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Java design patterns tutorials point pdf

Java design patterns simple explanation. Java design patterns with examples. Important design patterns in java. Java design patterns tutorialspoint pdf.

A design patterns are well-proved solution for solving the specific problem/task. Now, a question will be arising in your mind what kind of specific problem? Let me explain by taking an example.
Problem Given: Suppose you want to create a class for which only a single instance (or object) should be created and that single object can be used by all other classes. Solution: Singleton design pattern is the best solution of above specific problem. So, every design pattern has some specification or set of rules for solving the problems. What are those specifications, you will see later in the types of design patterns. But remember one-thing, design patterns are programming language independent strategies for solving the common object-oriented design problems. That means, a design pattern represents an idea, not a particular implementation. By using the design patterns you can make your code more flexible, reusable and maintainable. It is the most important part because java internally follows design patterns. To become a professional software developer, you must know at least some popular solutions (i.e. design patterns) to the coding problems. Advantage of design pattern: They are reusable in multiple projects. They provide the solutions that help to define the system architecture. They capture the software engineering experiences. They provide transparency to the design of an application. They are well-proved and testified solutions since they have been built upon the knowledge and experience of expert software developers. Design patterns don?t guarantee an absolute solution to a problem. They provide clarity to the system architecture and the possibility of building a better system. When should we use the design patterns? We must use the design patterns during the analysis and requirement phase of SDLC(Software Development Life Cycle).
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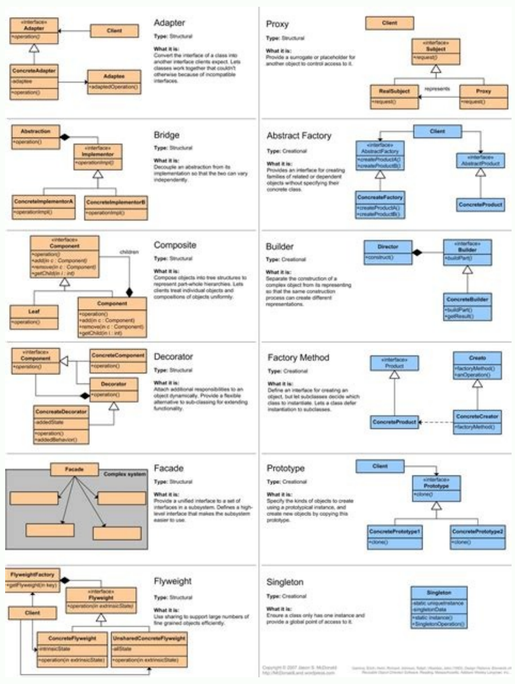

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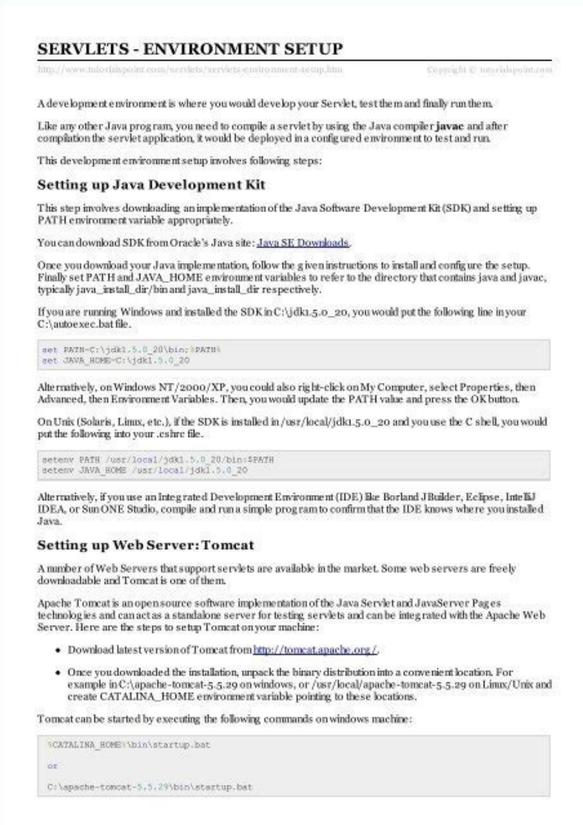

SERVLETS - ENVIRONMENT SETUP

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A development environment is where you would develop your Servlet, test them and finally run them.

Like any other Java program, you need to compile a servlet by using the Java compiler **javac** and after compilation the servlet application, it would be deployed in a configured environment to test and run.

This development environment setup involves following steps:

Setting up Java Development Kit

This step involves downloading an implementation of the Java Software Development Kit (SDK) and setting up PATH environment variable appropriately.

You can download SDK from Oracle's Java site: Java SE Downloads.

Once you download your Java implementation, follow the given instructions to install and configure the setup. Finally set PATH and JAVA_HOME environment variables to refer to the directory that contains java and javac, typically java_install_dir/bin and java_install_dir respectively.

If you are running Windows and installed the SDK in C:\jdk1.5.0_20, you would put the following line in your C:\autoexec.bat file.

```
set PATH=C:\jdk1.5.0_20\bin;%PATH%
set JAVA_HOME=C:\jdk1.5.0_20
```

Alternatively, on Windows NT/2000/XP, you could also right-click on My Computer, select Properties, then Advanced, then Environment Variables. Then, you would update the PATH value and press the OK button.

On Unix (Solaris, Linux, etc.), if the SDK is installed in /usr/local/jdk1.5.0_20 and you use the C shell, you would put the following into your .cshrc file.

```
setenv PATH /usr/local/jdk1.5.0_20/bin:$PATH
setenv JAVA_HOME /usr/local/jdk1.5.0_20
```

Alternatively, if you use an Integrated Development Environment (IDE) like Borland JBuilder, Eclipse, IntelliJ IDEA, or Sun ONE Studio, compile and run a simple program to confirm that the IDE knows where you installed Java.

Setting up Web Server: Tomcat

A number of Web Servers that support servlets are available in the market. Some web servers are freely downloadable and Tomcat is one of them.

Apache Tomcat is an open source software implementation of the Java Servlet and JavaServer Pages technologies and can act as a standalone server for testing servlets and can be integrated with the Apache Web Server. Here are the steps to setup Tomcat on your machine:

- Download latest version of Tomcat from http://tomcat.apache.org/.
- Once you downloaded the installation, unpack the binary distribution into a convenient location. For example in C:\apache-tomcat-5.5.29 on windows, or /usr/local/apache-tomcat-5.5.29 on Linux/Unix and create CATALINA_HOME environment variable pointing to these locations.

Tomcat can be started by executing the following commands on windows machine:

```
%CATALINA_HOME%\bin\startup.bat

or

C:\apache-tomcat-5.5.29\bin\startup.bat
```

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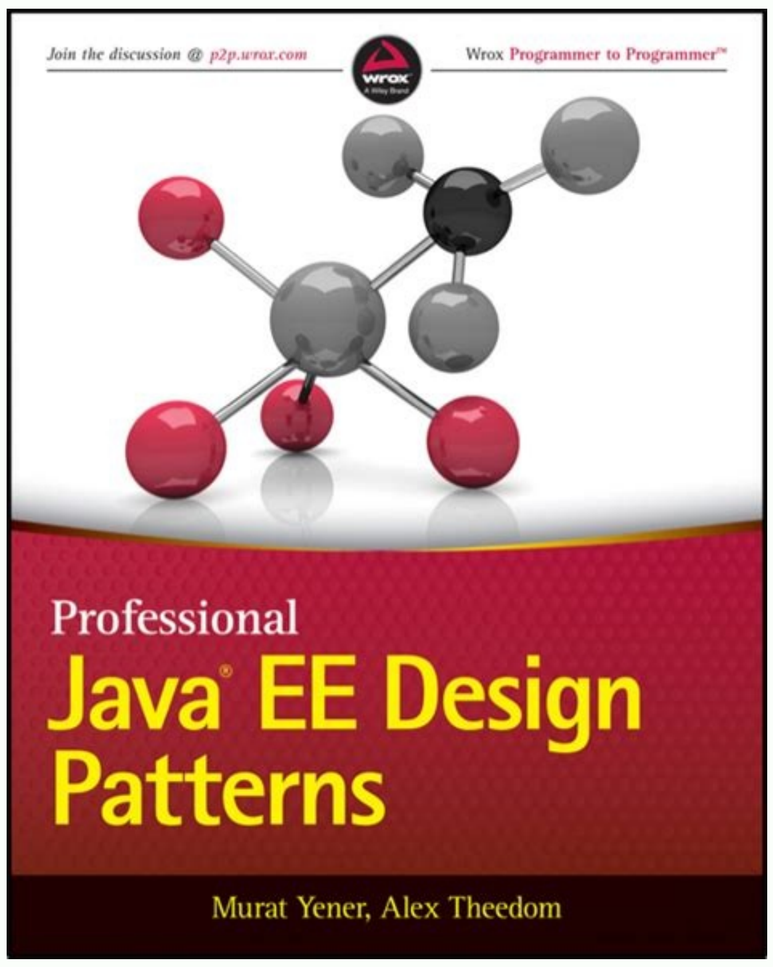

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This pattern takes out the responsibility of the instantiation of a Class from the client program to the factory class. We can apply a singleton pattern on the factory class or make the factory method static. Note: Learn more about the Factory Design Pattern. 3. Abstract Factory Pattern The abstract factory pattern is similar to the factory pattern and is a factory of factories. If you are familiar with the factory design pattern in Java, you will notice that we have a single factory class that returns the different subclasses based on the input provided and the factory class uses if-else or switch statements to achieve this. In the abstract factory pattern, we get rid of if-else block and have a factory class for each subclass and then an abstract factory class that will return the subclass based on the input factory class. Note: Learn more about the Abstract Factory Pattern. 4. Builder Pattern The builder pattern was introduced to solve some of the problems with factory and abstract Factory design patterns when the object contains a lot of attributes. This pattern solves the issue with a large number of optional parameters and inconsistent state by providing a way to build the object step-by-step and provide a method that will actually return the final Object.
Note: Learn more about the Builder Pattern. 5. Prototype Pattern The prototype pattern is used when the Object creation is costly and requires a lot of time and resources, and you have a similar Object already existing. So this pattern provides a mechanism to copy the original Object to a new Object and then modify it according to our needs. This pattern uses Java cloning to copy the Object. The prototype design pattern mandates that the Object which you are copying should provide the copying feature. It should not be done by any other class. However, whether to use the shallow or deep copy of the object properties depends on the requirements and is a design decision. Note: Learn more about the Prototype Pattern. Structural Design Patterns Structural design patterns provide different ways to create a Class structure (for example, using inheritance and composition to create a large Object from small Objects). 1. Adapter Pattern The adapter design pattern is one of the structural design patterns and is used so that two unrelated interfaces can work together. The object that joins these unrelated interfaces is called an adapter. Note: Learn more about the Adapter Pattern. 2. Composite Pattern The composite pattern is used when we have to represent a part-whole hierarchy. When we need to create a structure in a way that the objects in the structure have to be treated the same way, we can apply the composite design pattern. Note: Learn more about the Composite Pattern. 3. Proxy Pattern The proxy pattern provides a placeholder for another Object to control access to it. This pattern is used when we want to provide controlled access to functionality. Note: Learn more about the Proxy Pattern. 4. Flyweight Pattern The flyweight design pattern is used when we need to create a lot of Objects of a Class. Since every Object consumes memory space that can be crucial for low-memory devices (such as mobile devices or embedded systems), the flyweight design pattern can be applied to reduce the load on memory by sharing Objects.
String pool implementation in Java is one of the best examples of flyweight pattern implementation.
Note: Learn more about the Flyweight Pattern. 5. Facade Pattern The facade pattern is used to help client applications easily interact with the system. Note: Learn more about the Facade Pattern. 6. Bridge Pattern When we have interface hierarchies in both interfaces as well as implementations, then the bridge design pattern is used to decouple the interfaces from the implementation and to hide the implementation details from the client programs. The implementation of the bridge design pattern follows the notion of preferring composition over inheritance. Note: Learn more about the Bridge Pattern. 7. Decorator Pattern The decorator design pattern is used to modify the functionality of an object at runtime. At the same time, other instances of the same class will not be affected by this, so the individual object gets the modified behavior. The decorator design pattern is one of the structural design patterns (such as adapter pattern, bridge pattern, or composite pattern) and uses abstract classes or interface with the composition to implement.
We use inheritance or composition to extend the behavior of an object, but this is done at compile-time, and it’s applicable to all the instances of the class. We can’t add any new functionality to remove any existing behavior at runtime – this is when the decorator pattern is useful. Note: Learn more about the Decorator Pattern. Behavioral Design Patterns Behavioral patterns provide a solution for better interaction between objects and how to provide loose-coupling and flexibility to extend easily. 1. Template Method Pattern The template method pattern is a behavioral design pattern and is used to create a method stub and to defer some of the steps of implementation to the subclasses. The template method defines the steps to execute an algorithm, and it can provide a default implementation that might be common for all or some of the subclasses. Note: Learn more about the Template Method Pattern.
The mediator design pattern is used to provide a centralized communication medium between different objects in a system. If the objects interact with each other directly, the system components are tightly-coupled with each other which makes maintainability cost higher and not flexible to extend easily. The mediator pattern focuses on providing a mediator between objects for communication and implementing loose-coupling between objects. The mediator works as a router between objects, and it can have its own logic to provide a way of communication. Note: Learn more about the Mediator Pattern 3. Chain of Responsibility Pattern The chain of responsibility pattern is used to achieve loose-coupling in software design where a request from the client is passed to a chain of objects to process them. Then the object in the chain will decide who will be processing the request and whether the request is required to be sent to the next object in the chain or not. We know that we can have multiple catch blocks in a try-catch block code. Here every catch block is kind of a processor to process that particular exception. So when an exception occurs in the try block, it’s sent to the first catch block to process. If the catch block is not able to process it, it forwards the request to the next Object in the chain (i.e., the next catch block). If even the last catch block is not able to process it, the exception is thrown outside of the chain to the calling program. Note: Learn more about the Chain of Responsibility Pattern. 4. Observer Pattern An observer design pattern is useful when you are interested in the state of an Object and want to get notified whenever there is any change. In the observer pattern, the Object that watches the state of another Object is called observer, and the Object that is being watched is called subject. Java provides an built-in platform for implementing the observer pattern through the java.util.Observable class and java.util.Observer interface. However, it’s not widely used because the implementation is limited and most of the time we don’t want to end up extending a class solely for implementing the observer pattern as Java doesn’t provide multiple inheritances in classes. Java Message Service (JMS) uses the observer pattern along with the mediator pattern to allow applications to subscribe and publish data to other applications. Note: Learn more about the Observer Pattern. 5. Strategy Pattern Strategy pattern is used when we have multiple algorithms for a specific task, and the client decides the actual implementation be used at runtime. A strategy pattern is also known as a policy pattern. We define multiple algorithms and let client applications pass the algorithm to be used as a parameter. One of the best examples of this pattern is the Collections.sort() method that takes the Comparator parameter.
Based on the different implementations of comparator interfaces, the objects are getting sorted in different ways. Note: Learn more about the Strategy Pattern. 6. Command Pattern The command pattern is used to implement loose-coupling in a request-response model. In this pattern, the request is sent to the invoker and the invoker passes it to the encapsulated command object. The command object passes the request to the appropriate method of receiver to perform the specific action. Note: Learn more about the Command Pattern. 7. State Pattern The state design pattern is used when an Object changes its behavior based on its internal state. If we have to change the behavior of an Object based on its state, we can have a state variable in the Object and use if-else condition block to perform different actions based on the state. The state pattern is used to provide a systematic and loosely-coupled way to achieve this through context and state implementations.
Note: Learn more about the State Pattern. 8. Visitor Pattern The visitor pattern is used when we have to perform an operation on a group of similar kinds of objects.
With the help of a visitor pattern, we can move the operational logic from the objects to another class. Note: Learn more about the Visitor Pattern. 9. Interpreter Pattern The interpreter pattern is used to define a grammatical representation of a language and provides an interpreter to deal with this grammar. 10. Iterator Pattern The iterator pattern is one of the behavioral patterns and is used to provide a standard way to traverse through a group of objects. The iterator pattern is widely used in Java Collection Framework where the iterator interface provides methods for traversing through a Collection. This pattern is also used to provide different kinds of iterators based on our requirements. The iterator pattern hides the actual implementation of traversal through the Collection and client programs use iterator methods.
Note: Learn more about the Iterator Pattern. 11. Memento Pattern The memento design pattern is used when we want to save the state of an object so that we can restore it later on. This pattern is used to implement this in such a way that the saved state data of the object is not accessible outside of the Object, this protects the integrity of saved state data. Memento pattern is implemented with two Objects – originator and caretaker. The originator is the Object whose state needs to be saved and restored, and it uses an inner class to save the state of Object. The inner class is called “Memento”, and it’s private so that it can’t be accessed from other objects. Miscellaneous Design Patterns There are a lot of design patterns that don’t come under Gang of Four design patterns. Let’s look at some of these popular design patterns. 1. DAO Design Pattern The Data Access Object (DAO) design pattern is used to decouple the data persistence logic to a separate layer. DAO is a very popular pattern when we design systems to work with databases. The idea is to keep the service layer separate from the data access layer. This way we implement the separation of logic in our application.
Note: Learn more about the DAO Pattern. 2. Dependency Injection Pattern The dependency injection pattern allows us to remove the hard-coded dependencies and make our application loosely-coupled, extendable, and maintainable. We can implement dependency injection in Java to move the dependency resolution from compile-time to runtime. Spring framework is built on the principle of dependency injection. Note: Learn more about the Dependency Injection Pattern. 3. MVC Pattern Model-View-Controller (MVC) Pattern is one of the oldest architectural patterns for creating web applications. Conclusion This article summarized Java design patterns. You can check out Java design patterns example code from our GitHub Repository. Continue your learning with more Java tutorials. You can download the PDF of this wonderful tutorial by paying a nominal price of $9.99. Your contribution will go a long way in helping us serve more readers.