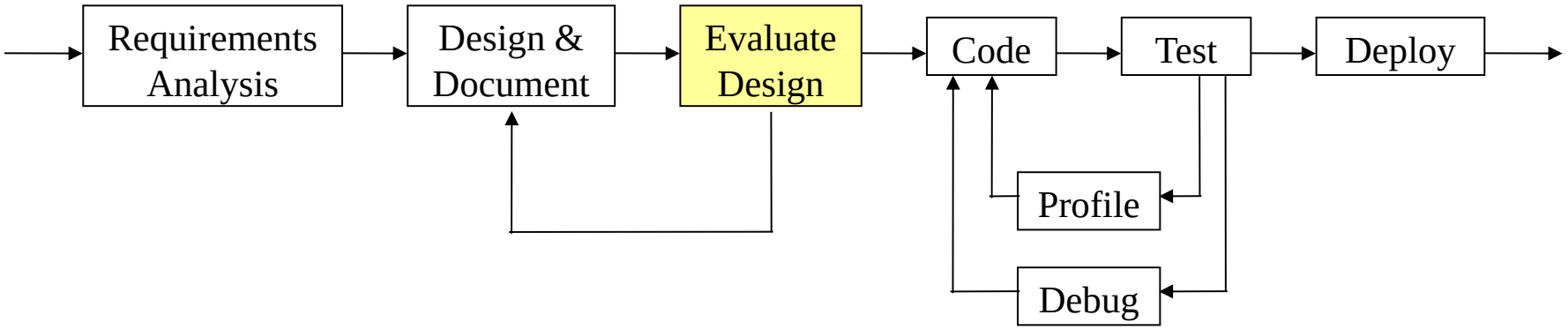
Design Review

CSE219, Computer Science III

Stony Brook University

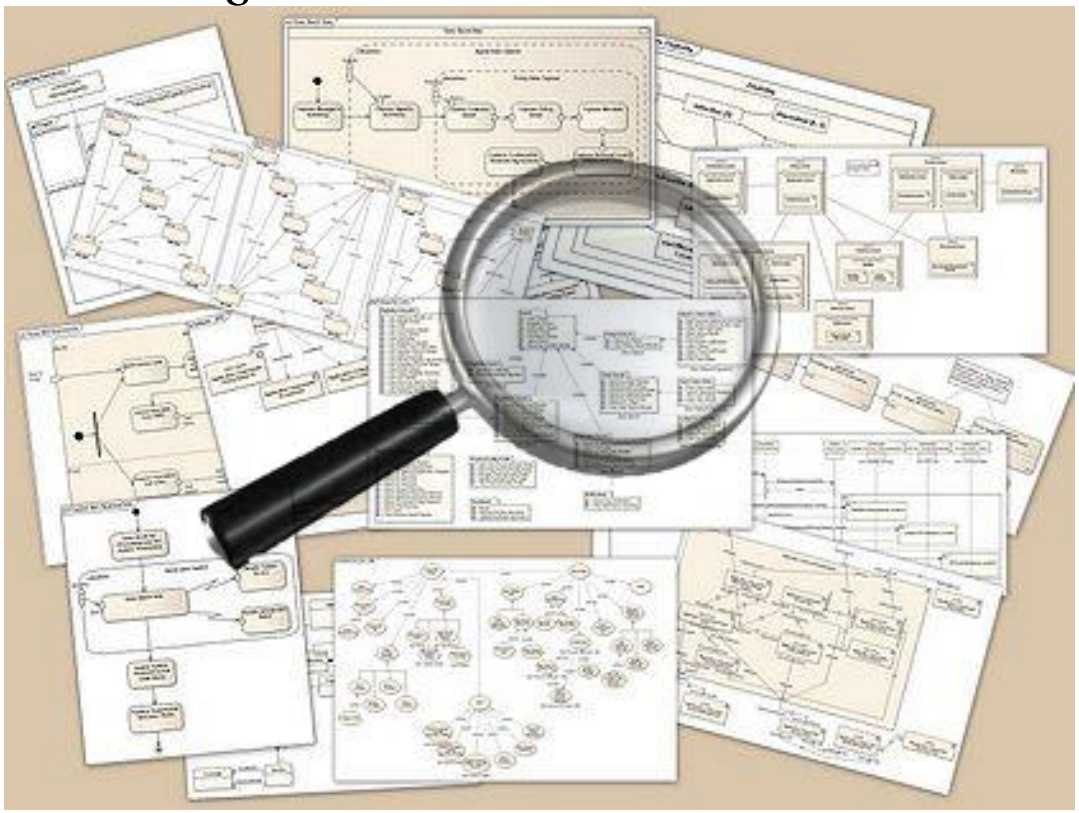
http://www.cs.stonybrook.edu/~cse219

Software Development Life Cycle



Evaluating a Design

- During the design of a large program, it is worthwhile to step back periodically & attempt a comprehensive evaluation of the design so far
  - called a *design review*



Design Reviews are not just for Software

Who performs the design review?

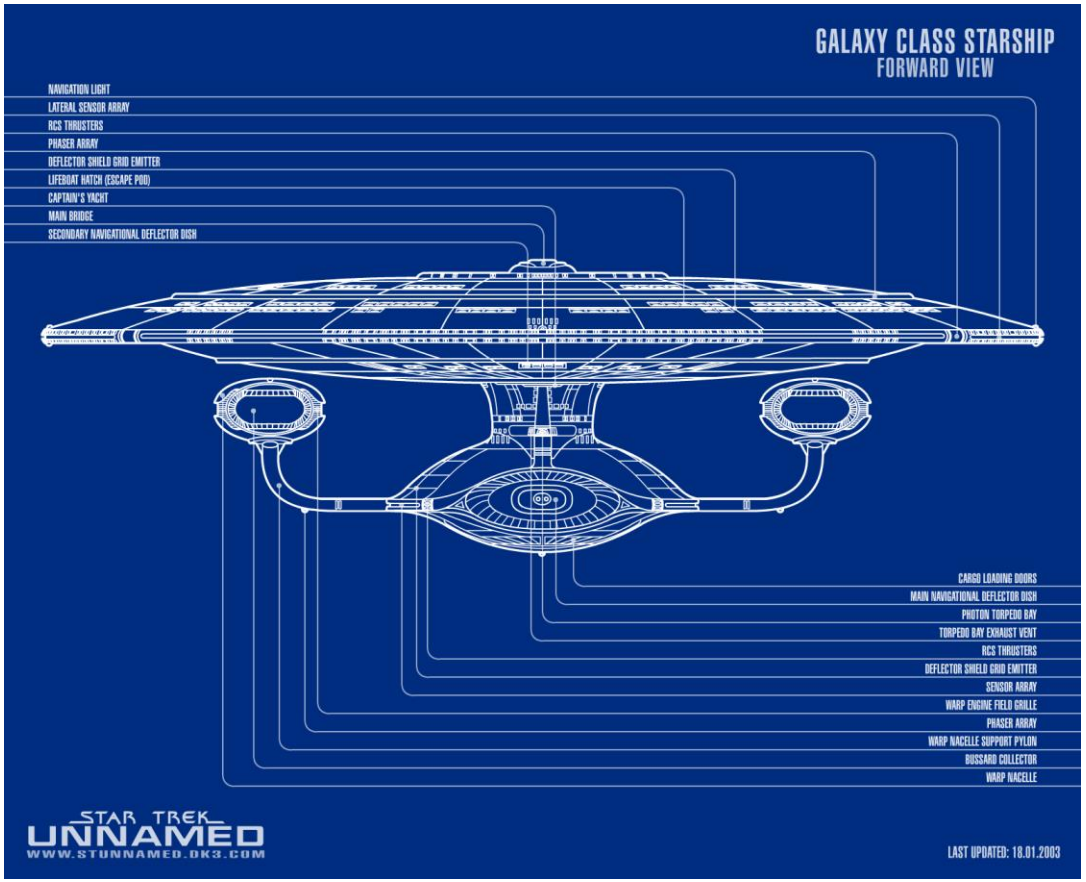
- Design review committee

- Members should include:
  - varied perspectives
  - some from the project
  - some external to the project

- All should be familiar with the design itself

There is no perfect design

- Is the design adequate?
- Will do the job with adequate performance & cost?



Critical Design Issues

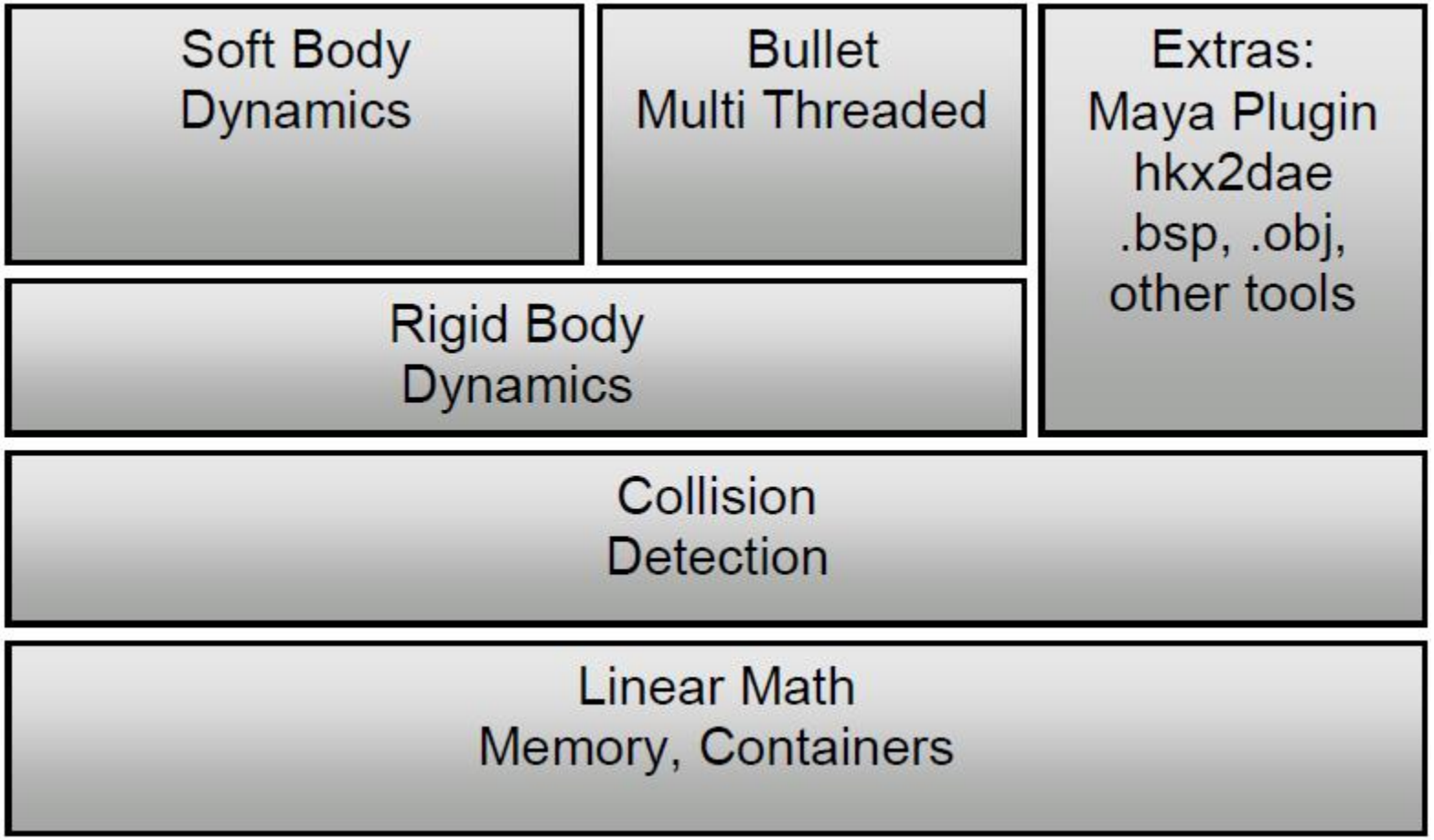
- Is it correct?
  - Will all implementations of the design exhibit the desired functionality?
- Is it efficient?
  - Are there implementations of the design that will be acceptably efficient?
- Is it testable & maintainable?
  - Does the design describe a program structure that will make implementations reasonably easy to build, test and maintain?
- Is it modifiable, extensible, & scalable?
  - How difficult will it be to enhance the design to accommodate future modifications?

Other Considerations

- Are the classes independent?
- Is there redundancy?
- Do they manage & protect their own data?
- Can they be tested individually?
- Do they promote code reuse?
- Is data and control flow clear or complex?

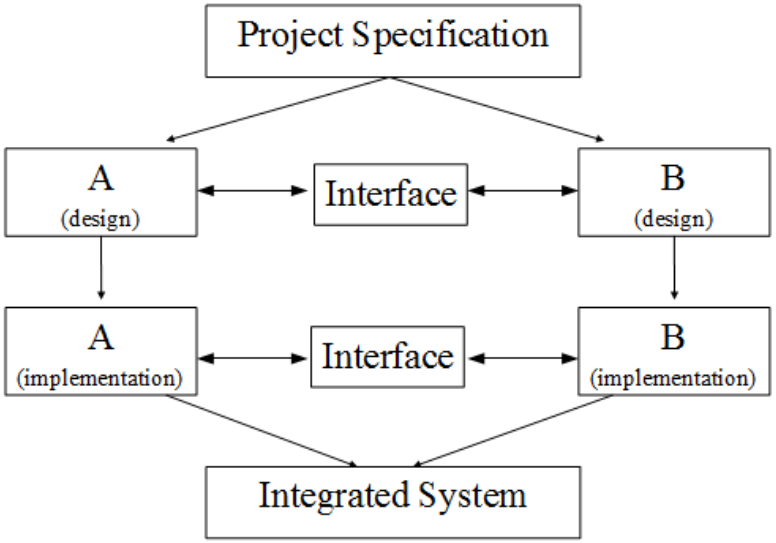
It all starts with a Modular Design

- Large software projects are divided up into separate modules
  - i.e. groups of related classes



Modular Design Methodology

- Decompose
  - large programming problems into smaller ones
  - i.e. sub-problems
- Solve
  - the sub-problems independently
  - modules solve sub-problems
- Assemble
  - the modules to build full system
  - called system integration
    - scariest parts of software development
    - serious design flaws can be exposed

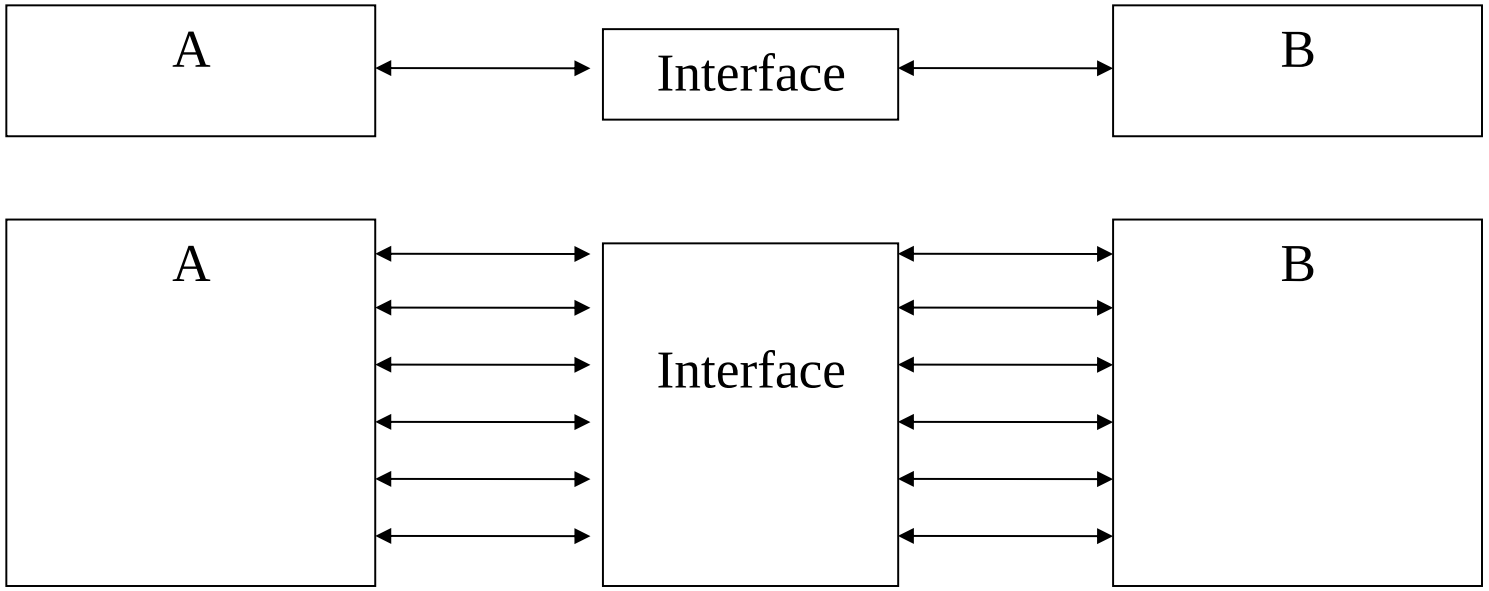


What makes a good modular design?

- Connections between modules are ***explicit***
- Connections between modules are ***minimized***
  - called narrow interfaces
- Modules use ***abstraction*** well
- Implementation of modules can be done ***independently***
  - modules avoid duplication of effort

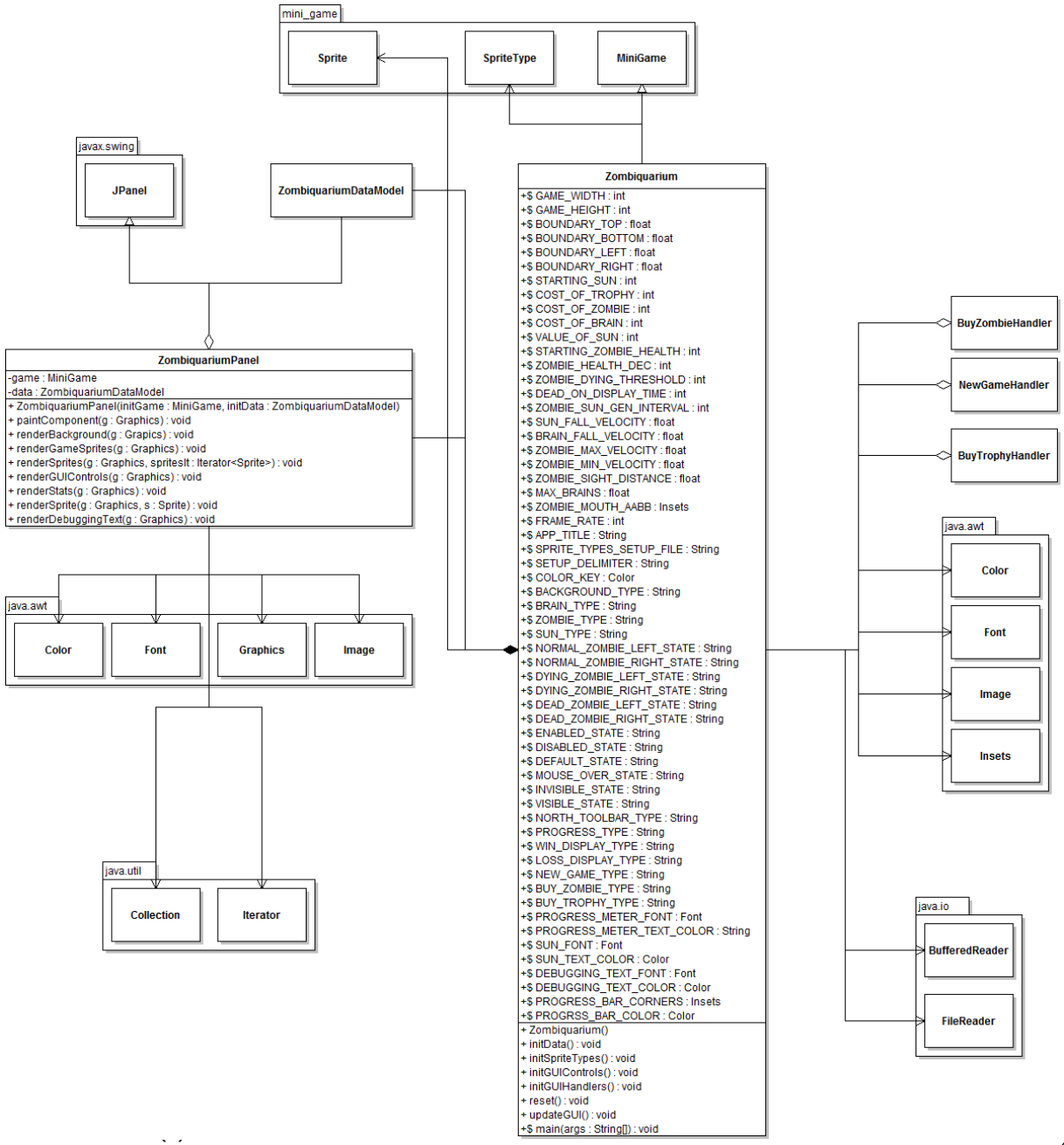
More on Narrow Interfaces

- A module should have access to only as much information as it needs to work
  - less chance of misuse
  - less coordination needed between team members
    - fewer meetings necessary



Design is Difficult

- Where do you begin?
- When is the design complete?



Good Design comes with Experience

- It takes time to become an expert

POSITION INFORMATION

- **Company:** AVID Technical Resources
- **Location:** Woodbury, NY
- **Status:** Full Time, Employee
- **Job Category:** IT/Software Development
- **Work Experience:** 10+ to 15 Years
- **Occupations:** Software/System Architecture Usability/Information Architecture Web/UI/UX Design
- **Salary/Wage:** $0.00 - $210,000.00 /year

POSITION DESCRIPTION

Java Architect

Please only reply with Java Architects that have created white papers that Developers have followed.

Must have a car to get to my client in Woodbury, Long Island.

Contract will last at least 1 year.

1st is a phone screen for 30 minutes, then a face to face for 2 hrs with the VP, and the other Architect.

The goal is to design for the best performance and create processes to be followed.

Create the white papers that will be followed by the developers.

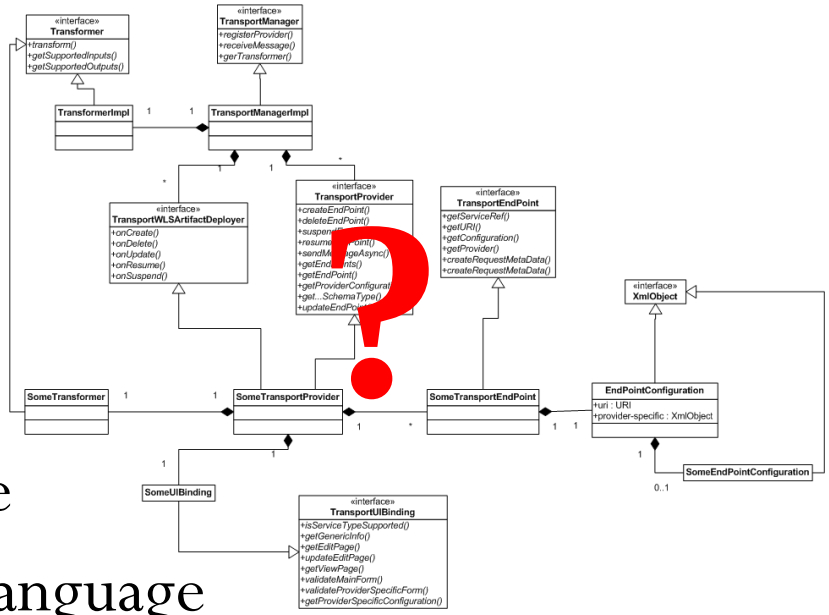
The consultant must be on-site every day, no telecommuting.

One architect is there right now, the other is retiring.

Performance monitoring, reporting, and tuning of Oracle databases.

How can a design be reviewed for correctness?

- Testing is not possible

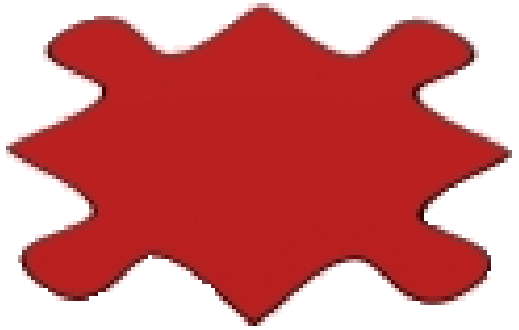


- Verification is not possible
  - unless it uses a formal language
  - typically not practical

- Use proven, systematic procedure
  - examine both local & global properties of the design

Local Properties

- Studying individual modules

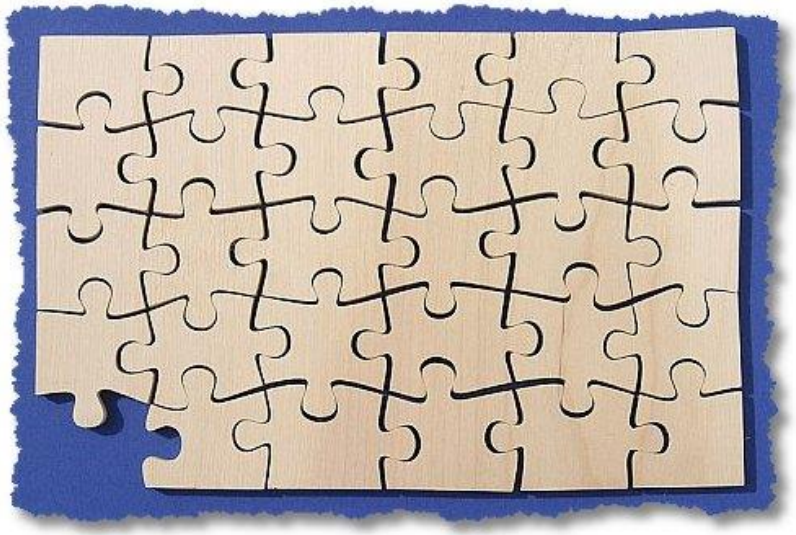


- Important local properties:
  - consistency
    - everything designed was as specified
  - completeness
    - everything specified was designed
  - performance
    - running time
    - storage requirements

Global Properties

- Studying how modules fit together
  - after examining local properties

Global Properties to Consider



- Is all the data accounted for?
  - from original SRS
    - exists properly in a module
    - rules are properly enforced
- Trace paths through the design
  - walk-through
  - select test data
    - Does control flow properly through the design?
    - Does data flow properly through the design?

Reviewing Design Structure

- Two key questions:
  - Is there an abstraction that would lead to a better modularization?
  - Have we grouped together things that really do not belong in the same module?
- Structural Considerations
  - Coherence of procedures
  - Coherence of types
  - Communication between modules
  - Reducing dependencies

Coherence of procedures

- A procedure (method) in a design should represent a single, coherent abstraction
- Indicators of lack of coherence:
  - if the best way to specify a procedure is to describe how it works
  - if the procedure is difficult to name
- Arbitrary restrictions:
  - length of a procedure
  - method calls in a procedure

Coherence of Types

- Examine each method to see how crucial it is for the data type
  - does it need to access instance or static variables of the class
- Move irrelevant methods out to another location
- Common with static functions

Communication between Modules

- Careful examination can uncover important design flaws
  - think of handing your HW 4 design to another student for inspection
    - Do these pieces really fit together?
  - to improve any design:
    - act like a jerk when examining your own design
    - ask questions that a jerk would ask
    - make sure your design addresses these jerky questions

Reducing Dependencies

- A design with fewer dependencies is generally better than one with more dependencies.
- What does this mean?
  - Make the design of each component dependent on as few other components as necessary
  - Example of bad framework design:
    - Every class in your framework uses every other class in your framework in one way or another
      - This would be terribly complex to test & modify

Look for Antipatterns

- Common patterns in programs that use poor design concepts
  - make reuse very difficult
  - source: http://www.antipatterns.com
- Ex:
  - The Blob
  - Spaghetti Code

Development AntiPattern:

The Blob

- **Symptoms**
  - Single class with many attributes & operations
  - Controller class with simple, data-object classes.
  - Lack of OO design.
  - A migrated legacy design
- **Consequences**
  - Lost OO advantage
  - Too complex to reuse or test.
  - Expensive to load

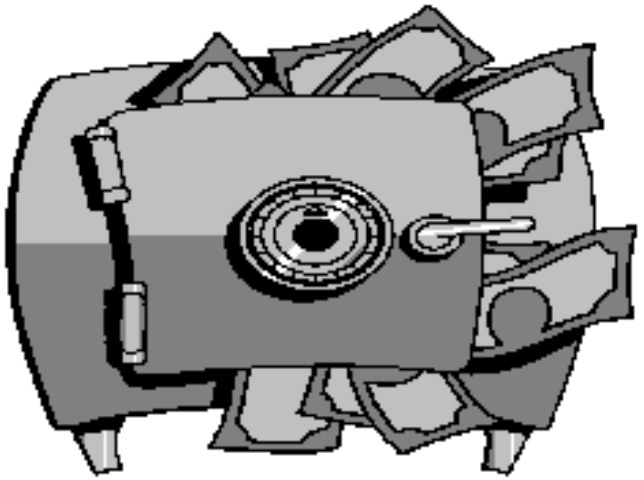
MITRE

Development AntiPattern:

Spaghetti Code

- **spa·ghet·ti code** [Slang] an undocumented piece of software source code that cannot be extended or modified without extreme difficulty due to its convoluted structure.

Un-structured code
is a liability



Well structured code
is an investment.

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So what's next?

- Design Patterns
- Implementation Strategies
- Design to Test
- Profiling
- Deployment,
- Etc.