Reusable Software Assets

Jonathan I. Maletic, Ph. D.

<SDML>
Department of Computer Science
Kent State University

What is Reuse

- Black box Reuse –
  - reuse of an asset as is
  - Plug and play
  - No modification of asset is needed.
- Glass box Reuse –
  - modification of asset is needed in order to utilize it for the specific problem.

Reuse Process

- Find the proper asset
- Understand it
- Modify it
- Integration and testing

Reusable Software

- Consists of not only of source code, but includes a wide variety of software-related products and concepts.
- These concepts are at varying degrees of abstraction.
- Software asset = item that costs money to build, store, and train others to use properly.

Types of Assets:

- Architectures [Monroe97] and Architectural Styles [Shaw96, Monroe97]
- Idioms [Coplien97]
- Design Patterns [Gamma95]
- Pattern Languages [Kerth97]
- Frameworks [Johnson97, Schmid97]
- Components [Kerth97]
- Objects/Classes
- Kits/Libraries
- Domain Models

Architectures

- Software Architecture involves the description of elements from which systems are build, interactions among those elements, patterns that guide their composition, and constraints on these patterns [Shaw96].
- Sometimes architecture and design are equated. Although an architecture may represent a design, not all designs are also architectures.
- Domain specific. High level of abstraction.

Architectural Styles (1)

- Define a family of architectures.
- Define a *vocabulary* of components, *connector* (interactions among the components) types, and a set of *constraints* on how they can be combined.
- Slightly domain specific. High level of abstraction.
- Example: client-server, pipe-and-filter, blackboard architectures.

Architectural Styles (2)

- The term *architectural styles* is often used interchangeably with *architectural patterns*, or *architectural idioms*.
- The exact definition of a style is an active research issue and debate.

Idioms

- Typical styles or methods about methods which are used to build a software systems
- A philosophy of use
- Domain independent
- High level of abstraction
- Examples:
  - Coding styles
  - GUI look and feel

Frameworks (1)

- A set of reusable classes or components used to develop a specific type of software system or subsystem. High level definitions (design patterns) of the way the components interact are also contained.
- Reusable designs of all or part of system.
- Are actual programs.
- A framework's purpose is to provide a system/application skeleton that developers can customize.

Frameworks (2)

- Domain specific. Contains elements of high and low level of abstraction.
- Types of frameworks:
  - Domain Specific - Accounting framework
  - Generic GUI Framework for information visualization

Design Patterns

- Description of methods (communicating objects and classes) that can be customized to solve a general design (recurring) problem in a particular context.
- Design patterns vary in their granularity and level of abstraction.
- Patterns are classified by their *purpose* (creational, structural, behavioral) and *scope* (class, object).

Design Patterns - examples

- Factory method (creational, class) – allows a class to defer instantiation to subclasses.
- Facade (structural, object) – provides a unified interface to a set of interfaces in a subsystem. Facade defines a higher-level interface that makes the subsystem easier to use.
- Iterator (behavioral, object) - provides a way to access an aggregation of objects or elements.
- Could be both domain dependent and independent. High level of abstraction.

Pattern Languages

- A system of patterns organized in a structure that guides the pattern's application.
- Simply put, pattern languages are collections of related patterns.
- Pattern languages order the high (meta) level problem solving processes.
- Domain dependent. High level of abstraction.

Components

- A reusable concrete (implemented) piece of software (program) that is concise with respect to problem type.
- Usually, a component provides a particular function or group of related functions.
- Black box component - no modification required, typically parameterizable.
- White box component - modification required to solve problem at hand.
- Domain dependent. Low level of abstraction.

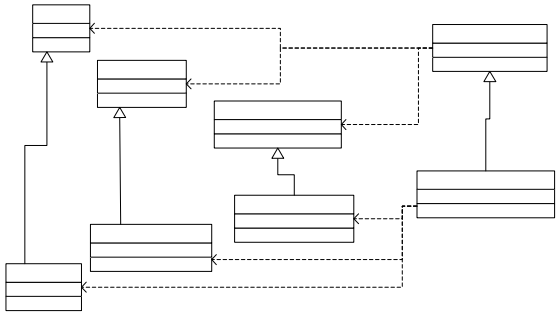
Kits/Libraries

- A set of useful routines, classes, functions.
- Domain dependent. Low level of abstraction.
- Examples:
  - STL (Standard Template Library)
  - Math library
- They are used, but not really reused.

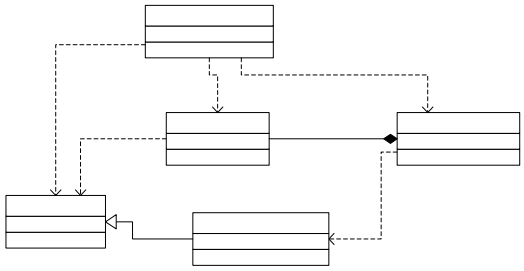
The Relationships

- Use standard UML descriptions and relationships
  - Dependency
  - Aggregation
  - Association
  - Inheritance and instantiation

Architectures



Design Patterns



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Architectural Style

Idioms

Pattern Languages are used to help describe idioms and/or philosophies (be they architectural, or design)

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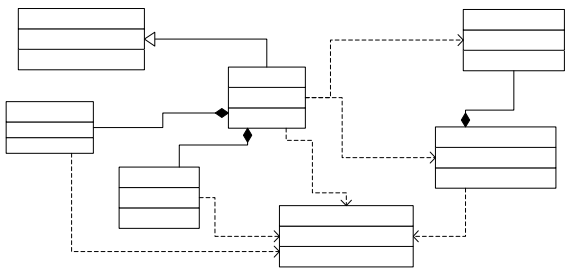
Design Pattern * 1 **Pattern Language**

Domain Model for X

Frameworks



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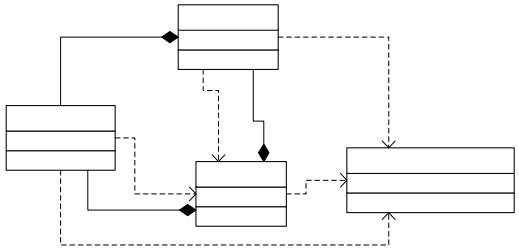
idioms +philosophy +design **Pattern Language**

* *

Components



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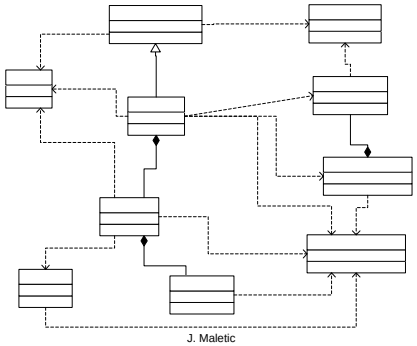
1 **Component**

Unified Overview



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Domain Model for X

Library/Kit

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Final Notes

- One of the main success factors to the reuse of anything (software, ideas, or circuit designs) is standardization of terms and concepts.
- Given a standard vocabulary people can covey ideas to each other more quickly and reuse ideas and concepts over and over.
- Training is a very important part of reuse.

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chitectural Style **Domain Model**

Idioms

Framework

Design Pattern

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