SE 3140

SOFTWARE DESIGN AND MODELING

VI. DESIGN PRINCIPLES AND PATTERNS

❑ SYMPTOMS OF ROTTING DESIGN.

These four symptoms
(**Rigidity, Fragility, immobility and viscosity**) are the signs of poor architecture.

But what causes that rot to take place?

❑ SYMPTOMS OF ROTTING DESIGN.

But what causes that rot to take place?

❖ Changing requirements

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❑ SYMPTOMS OF ROTTING DESIGN.

❖ Changing requirements causes rot to design

Modification may be requested in a way that the requirement or initial design did not anticipate the changes.

Requirements should not be blamed, as an engineer , you know requirements will change.

We must find a way to make your design resilient to such changes and protect it from rotting.

❑ SYMPTOMS OF ROTTING DESIGN.

What kind of changes causes design to rot?

Changes that introduced new and unplanned dependencies.

It is the architecture dependency that is degrading.

In other to solve this, the decencies in an architecture must be managed.

❑ SYMPTOMS OF ROTTING DESIGN.

❖ Managing Dependency

- Dependency architecture degrading can be manage by the creation of dependency firewalls.

Across such firewalls, dependencies do not propagates.

Object oriented design is known to have principles and techniques for building such firewalls and managing modules dependencies.

❑ SYMPTOMS OF ROTTING DESIGN.

❖ Managing Dependency

Dependency architecture degrading can be manage by the creation of dependency firewalls.

The principles and techniques that helps maintain the dependency architecture of an application is Design Principles and Patterns.

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DESIGN PATTERNS

- Introduction

When following the Principle of design to create object oriented architecture, one finds that one repeats the same structure over and over again.

These repeating structures of design and architecture are known as design Patterns.

DESIGN PATTERNS

❖ Introduction

The benefits of Object Oriented language has the advantage of writing codes that are flexible, maintainable and re-usable.

- Flexible :Can make any change with less or any pain.
- Maintainable :Code easily change and any change to a part of the code will not affect any other part of the code.
- Re-usable: Can be reuse anywhere without any trouble.

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DESIGN PATTERNS

❖ what are Design Patterns?

The advantages of OO Languages implementation comes from Design.

- Designing is an art and it comes from experience.

- There are some set of solution already written by some of the advanced and experienced developers while facing with solving similar designing problems.

These solutions are known as Design Patterns.

DESIGN PATTERNS

❖ what are Design Patterns?

What are design Patterns ?

- Best practices used by the experience developers.
- They are usually re-usable solutions to commonly occurring problems.
- Patterns are not complete codes but could be use as templates which can be applied to a problem.

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DESIGN PATTERNS

- What are Design Patterns?

There are four essential elements of Patterns :-

1. Pattern Name
2. The problem
3. The solution
4. The result and consequences of applying the pattern

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DESIGN PATTERNS

❖ what are Design Patterns?

There are four essential elements of Patterns :-

1. Pattern Name

It provides a single and meaningful name to a pattern which defines a design problem and a solution for it.

- Naming a design patterns helps itself to be referred to others easily.
- It ease documentation

DESIGN PATTERNS

❖ what are Design Patterns?

There are four essential elements of Patterns :-

2. The problem:-

It describes when to apply the pattern.

- It explains the problem and its context.
- Sometimes the problem will include a list of conditions that must be met before it makes sense to apply the pattern.

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DESIGN PATTERNS

❖ what are Design Patterns?

There are four essential elements of Patterns :-

3. The solution:-

It describes the elements that makes up the design, their relationship, responsibilities and collaborations.

- The solution is not the complete code.
- It works as a template which can be fulfilled with code.
- It provides an abstract description of a design and how a general arrangement of elements solves it.

DESIGN PATTERNS

❖ what are Design Patterns?

There are four essential elements of Patterns :-

4. The results and consequences of applying the pattern

- It include its impact on a system flexibility, extensibility or portability.
- Listing the consequences explicitly helps you understand and evaluate them.

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❖ why use Design Patterns?

The reasons to consider applying pattern revolves around flexibility, reusability, share vocabulary and capturing of best practices .

- Design patterns makes it easier to reuse successful designs and architectures.
- Design patterns can improve the documentation of maintenance of existing system by explicitly specification of class and objects interactions.

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- How to select and use one

Several design patterns exist.

- Several patterns looks similar though with different implementation. To select one

1. Identify the kind of design problem you are facing

The problem may be creational, structural, behavioral.

2. Filter the pattern among several patterns and select the appropriate one.

- To chose one, you must have a good knowledge about each of them.

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DESIGN PATTERNS

- How to select and use one

Points to note:-

- Design patterns can be used to solve more than one problem.
- One design problem can be solved by more than one design patterns.
- Choosing the patterns which fits exactly , depends on your knowledge and understanding about the design pattern.

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- Categorization of patterns

Design patterns can be categorized in the following three categories.

These are :-

1. **The Creational Patterns**
2. **Structural Patterns**
3. **Behavior Patterns**

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❖ Creational Patterns

Creational design patterns are used to design the instantiation process of objects.

- The creational pattern uses the inheritance to vary the object creation. They are two concepts to note:-

1. They all encapsulate knowledge about which concrete classes the system uses.
2. They hide how instances of these classes are created and put together.

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❖ Creational Patterns

Creational design patterns are used to design the instantiation process of objects.

It gives flexibility in what gets created, who creates it, how it gets created, and when.

In some cases,

- Two or more patterns looks fit as a solution to a problem.
- Two patterns complement each other.

DESIGN PATTERNS

- Some Creational Patterns

1. Abstract Factory
2. Builder
3. Factory Method
4. Prototype
5. Singleton

DESIGN PATTERNS

- Structural Patterns

It concerns how classes and objects are composed to form larger structures.

- Structural class patterns use inheritance to compose interfaces or implementations.
- Structural object patterns describes ways to compose objects to realize new functionality.

DESIGN PATTERNS

- Some Structural Patterns

1. Adapter
2. Bridge
3. Composite
4. Decorator
5. Flyweight
6. Proxy

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- Some Behavior Patterns

1. Chain of Responsibility
2. Command
3. Interpreter
4. Iterate
5. Mediator
6. Memento
7. Observer
8. state
9. Strategy
10. Template Method
11. Visitor

DESIGN PATTERNS

- Behavior Patterns

Patterns concern with algorithms and the assignment of responsibilities between objects.

- It defines not just patterns of objects or classes but also the patterns of communication between them.
- It uses composition rather than inheritance.
- Some describes how a group of peer objects cooperate to perform a task that no single object can carry out by itself.

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❖ REVISION QUESTIONS

1. Give 3 classes of design patterns
2. What are design patterns?
3. Give the differences between the 3 types of patterns
4. Give 2 practical examples of the following patterns. Proxy, mediator, singleton , memento
5. Give 3 reasons for using design patterns
6. Give one key issue that helps in selecting and appropriate design pattern
7. Give 4 essential elements of design patterns
8. Give 2 steps used to select a design pattern.