

Diagrams

Package and Deployment Diagram

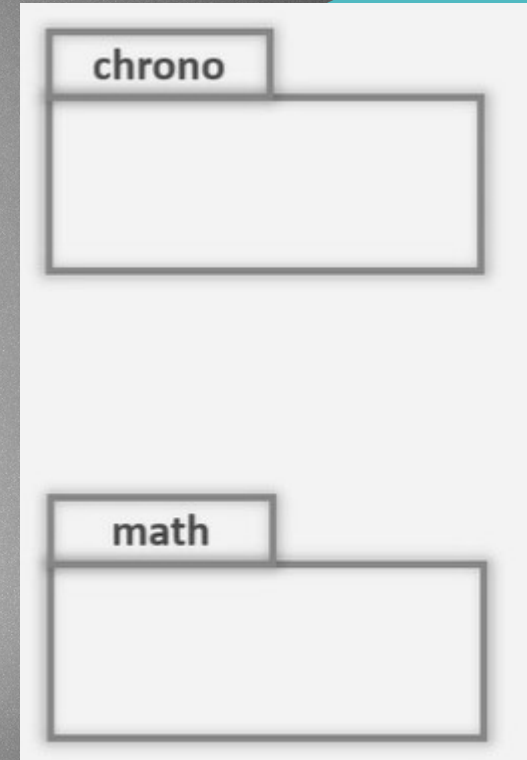
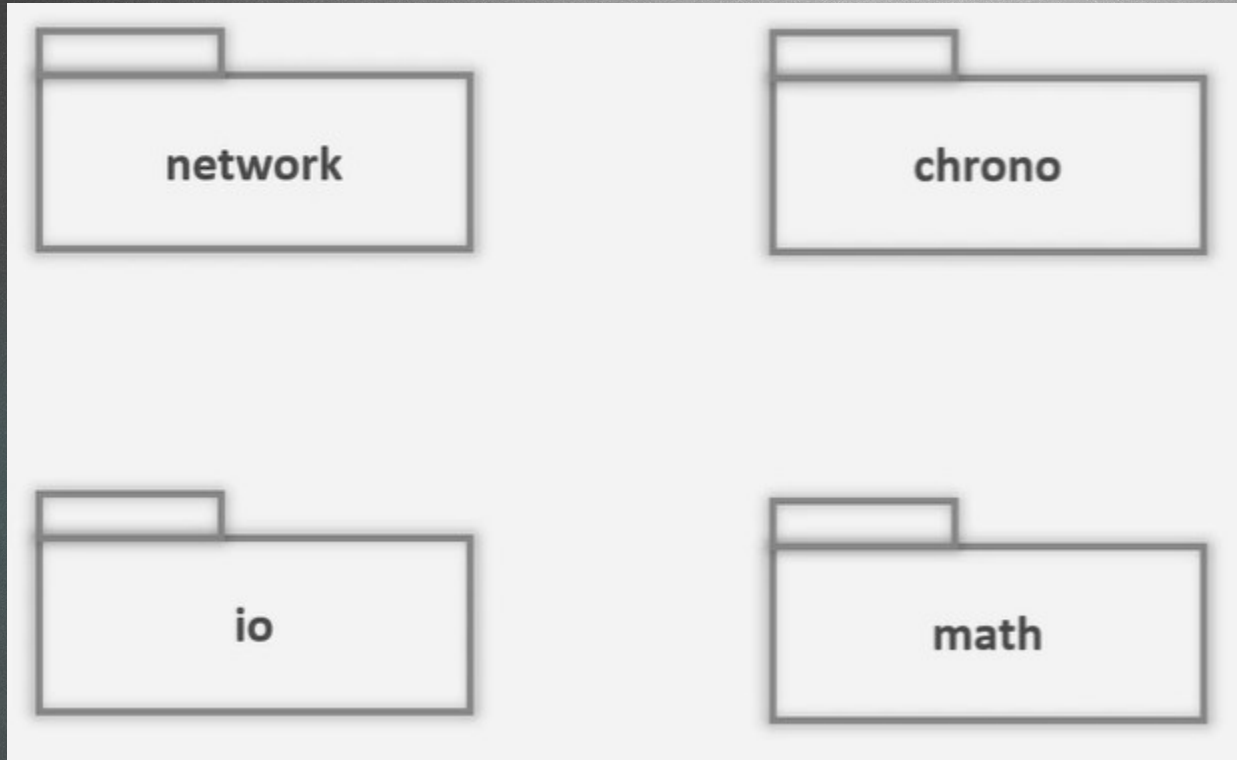


Package Diagram

- ❏ Packages/namespaces are used to organize classes in a large application.
- ❏ This reduces the complexity of understanding the architecture of the application
- ❏ UML provides packages to model a group of classes.
- ❏ The packages are placed in a package diagram along with their dependencies
- ❏ They are part of the development view

Package

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Package content

- ✎ A package organizes UML elements
- ✎ These elements can be drawn inside the package



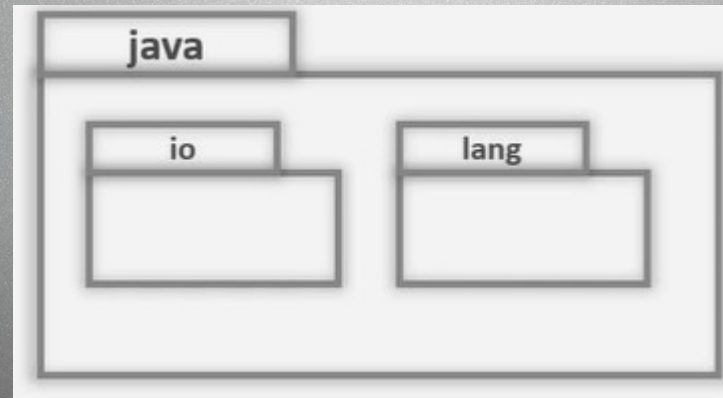
```
Array.java
1 package system;
2
3 public class Array {
4     /*
5      * Members
6      */
7 }

Console.java
1 package system;
2
3 public class Console {
4     /*
5      * Members
6      */
7 }
```

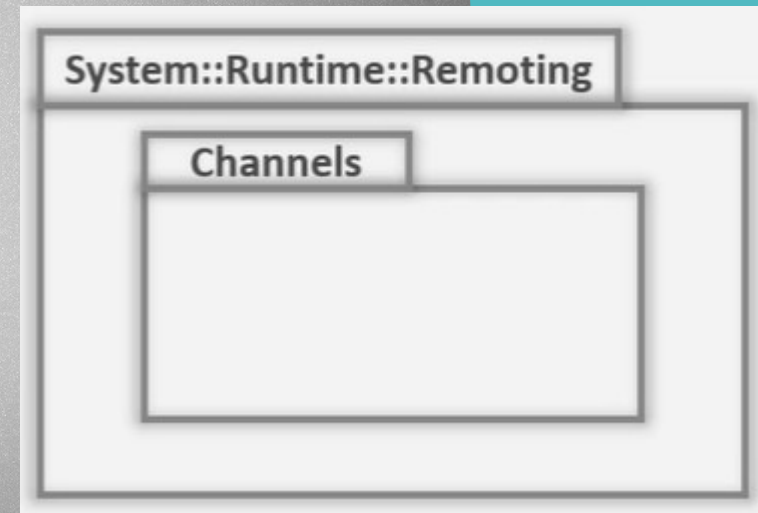
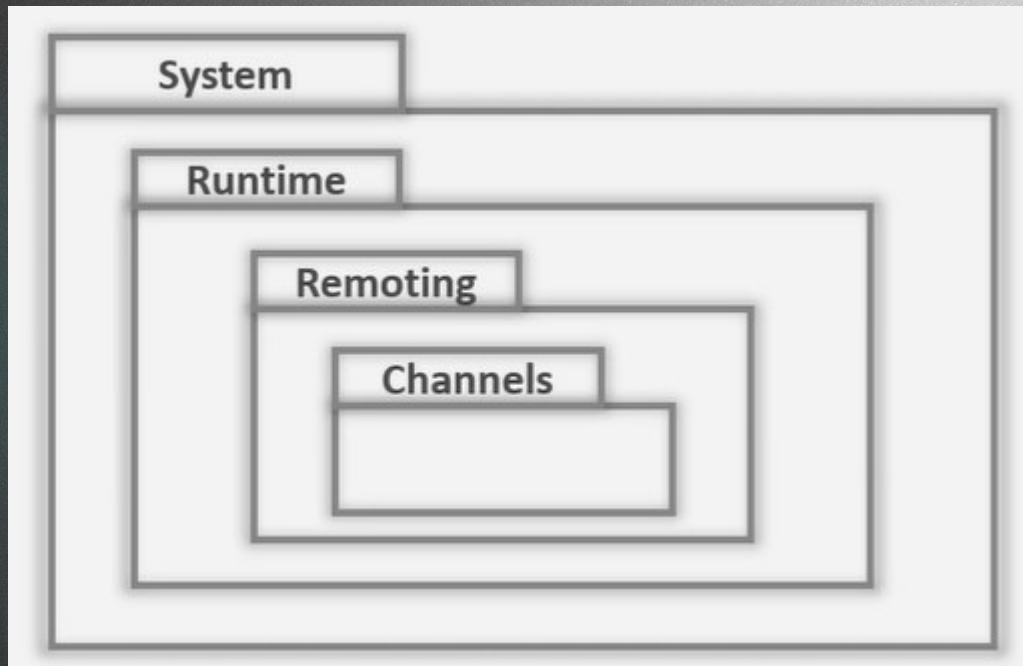
The image shows a screenshot of two Java source code files. The left file is 'Array.java' and the right file is 'Console.java'. Both files contain the same code structure: a package declaration 'package system;', followed by a public class declaration 'public class' (either 'Array' or 'Console'), and a class body with a multi-line comment '/* * Members */'. The code is displayed in a monospaced font with syntax highlighting.

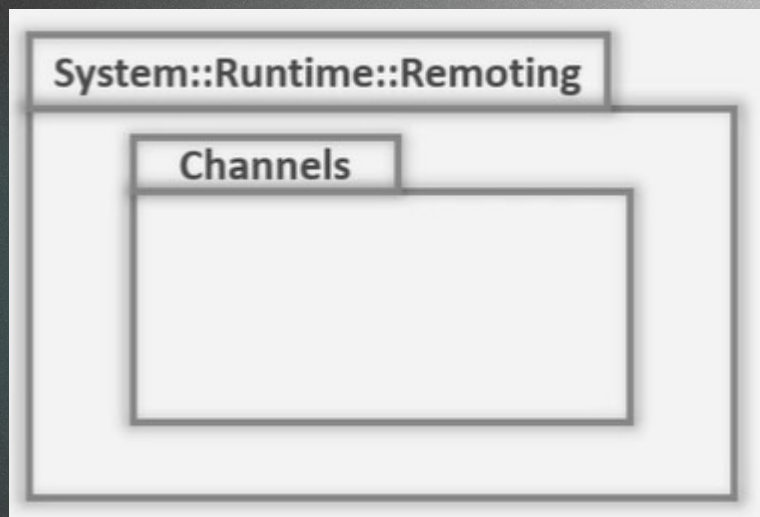
Nested Packages

- ☞ Packages can be nested
- ☞ This allows us to model the deep nesting of the packages in large applications



Nested Packages



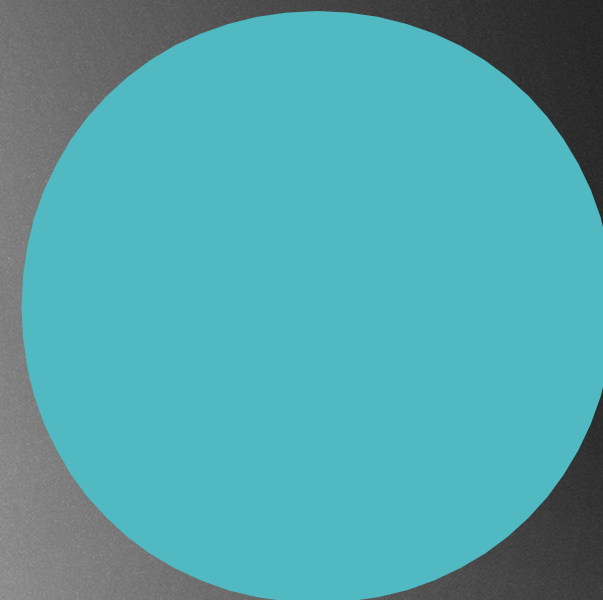
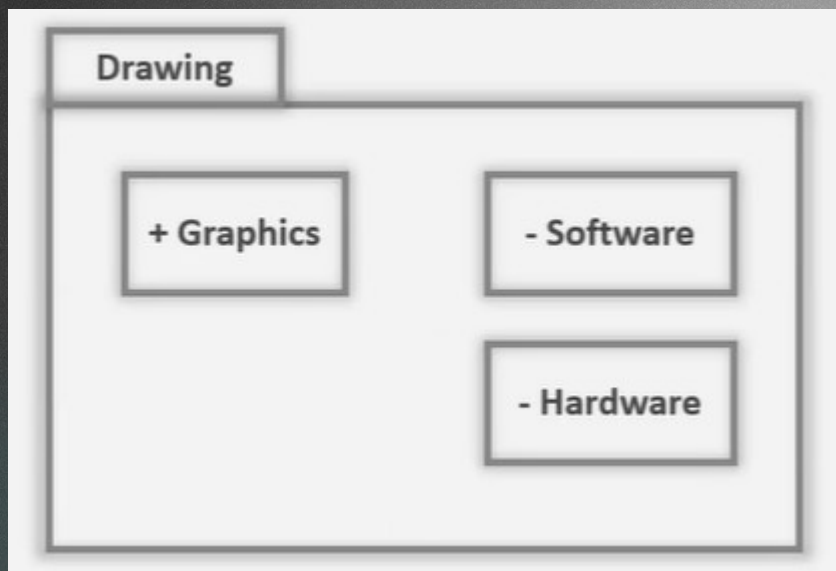


```
package system.runtime.remoting.channels;  
  
public class Test {  
  
}
```


Element Visibility

- ☞ The elements inside the packages can have two of visibility
- ☞ Private:
 - ☞ Elements with public visibility can be used outside the package
- ☞ Public:
 - ☞ Elements with the private visibility can be used only by elements of the same package
- ☞ Public visibility uses the + sign & private visibility use - sign

Example



```
Graphics.java
1 package drawing;
2
3 public class Graphics {
4
5 }
6

Software.java
1 package drawing;
2
3 class Software {
4
5 }
6

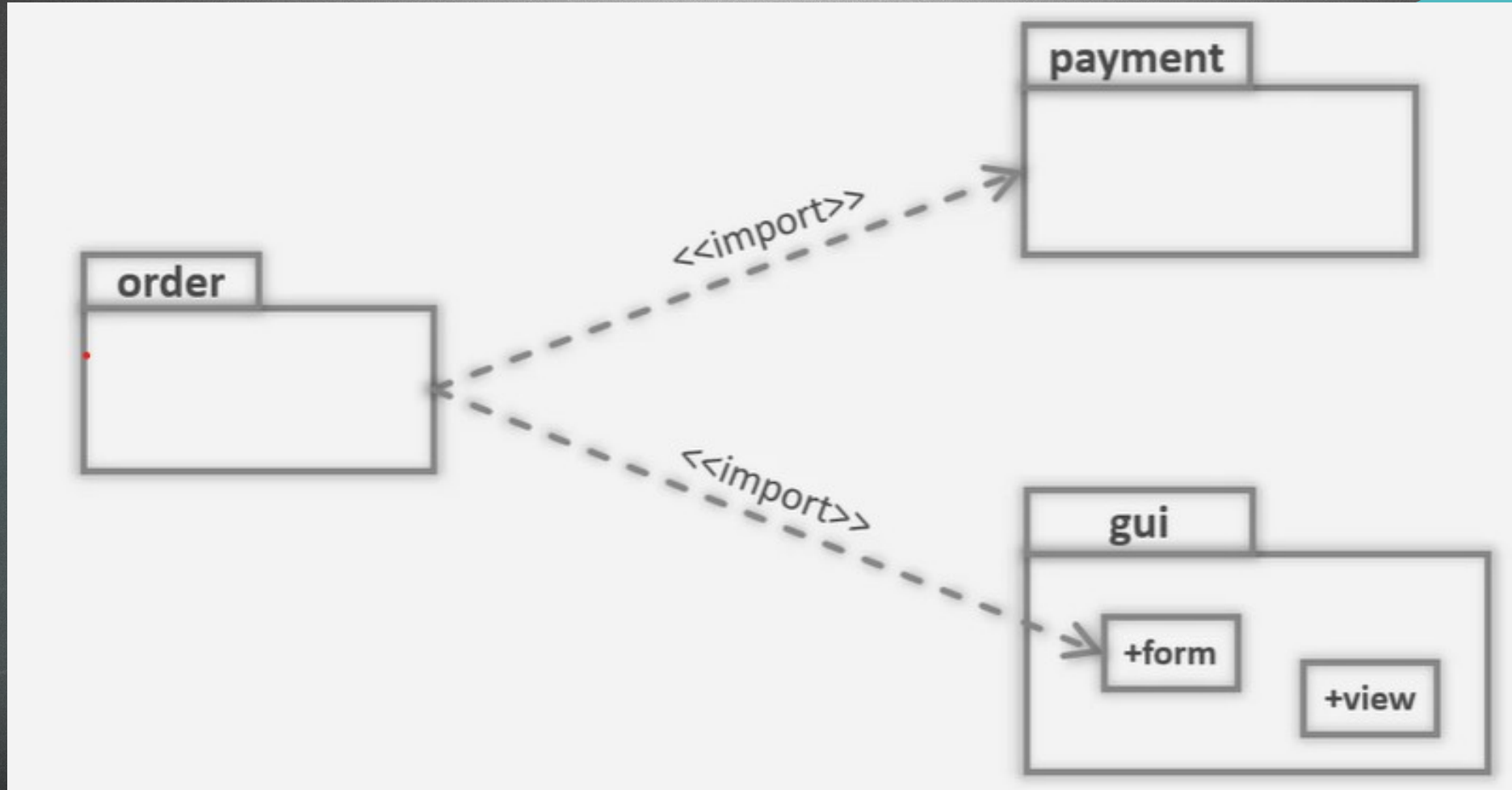
Hardware.java
1 package drawing;
2
3 class Hardware {
4
5 }
6
```


Importing Packages

- ✎ To access an element in another package, you have to use full scoped names
- ✎ Alternatively, a package can be imported that causes all the public elements to be available without using full scoped names
- ✎ The imported packages is called target packages
- ✎ The import creates a dependency & is shown with a dashed arrow
- ✎ The arrow points to the target packages & uses <<import>> stereotype
- ✎ A package can import a specific element of the whole
- ✎ Note that element should be public

Import

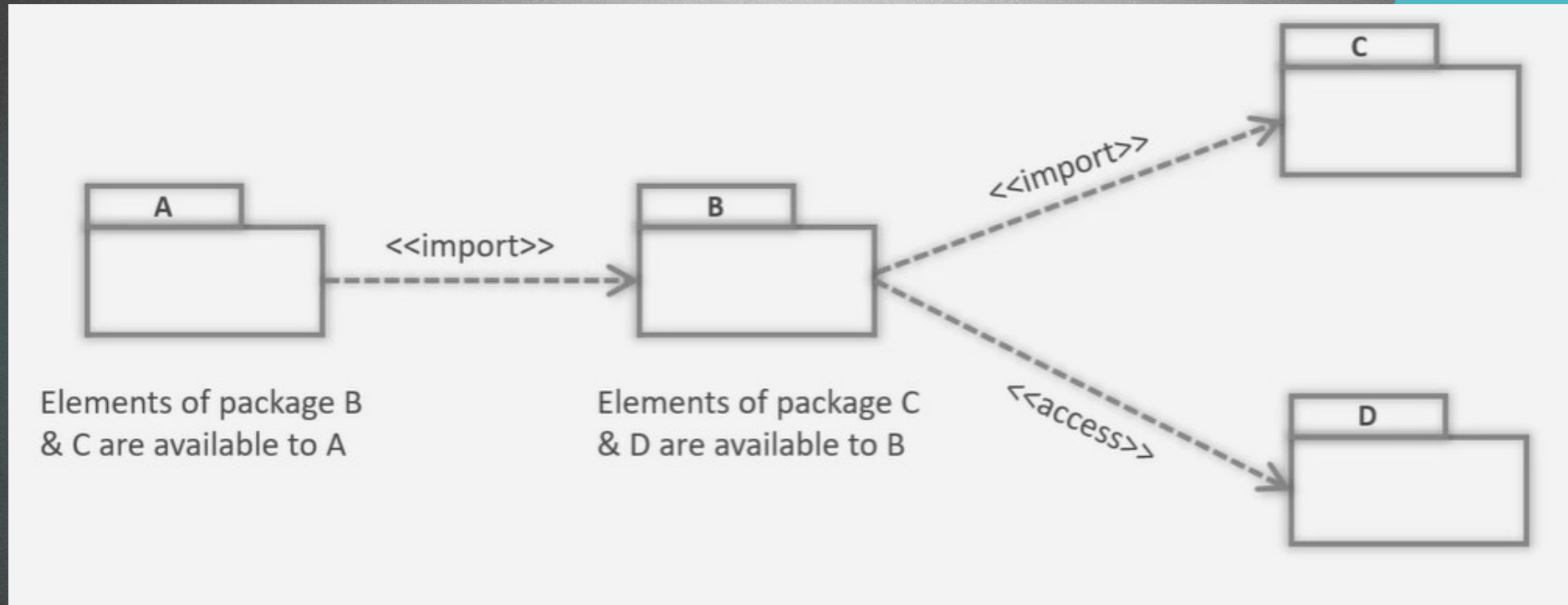
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Import

- ❏ The import relation itself has visibility
- ❏ An import can be public import or private import
- ❏ In public import, elements have public visibility inside the importin packages
- ❏ To avoid exposing the imported packages elements, you can use private import by specifying <<access>> stereotype

Example



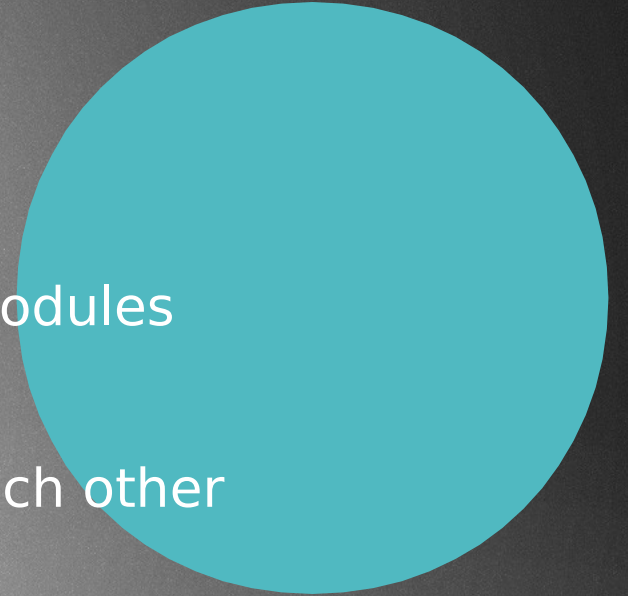

```
package com.poash.oop;

import drawing.* ;
import drawing.Graphics;

public class Program {
    private void Draw() {
        Graphics gph = new Graphics() ;
        //Full qualified name
        drawing.Graphics g = new drawing.Graphics() ;
    }
}
```


When to use?

- 🕒 To show high-level view of the system
- 🕒 The view could be requirements or design
- 🕒 Organize the complexity by dividing the system into modules
- 🕒 Keep track of dependencies
- 🕒 Understand how major parts of the system relate to each other



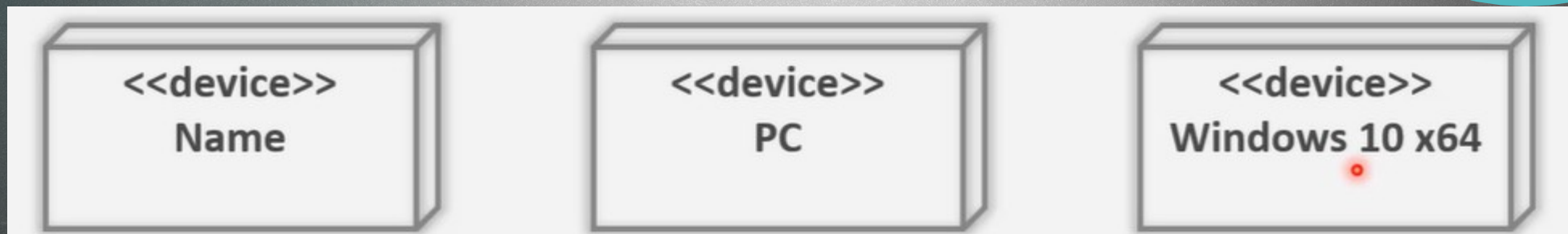
Deployment Diagram

- ❏ Represents the physical view in Kruchten's 4+1 model
- ❏ Concerned with the physical elements of the system
- ❏ These elements are executable files and the hardware they run on
- ❏ Describes the elements, where they are located on the hardware and how they communicate with each other



Node

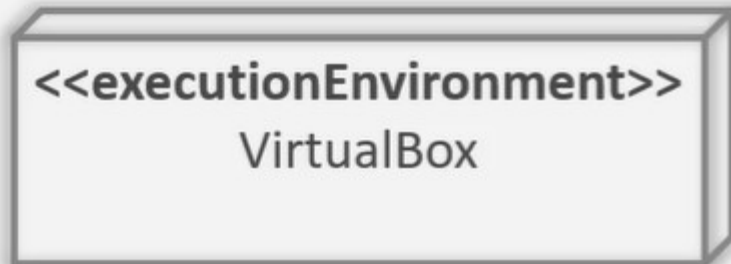
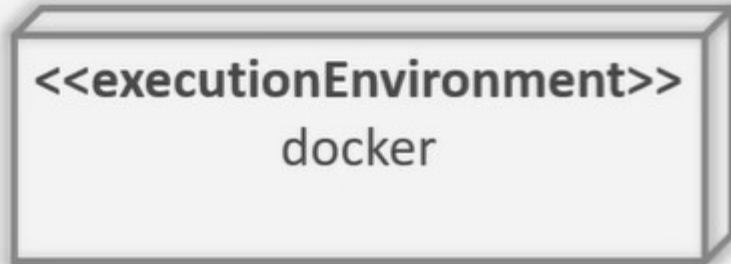
- ❏ The core part in a deployment diagram is a node
- ❏ It shows the computer hardware and is shown in a 3D box with `<<device>>` stereotype and a name
- ❏ The name can be general or specific name i.e. PC is general name, but windows 10 x64 is a specific name



Node

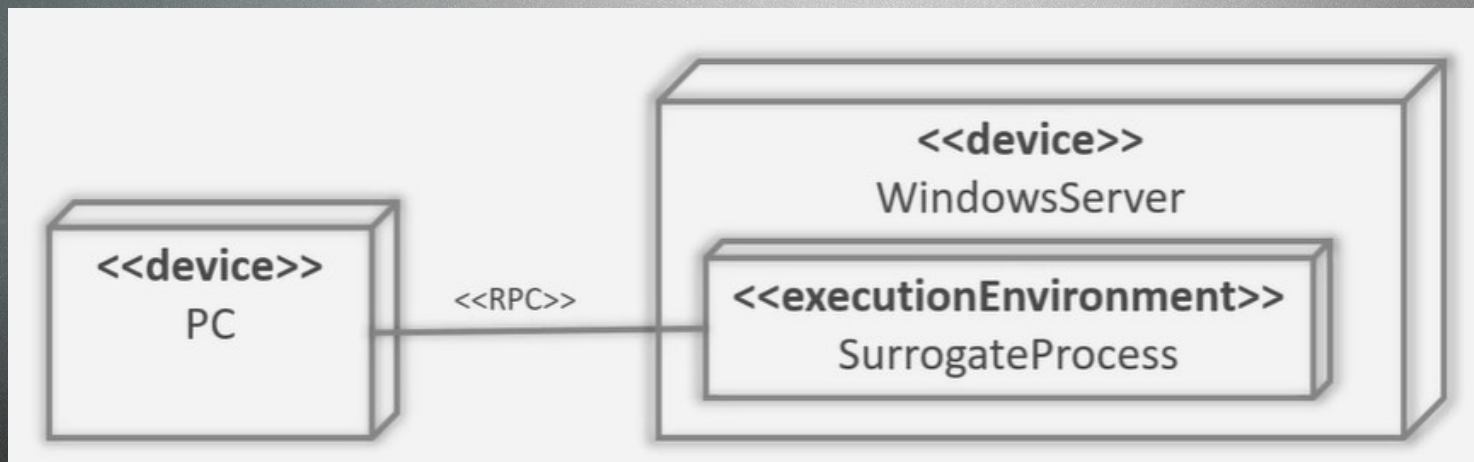
- ❏ Nodes don't need to represent a hardware
- ❏ Some type of the software provide an execution environment in which other software components can be executed
- ❏ So, a node can be hardware or software resources that can host software or related files
- ❏ A software node can be an application context
 - ❏ Generally not part of the software that is developed
 - ❏ Provide by a third-party that provides services to our software
- ❏ Examples of such execution environments are OS, Web server, Docker, App server, etc.

Example



Node Communication

- ❏ A node may have to communicate with other nodes to fulfil its tasks
- ❏ This is shown through communication oaths; a solid line that connects two nodes
- ❏ The type of communication is shown through a stereotype

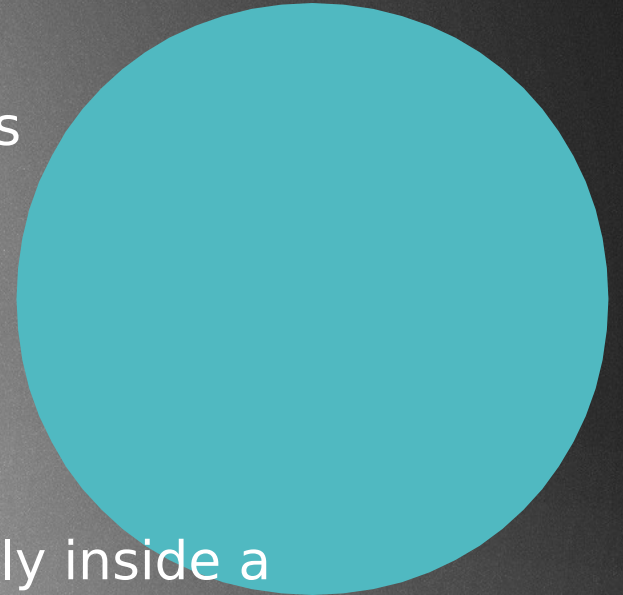


Artifacts

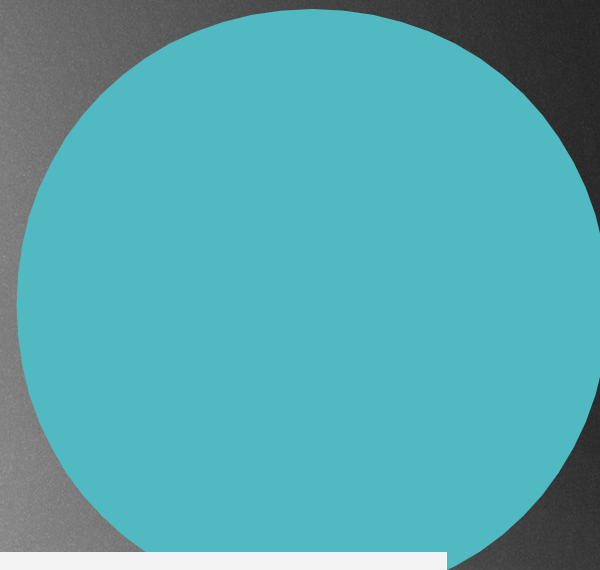
- ④ An artifact is a physical file that is generated pout of software development process
- ④ An artifact can be of the following type
 - ④ Executable, such as .exe or .jar file
 - ④ Libraries, such as .lib, .dll
 - ④ Source files, such as .cpp, .java
 - ④ Configuration files used by software att runtime, such as .xml or .ini

Artifacts

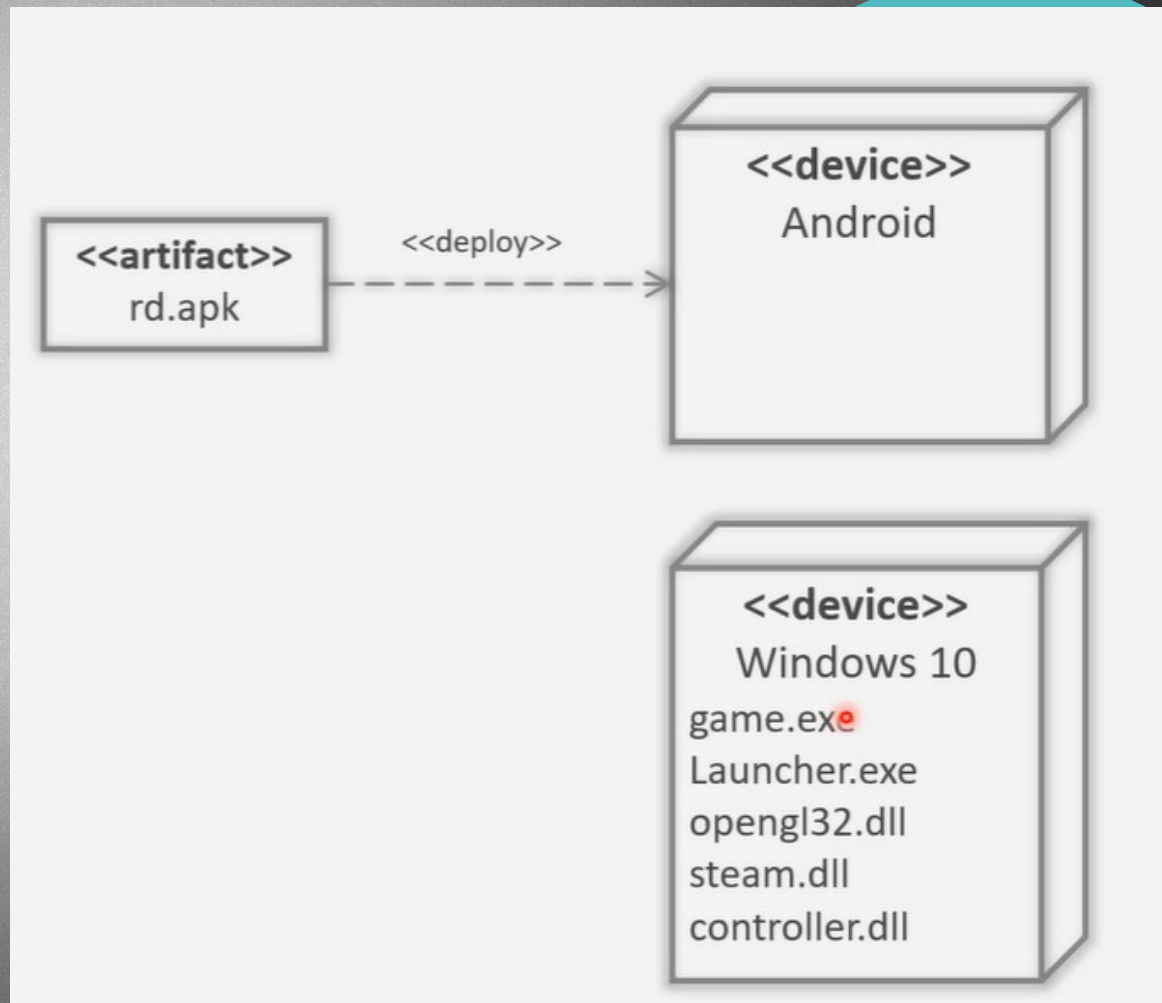
- UML provides multiple notations for represents artifacts
- Artifacts are represented in a rectangle
 - With the <<artifact>> stereotype
 - With a document icon in the top right corner
 - With a dependency arrow towards the node
- If there are too many artifacts, you can list them directly inside a node
- You can also show dependency between artifacts through a dependency arrow



Example



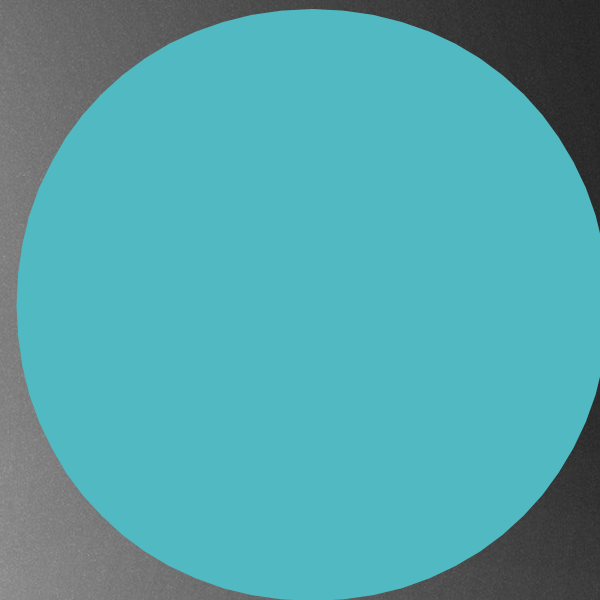
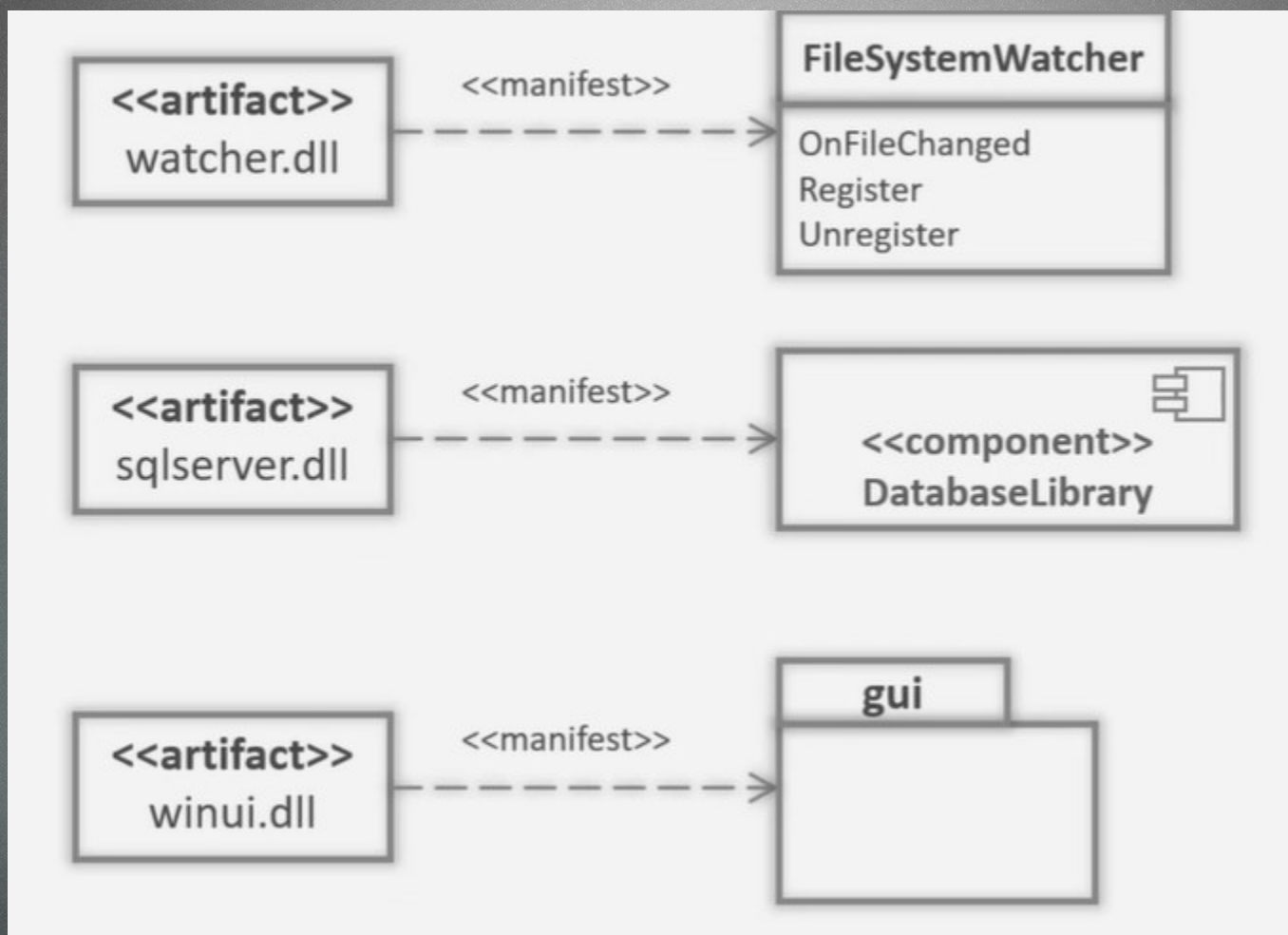
Example



Artifacts

- ❏ Software can be modularized through packages or components
- ❏ These are ultimately compiled into one or more files or artifacts
- ❏ If an artifact is physical representation of a component, then the artifact *manifest* that component
- ❏ Note that artifact can manifest a class, package or a component
- ❏ This relationship is shown through a dependency arrow with `<<manifest>>` stereotype

Example



Advantages

- ④ Useful in all stages of the design process
- ④ Especially, in the earlier stages, you can get an overview of the architecture of the system without dealing with details
- ④ A rough sketch can be v=created that can be refined in the later stages of the software development
- ④ The refinement can help express the current view of the physical system with other stakeholders

When to use?

- 🕒 Create rough sketch of the physical layout of the system
- 🕒 Discover issues involved in deployment process
- 🕒 Identify & explore dependencies between your software & its environment
- 🕒 Visualize the physical topology of the system's deployment