from the **add** module

using an absolute import
by specifying the absolute path to the function.
calculator.add

```
# calculate.py

from calculator.add import add

result = add(5, 9)

print(result)
```

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Importing from packages - relative import (1)

relative imports are used to import modules or packages
relative to the current module's position in the package hierarchy.

relative imports are specified using dots (.)
to indicate the level of relative positioning.

let's create a subpackage in the **calculator** package,
call the subpackage **multiply**,
then move the **multiply**.py module into that subpackage,

```
calculator/
      ├── __init__.py
      ├── add.py
      ├── subtract.py
      └── multiply/
            ├── __init__.py
            └── multiply.py
```

```
calculator/
├── __init__.py
├── add.py
├── subtract.py
└── multiply.py
```

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Importing from packages - relative import (2)

use relative imports to access the multiply module
from other modules within the **calculator** package
or its subpackages.

For instance, if we had a module
inside the **calculator** package
that needs to import the **multiply** module

```
calculator/
      ├── __init__.py
      ├── add.py
      ├── subtract.py
      └── multiply/
            ├── __init__.py
            └── multiply.py
```

```
from .multiply import multiply

result = multiply(5, 9)
print(result)
```

```
from .multiply import multiply
```

package **multiply**

module **multiply** (**multiply**.py)

Overall, relative imports are particularly useful
for imports within a package and subpackage structure.

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The __all__ attribute

when we want to use all modules
from a package or subpackages, or
all functions and variables from a module,
so typing out all names becomes quite cumbersome.

so we want a way to specify that
we're importing
    all functions and variables that a module has or
    all modules that package offers.

Python has the __all__ attribute,
which is used in modules or packages
to control what gets imported
when a user uses the
from module import * statement.

__all__ attribute allows us to specify a list of names
that will be considered "public" and
will be imported when the wildcard (*) import is used.

In a module, we can define the __all__ attribute
to explicitly specify
which names should be imported
when the **from module import *** statement is used.

this helps prevent
unintended imports of internal names,
providing a clear way of
showing the functions
that can be imported publicly and
that are for use only inside a module.

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Using the __all__ attribute in modules (1-2)

```
# my_module.py

__all__ = ['public_function', 'public_variable']

def public_function():
    return "This is a public function."

def _internal_function():
    return "This is an internal function."

public_variable = "This is a public variable."
_internal_variable = "This is an internal variable."
```

defines a module named my_module.py,
and with the __all__ attribute being set,
only the public_function
and the public_variable will be imported
when the from my_module import * is used.

The function and variable names
starting with an underscore
the _internal_function
and the _internal_variable
won't be imported.

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Using the __all__ attribute in modules (2)

If we know the absolute paths
to the functions starting with an underscore,
the **_internal_function**
and the **_internal_variable**
we can still import them to our code.

However, that goes against the convention of encapsulation,
since the underscore (_) denotes them
as private members of the module
and indicates that they shouldn't be used outside the module.

So it's good practice to follow Python programming conventions
even if Python doesn't enforce strict encapsulation.

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Using the __all__ attribute in packages (1)

The __all__ attribute can also be used in __init__.py files
within a package or subpackage
to control the default behavior of wildcard imports
for submodules or subpackages.

This can help ensure that only specific modules
are imported when using wildcard imports on packages:

```
# my_package/__init__.py

__all__ = ['submodule1', 'subpackage']

from . import submodule1
from . import subpackage
```

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Using the __all__ attribute in packages (2)

This example shows an __init__.py file
specifying that only **submodule1** and **subpackage1**
will be imported when using **from my_package import ***.

Other submodules or subpackages won't be imported by default.

As in the case of modules, we can still import the other modules
not specified in the __all__ attribute list
if we know their absolute paths.

So the __all__ attribute acts as a convention
rather than as a strict rule.

It's meant to communicate what can be used publicly
from a module or a package.

It is, however, recommended that explicit imports
(import module_name) be used
instead of wildcard imports (from module_name import *).

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import <module_name>

import <module_name>

this does not make the module contents
directly accessible to the caller.

Each module has its own private symbol table,
which serves as the global symbol table
for all objects defined in the module.

So, a module creates a separate namespace.

The statement **import** <module_name>
only places <module_name> in the caller's symbol table.

The objects that are defined in the module
remain in the module's private symbol table.

From the caller, objects in the module are only accessible
when prefixed with <module_name> via dot notation, as you'll see below.

https://realpython.com/lessons/import-statement/

from <module_name> **import** <name(s)>

An alternate form of the import statement
allows individual objects from the module
to be imported directly into the caller's symbol table:

from <module_name> import <name(s)>

Following execution of the above statement,
<name(s)> can be referenced in the caller's environment
without the <module_name> prefix:

Because this form of import
places the object names directly
into the caller's symbol table,

any objects that already exist with the same name
will be overwritten:

https://realpython.com/lessons/import-statement/

from <module_name> **import** <name> **as** <alt_name>

from <module_name> import <name> as <alt_name>

It’s also possible to import individual objects
but put them into the local symbol table with alternate names:

from <module_name> import <name> as <alt_name>[, <name> as <alt_name> …]

This makes it possible to place names
directly into the local symbol table
but avoid conflicts with previously existing names:

https://realpython.com/lessons/import-statement/

import <module_name> **as** <alt_name>

import <module_name> as <alt_name>

You can also import an entire module under an alternate name:

import <module_name> as <alt_name>

Module contents can be imported from within a function definition.

In that case, the import does not occur until the function is called:

However, Python 3 does not allow the indiscriminate import * syntax from within a function:

https://realpython.com/lessons/import-statement/

Package (1)

modules are
files containing Python statements and definitions,
like function and class definitions.

to bundle multiple modules together,
create a package.

a package is
basically a directory
with several Python files (modules)
and a special file **__init__.py**

inside of the Python path,
every directory contains **__init__.py**,
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
structuring Python's module namespace
by using "dotted module names".

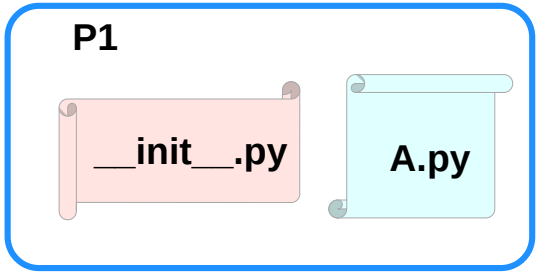
A.B stands for
a submodule named **B**
in a package named **A**.

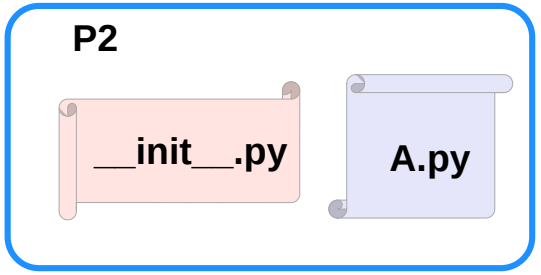
two different packages like **P1** and **P2**
can both have modules with the same name,
let's say **A**, for example.

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

P1.A
P2.A

A package is imported like a "normal" module.





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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

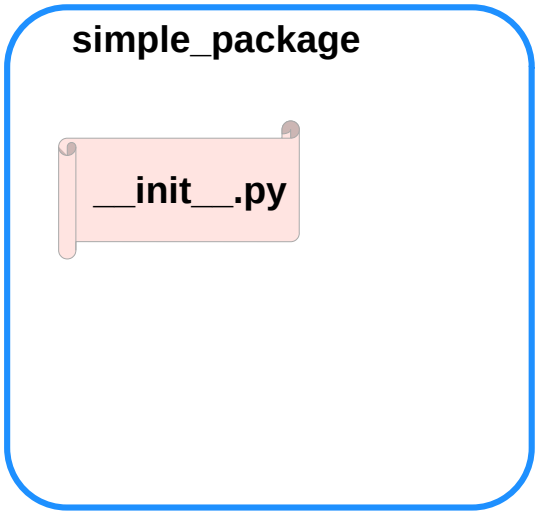
must create directory "simple_package"
and this directory needs to contain the "**__init__.py**" file

this file can be empty, or
can contain valid Python code.

this code will be executed
when a package is imported,

so it can be used to initialize a package,

e.g. to make sure that
some other modules are imported or
some values set.



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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")
```

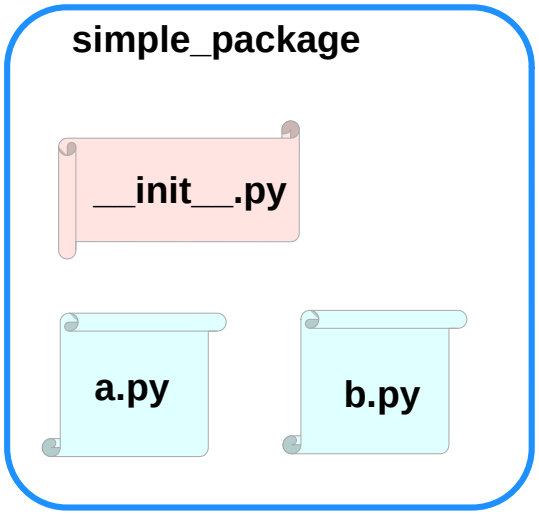
b.py: ➡ submodule **b**

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

an empty file with the name **__init__.py**
inside of simple_package directory

__init__.py:

```
empty file
```



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Examples of creating a package (2)

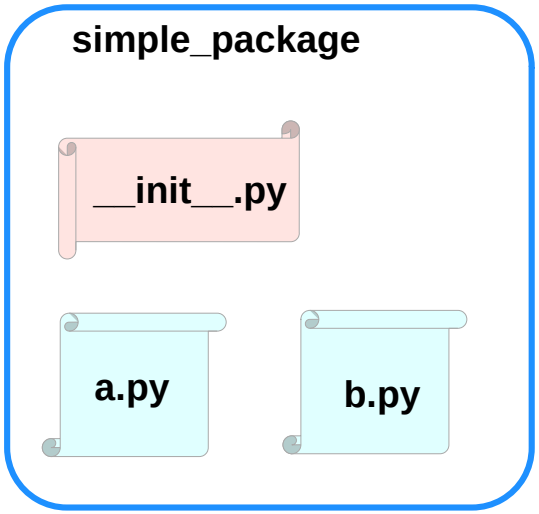
import **simple_package** from the interactive Python shell,

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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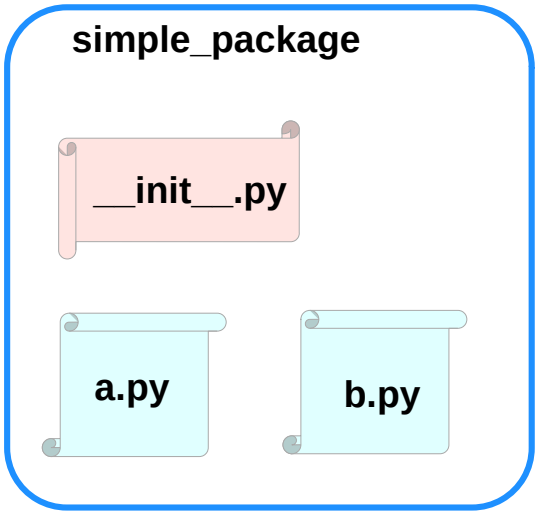
Examples of creating a package (3)

```
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 loaded
but neither the module "**a**" nor the module "**b**" has been loaded

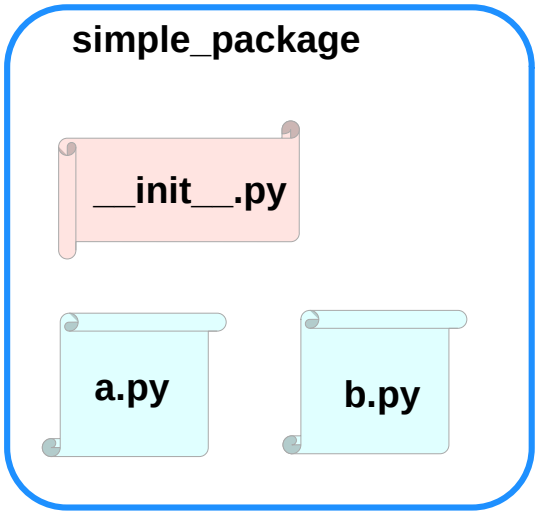
can't access neither "**a**" nor "**b**"
by solely importing **simple_package**.

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 automatically load these modules.

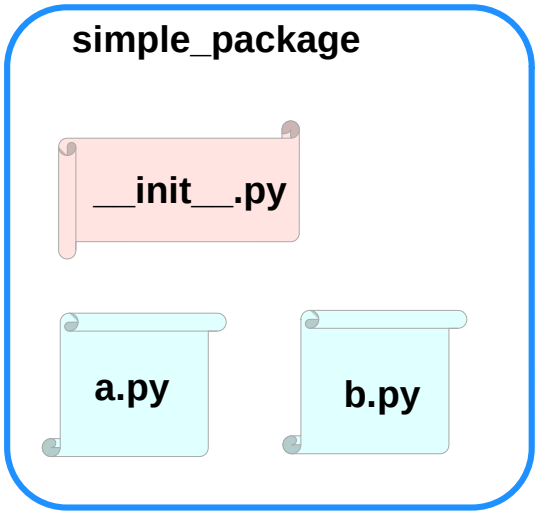
add the following lines to the file __init__.py:

```
import simple_package.a
import simple_package.b
```

Then

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

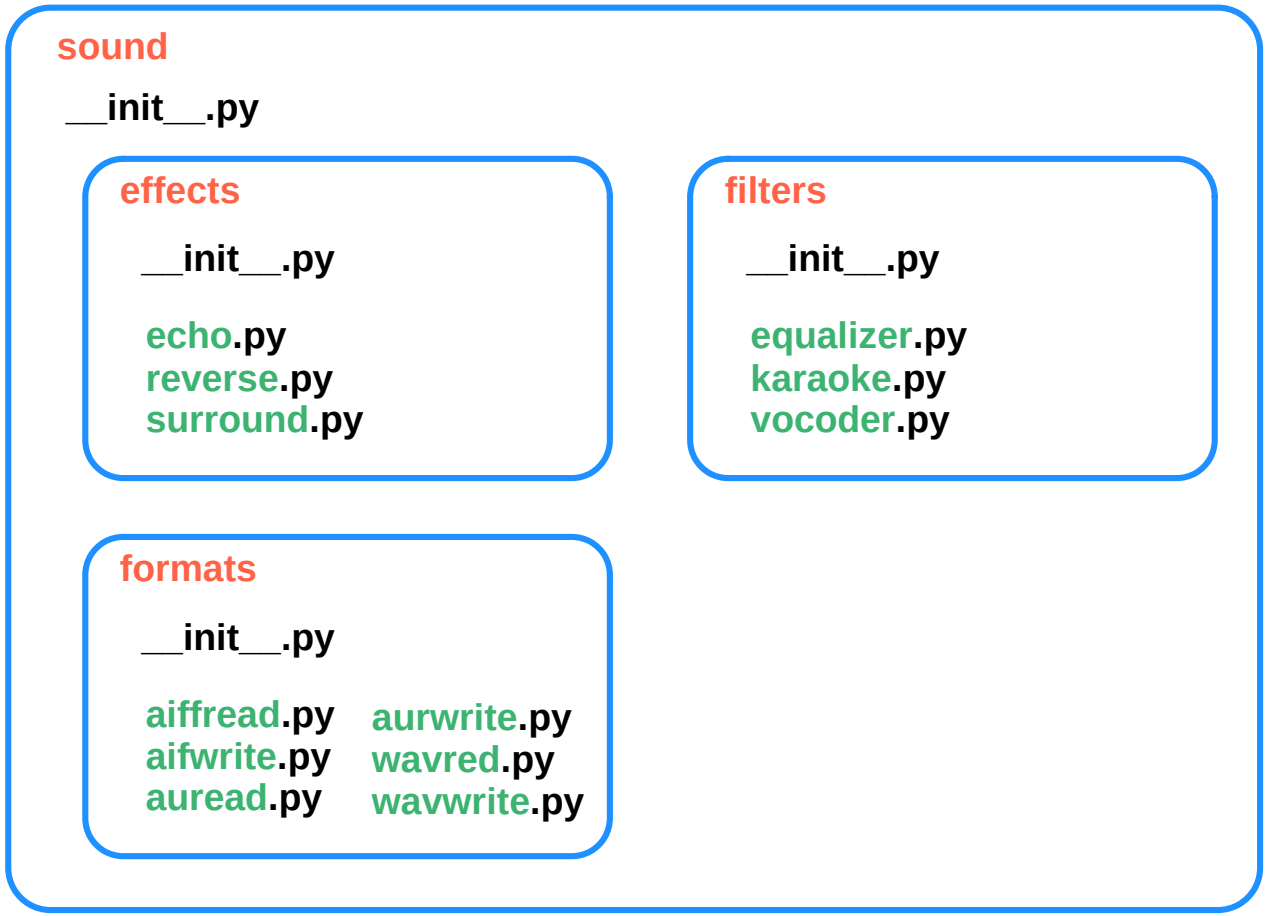
```
Hello, function 'bar' from module 'a' calling
Hello, function 'foo' from module 'b' calling
```



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

Package Examples (1)

```
sound
|-- effects
|   |-- __init__.py
|   |-- echo.py
|   |-- reverse.py
|   `-- surround.py
|-- filters
|   |-- __init__.py
|   |-- equalizer.py
|   |-- karaoke.py
|   `-- vocoder.py
|-- formats
|   |-- __init__.py
|   |-- aiffread.py
|   |-- aiffwrite.py
|   |-- auread.py
|   |-- auwrite.py
|   |-- wavread.py
|   `-- wavwrite.py
`-- __init__.py
```



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Package Examples **sound1**

sound1

__init__.py

effects

__init__.py

echo.py
reverse.py
surround.py

filters

__init__.py

equalizer.py
karaoke.py
vocoder.py

formats

__init__.py

aiffread.py
aifwrite.py
auread.py
aurwrite.py
wavred.py
wavwrite.py

```
import sound1
print(sound1)           … OK
print(sound1.effects)   … Error

import sound1.effects
print(sound1.effects)   … OK
```

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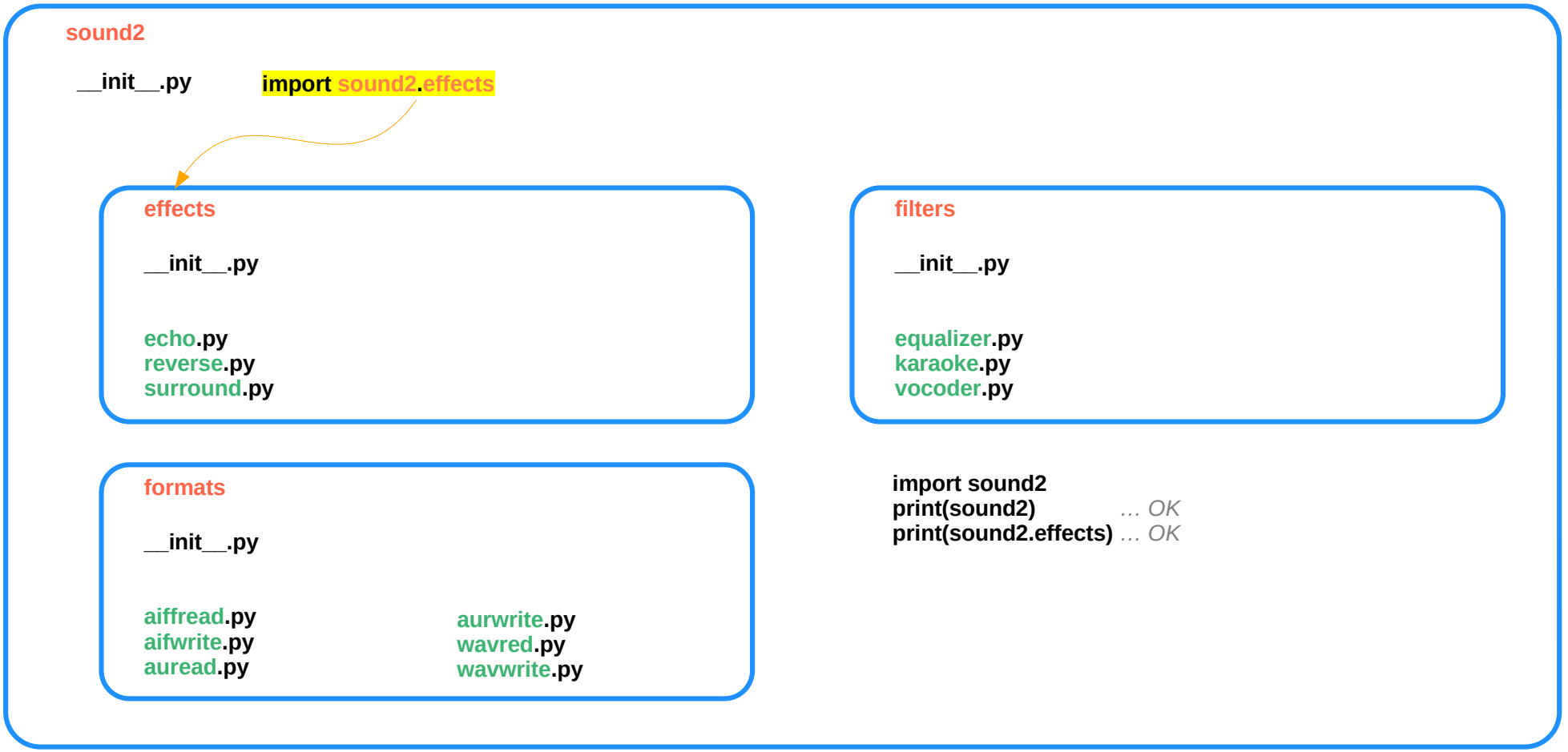
Package Examples **sound2**



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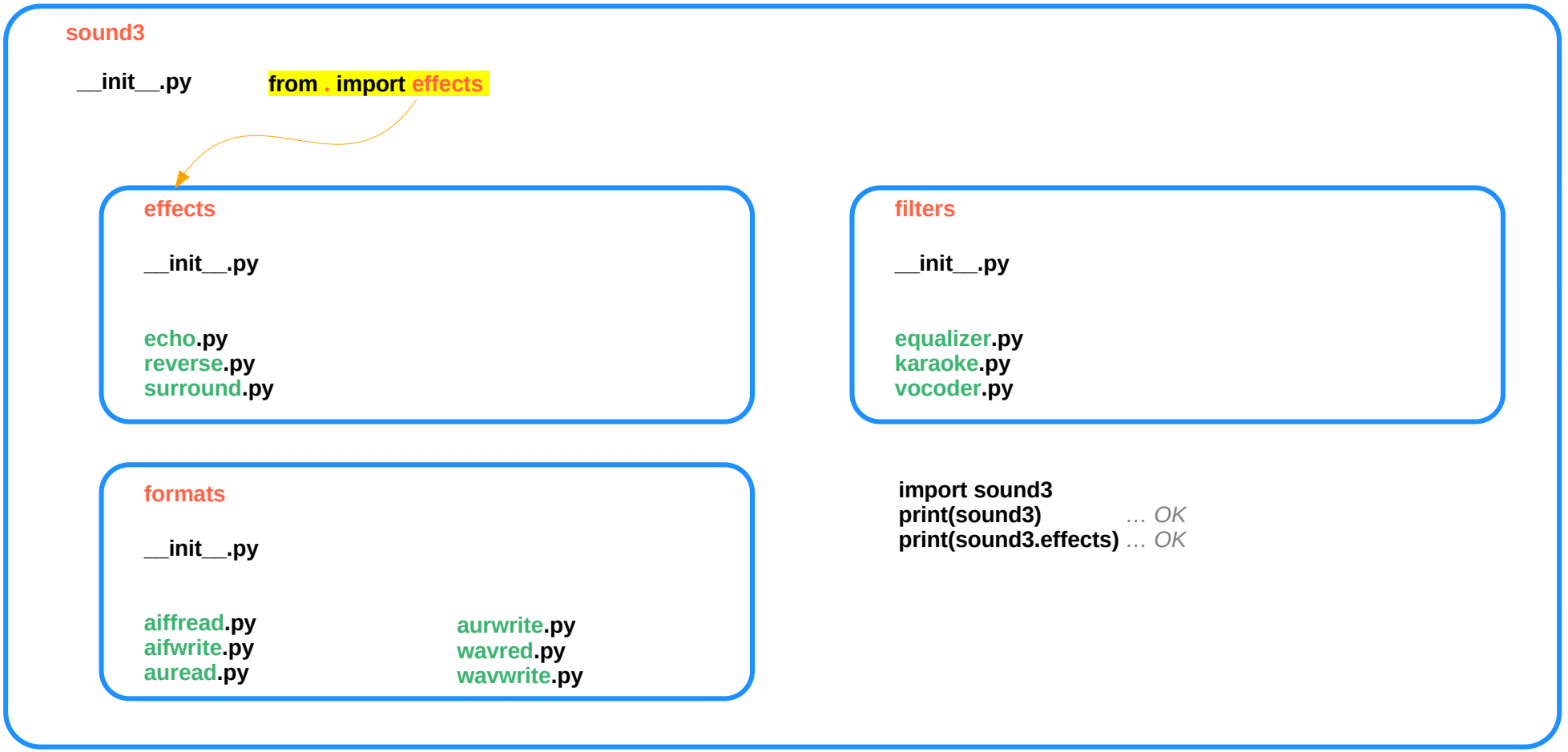
Package Examples **sound3**



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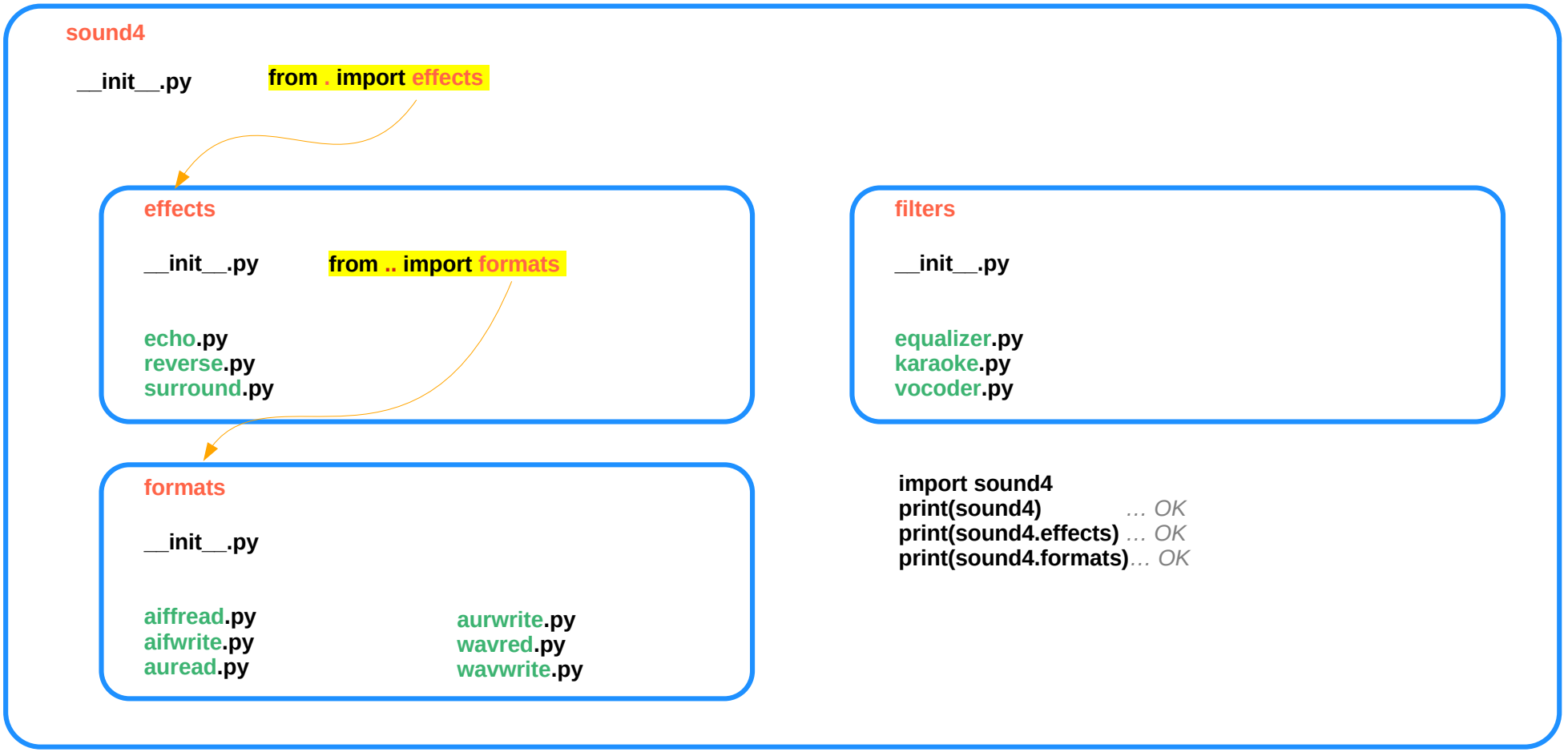
Package Examples **sound4**



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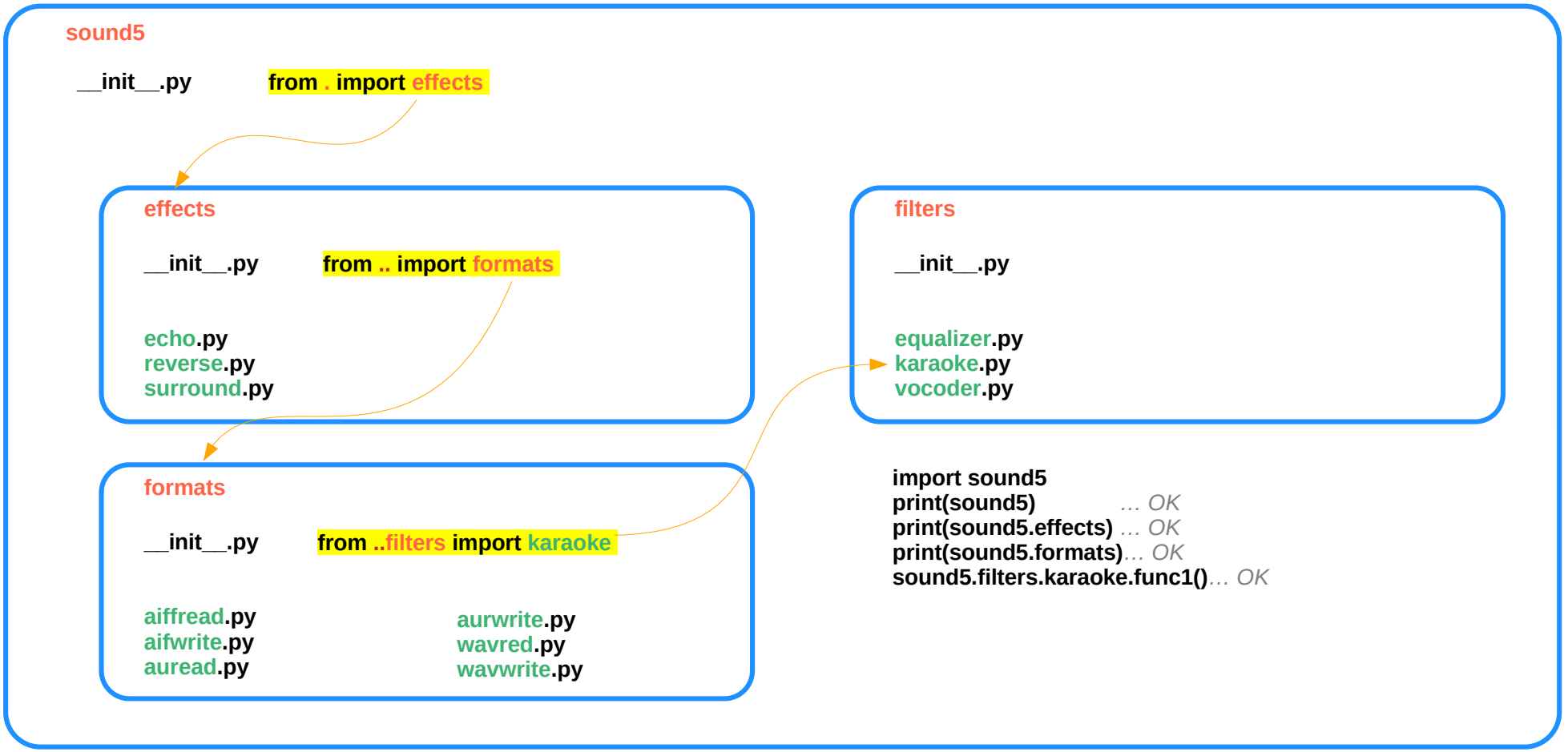
Package Examples **sound5**



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Package Examples **sound6**

sound6

__init__.py

foobar.py *empty file*

effects

__init__.py

echo.py
reverse.py
surround.py

filters

__init__.py

equalizer.py
karaoke.py
vocoder.py

formats

__init__.py

aiffread.py
aifwrite.py
auread.py
aurwrite.py
wavred.py
wavwrite.py

```
from sound6 import *
        sound6 package is getting 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 Examples **sound7**

sound7

__init__.py `__all__ = ["effects", "filters", "formats", "foobar"]`

foobar.py *empty file*

effects

__init__.py

sound6 package
effects package
filters package
formats package
foobar module

echo.py
reverse.py
surround.py

filters

__init__.py

equalizer.py
karaoke.py
vocoder.py

formats

__init__.py

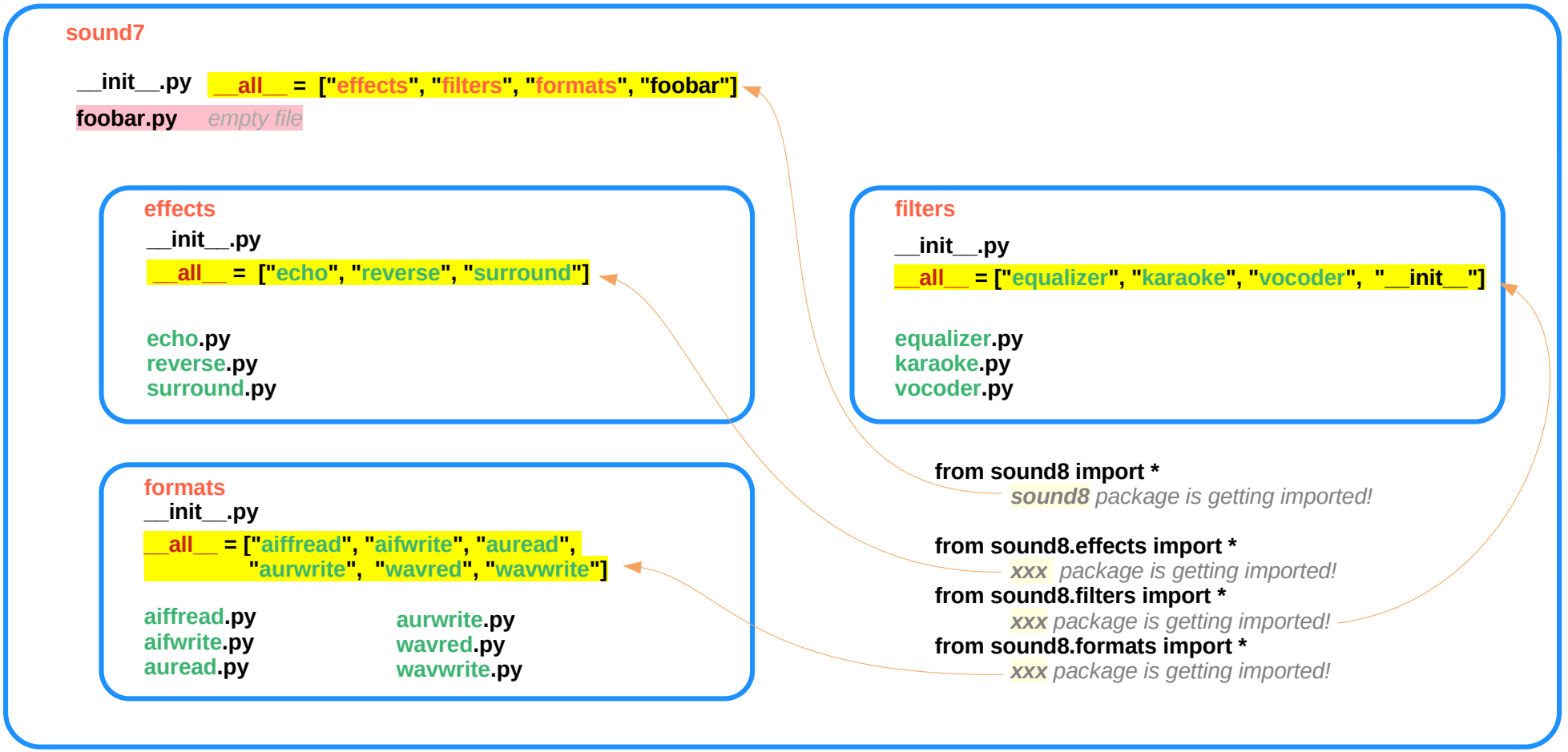
aiffread.py
aifwrite.py
auread.py
aurwrite.py
wavred.py
wavwrite.py

```
from sound7 import *
```
sound7 package is getting imported!

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

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

Package Examples **sound8**



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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 subpackages
will be imported
effects, filters and formats

because the file **__init__.py**
doesn't contain any code
for importing subpackages:

import sound1
print(sound1) *… OK*
print(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!")
```

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Package **sound1** (2)

```
import sound1
print(sound1)
print(sound1.effects)
```

print(sound1)

OUTPUT:

```
<module 'sound1' from '/data/Dropbox (Bodenseo)/
Bodenseo Team Folder/melisa/notebooks_en/
sound1/__init__.py'>
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
<ipython-input-2-0b6d7fed3b24> in <module>
      3 print(sound1)
      4
----> 5 print(sound1.effects)
AttributeError: module 'sound1' has no attribute 'effects'
```

print(sound1.effects)

If you also want to use the package **effects**,
you have to import it explicitly with import **sound.effects**:

```
import sound1.effects
print(sound1.effects)
```

```
<module 'sound1.effects' from '/data/Dropbox (Bodenseo)/
Bodenseo Team Folder/melisa/notebooks_en/
sound1/effects/__init__.py'>
```

It is possible to have the submodule importing done automatically when importing the sound1 module.

We will change now to **sound2** to demonstrate how to do this.

We use the same files as in **sound1**,
but we will add the code line **import sound2.effects**
into the file **__init__.py** of the directory **sound2**.

```
"""An empty sound package
This is the sound package, providing hardly anything!"""
import sound2.effects
print("sound2.effects package is getting imported!")
)
```

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Package **sound2**

__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!")
```

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

Package **sound3**

__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!")
```

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Package **sound4**

*__**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
|-- 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!")
```

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Package **sound5**

*__**init**__.py*
```
print("sound5 package is getting imported!")
from . import effects
```

*effects/__**init**__.py*
```
print("effects package is getting imported!")
from .. import formats
```

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!")
```

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Package **sound6** (1)

*__**init**__.py*
```
print("sound5 package is getting imported!")
```

foobar.py
empty file

*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*
|-- ***foobar**.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!")
```

```
from sound6 import *
        sound6 package is getting imported!

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

*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!")
```

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Package **sound6** (2)

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

want to import all the **submodules** and **subpackages**
of the package **sound6**.

```
from sound6 import *

sound6 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
```

sound7
|-- effects
|-- filters
|-- formats
|-- *__init__.py*
|-- *foobar.py*

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Package **sound7** (1)

__init__.py
```
print("sound5 package is getting imported!")
__all__ = ["formats", "filters", "effects",
           "foobar"]
```

foobar.py
empty file

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!")
```

```
sound7
|-- effects
|-- filters
|-- formats
|-- __init__.py
|-- foobar.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!")
```

```
from sound7 import *          … OK

from sound8.effects import *  … not OK
```

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!")
```

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

Package **sound7** (2)

explicit index for the **subpackages** and **modules**
of a package, which should be imported.

define a **list** named **__all__**.
to the **__init__.py** file of the **sound** directory.

: the list of **module** and **package names** to be imported
when **from package import *** is encountered.

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

```
from sound7 import *
```

```
sound7 package is getting imported!
formats package is getting imported!
filters package is getting imported!
effects package is getting imported!
foobar module is getting imported
```

```
sound7
|-- effects
|-- filters
|-- formats
|-- __init__.py
|-- foobar.py
```

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 effects**

```
from sound.effects import *
sound7 package is getting imported!
effects package is getting imported!

dir()
['__builtins__', '__doc__', '__loader__', '__name__',
'__package__', '__spec__']
```

Like expected the modules inside of **effects**
have not been imported automatically.

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

Package **sound8** (1)

__init__.py
```
print("sound5 package is getting imported!")
__all__ =  ["formats", "filters", "effects",
            "foobar"]
```

foobar.py
empty file

effects/__init__.py
```
print("effects package is getting imported!")
__all__ =  ["echo", "surround", "reverse"]
```

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!")
```

```
sound8
|-- effects
|-- filters
|-- formats
|-- __init__.py
|-- foobar.py
```

filters/__init__.py
```
print("filters package is getting imported!")
__all__ = ["equalizer", "__init__", "karaoke",
           "vocoder"]
```

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!")
```

```
from sound8 import *            … OK

from sound8.effects import *    … OK

from sound8.filters import *    … OK

from sound8.formats import *    … OK
```

formats/__init__.py
```
print("formats package is getting imported!")
__all__ = ["aiffread", "aiffwrite", "auread",
           "auwrite",  "wavread", "wavwrite"]
```

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!")
```

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Package **sound8** (2)

__all__ list in the __init__ file of each sub-package

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

```
from sound8 import *

sound8 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 ***

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

Package **sound6** (3)

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