

What Is a Package?

A package is a namespace that organizes a set of related classes and interfaces. Conceptually you can think of packages as being similar to different folders on your computer. You might keep HTML pages in one folder, images in another, and scripts or applications in yet another. Because software written in the Java programming language can be composed of hundreds or *thousands* of individual classes, it makes sense to keep things organized by placing related classes and interfaces into packages.

The Java platform provides an enormous class library (a set of packages) suitable for use in your own applications. This library is known as the "Application Programming Interface", or "API" for short. Its packages represent the tasks most commonly associated with general-purpose programming. For example, a `String` object contains state and behavior for character strings; a `File` object allows a programmer to easily create, delete, inspect, compare, or modify a file on the filesystem; a `Socket` object allows for the creation and use of network sockets; various GUI objects control buttons and checkboxes and anything else related to graphical user interfaces. There are literally thousands of classes to choose from. This allows you, the programmer, to focus on the design of your particular application, rather than the infrastructure required to make it work.

Java Package

A **java package** is a group of similar types of classes, interfaces and sub-packages.

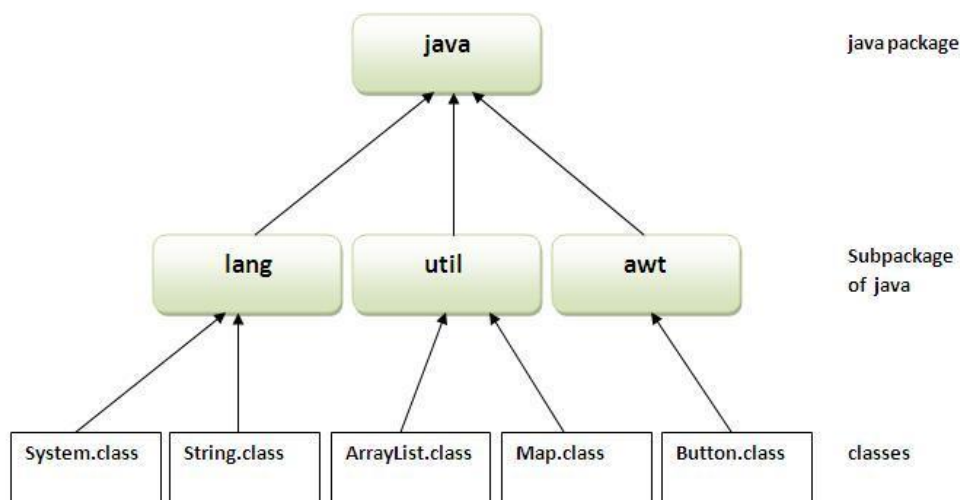
Package in java can be categorized in two form, built-in package and user-defined package.

There are many built-in packages such as java, lang, awt, javax, swing, net, io, util, sql etc.

Here, we will have the detailed learning of creating and using user-defined packages.

Advantage of Java Package

- 1) Java package is used to categorize the classes and interfaces so that they can be easily maintained.
- 2) Java package provides access protection.
- 3) Java package removes naming collision.



Simple example of java package

The **package keyword** is used to create a package in java.

1. `//save as Simple.java`
2. `package mypack;`
3. `public class Simple{`

```
4. public static void main(String args[]){
5.     System.out.println("Welcome to package");
6. }
7. }
```

How to compile java package

If you are not using any IDE, you need to follow the **syntax** given below:

```
1. javac -d directory javafilename
```

For **example**

```
1. javac -d . Simple.java
```

The -d switch specifies the destination where to put the generated class file. You can use any directory name like /home (in case of Linux), d:/abc (in case of windows) etc. If you want to keep the package within the same directory, you can use . (dot).

How to run java package program

You need to use fully qualified name e.g. mypack.Simple etc to run the class.

To Compile: javac -d . Simple.java

To Run: java mypack.Simple

Output:Welcome to package

The -d is a switch that tells the compiler where to put the class file i.e. it represents destination. The . represents the current folder.

How to access package from another package?

There are three ways to access the package from outside the package.

1. import package.*;
2. import package.classname;
3. fully qualified name.

1) Using packagename.*

If you use package.* then all the classes and interfaces of this package will be accessible but not subpackages.

The import keyword is used to make the classes and interface of another package accessible to the current package.

Example of package that import the packagename.*

```
1. //save by A.java
2.
3. package pack;
4. public class A{
5.     public void msg(){System.out.println("Hello");}
6. }
```

```
1. //save by B.java
2.
3. package mypack;
4. import pack.*;
5.
6. class B{
7.     public static void main(String args[]){
8.         A obj = new A();
9.         obj.msg();
10.    }
11. }
```

Output:Hello

2) Using packagename.classname

If you import package.classname then only declared class of this package will be accessible.

Example of package by import package.classname

```
1. //save by A.java
2.
3. package pack;
4. public class A{
5.     public void msg(){System.out.println("Hello");}
6. }
```

```

1. //save by B.java
2.
3. package mypack;
4. import pack.A;
5.
6. class B{
7.     public static void main(String args[]){
8.         A obj = new A();
9.         obj.msg();
10.    }
11. }

```

Output:Hello

3) Using fully qualified name

If you use fully qualified name then only declared class of this package will be accessible. Now there is no need to import. But you need to use fully qualified name every time when you are accessing the class or interface.

It is generally used when two packages have same class name e.g. java.util and java.sql packages contain Date class.

Example of package by import fully qualified name

```

1. //save by A.java
2.
3. package pack;
4. public class A{
5.     public void msg(){System.out.println("Hello");}
6. }

1. //save by B.java
2.
3. package mypack;
4. class B{
5.     public static void main(String args[]){
6.         pack.A obj = new pack.A();//using fully qualified name
7.         obj.msg();
8.     }
9. }

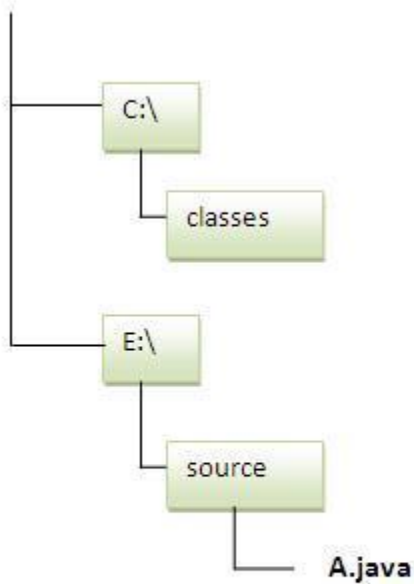
```

Output:Hello

Note: If you import a package, subpackages will not be imported.

If you import a package, all the classes and interface of that package will be imported excluding the classes and interfaces of the subpackages. Hence, you need to import the subpackage as well.

Note: Sequence of the program must be package then import then class.



Packages are used in Java in order to prevent naming conflicts, to control access, to make searching/locating and usage of classes, interfaces, enumerations and annotations easier, etc.

A Package can be defined as a grouping of related types(classes, interfaces, enumerations and annotations) providing access protection and name space management.

Some of the existing packages in Java are::

- **java.lang** - bundles the fundamental classes
- **java.io** - classes for input , output functions are bundled in this package

Programmers can define their own packages to bundle group of classes/interfaces, etc. It is a good practice to group related classes implemented by you so that a programmer can easily determine that the classes, interfaces, enumerations, annotations are related.

Since the package creates a new namespace there won't be any name conflicts with names in other packages. Using packages, it is easier to provide access control and it is also easier to locate the related classes.

Creating a package:

When creating a package, you should choose a name for the package and put a **package** statement with that name at the top of every source file that contains the classes, interfaces, enumerations, and annotation types that you want to include in the package.

The **package** statement should be the first line in the source file. There can be only one package statement in each source file, and it applies to all types in the file.

If a package statement is not used then the class, interfaces, enumerations, and annotation types will be put into an unnamed package.

Example:

Let us look at an example that creates a package called **animals**. It is common practice to use lowercased names of packages to avoid any conflicts with the names of classes, interfaces.

Put an interface in the package *animals*:

```
/* File name : Animal.java */
package animals;

interface Animal {
    public void eat();
    public void travel();
}
```

Now, put an implementation in the same package *animals*:

```

package animals;

/* File name : MammalInt.java */
public class MammalInt implements Animal{

    public void eat(){
        System.out.println("Mammal eats");
    }

    public void travel(){
        System.out.println("Mammal travels");
    }

    public int noOfLegs(){
        return 0;
    }

    public static void main(String args[]){
        MammalInt m = new MammalInt();
        m.eat();
        m.travel();
    }
}

```

Now, you compile these two files and put them in a sub-directory called **animals** and try to run as follows:

```

$ mkdir animals
$ cp Animal.class MammalInt.class animals
$ java animals/MammalInt
Mammal eats
Mammal travels

```

The import Keyword:

If a class wants to use another class in the same package, the package name does not need to be used. Classes in the same package find each other without any special syntax.

Example:

Here, a class named Boss is added to the payroll package that already contains Employee. The Boss can then refer to the Employee class without using the payroll prefix, as demonstrated by the following Boss class.

```

package payroll;

public class Boss
{
    public void payEmployee(Employee e)
    {
        e.mailCheck();
    }
}

```


What happens if Boss is not in the payroll package? The Boss class must then use one of the following techniques for referring to a class in a different package.

- The fully qualified name of the class can be used. For example:

```
payroll.Employee
```

- The package can be imported using the import keyword and the wild card (*). For example:

```
import payroll.*;
```

- The class itself can be imported using the import keyword. For example:

```
import payroll.Employee;
```

Note: A class file can contain any number of import statements. The import statements must appear after the package statement and before the class declaration.

The Directory Structure of Packages:

Two major results occur when a class is placed in a package:

- The name of the package becomes a part of the name of the class, as we just discussed in the previous section.
- The name of the package must match the directory structure where the corresponding bytecode resides.

Here is simple way of managing your files in Java:

Put the source code for a class, interface, enumeration, or annotation type in a text file whose name is the simple name of the type and whose extension is **.java**. For example:

```
// File Name : Car.java

package vehicle;

public class Car {
    // Class implementation.
}
```

Now, put the source file in a directory whose name reflects the name of the package to which the class belongs:

```
....\vehicle\Car.java
```

Now, the qualified class name and pathname would be as below:

- Class name -> vehicle.Car
- Path name -> vehicle\Car.java (in windows)

In general, a company uses its reversed Internet domain name for its package names. Example: A company's Internet domain name is apple.com, then all its package names would start with com.apple. Each component of the package name corresponds to a subdirectory.

Example: The company had a com.apple.computers package that contained a Dell.java source file, it would be contained in a series of subdirectories like this:

```
....\com\apple\computers\Dell.java
```

At the time of compilation, the compiler creates a different output file for each class, interface and enumeration defined in it. The base name of the output file is the name of the type, and its extension is **.class**

For example:

```
// File Name: Dell.java

package com.apple.computers;
public class Dell{

}
class Ups{

}
```

Now, compile this file as follows using -d option:

```
$javac -d . Dell.java
```

This would put compiled files as follows:

```
.\com\apple\computers\Dell.class
.\com\apple\computers\Ups.class
```

Subpackage (package inside another package)

Assume we have another file called **HelloMoon.java**. We want to store it in a subpackage "**moon**", which stays inside package **world**. The `HelloMoon` class should look something like this:

```
package world.moon;

public class HelloMoon {
    private String holeName = "rabbit hole";

    public getHoleName() {
        return hole;
    }

    public setHole(String holeName) {
        this.holeName = holeName;
    }
}
```

If we store the package `world` under C: as before, the **HelloMoon.java** would be **c:\world\moon\HelloMoon.java**