Object-Oriented Design VectorGraphics

CSSE 221

Fundamentals of Software Development Honors

Rose-Hulman Institute of Technology

Announcements

- Turn in HW4 now
- Exam 1 returned
  - Look at the posted solution
  - Opportunity for questions tomorrow
- Capsules round 1 returned
  - Again, great work researching!

This week: VectorGraphics

- Monday:
  - More about software design and planning
  - Project workday
- Tuesday:
  - Lists and Iterators (capsule)
  - Review big-Oh
- Thursday:
  - Threads (capsule)
  - Project workday

A team project to create a scalable graphics program.

Vector Graphics Assignment

http://www.rose-hulman.edu/class/csse/binaries/VideoDemos/VectorGraphics220.mov

Work time now

- Read the specification
- Design (CRC cards and UML) due Thursday
- Code due Monday
- In 10 minutes
  - How to create CRC cards
  - Review of UML

A practical technique

Object-Oriented Design

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Object-Oriented Design

- We won’t use full-scale, formal methodologies
  - Those are in later SE courses
- We will practice a common object-oriented design technique using CRC Cards which then get turned into your UML class diagram
- Like any design technique,
  the key to success is practice

Key Steps in Our Design Process

1. **Discover classes** based on requirements
   - Come from **nouns** in the problem description
2. **Determine responsibilities** of each class
   - Come from **verbs** associated with the classes
3. **Describe relationships** between classes:

   is-a, has-a

May…

Represent single concepts

`Circle, BigRational`

Represent visual elements of the project

`ColoredPanel`, **`GameButton`**

Be abstractions of real-life entities

`BankAccount`, **`TicTacToeBoard`**

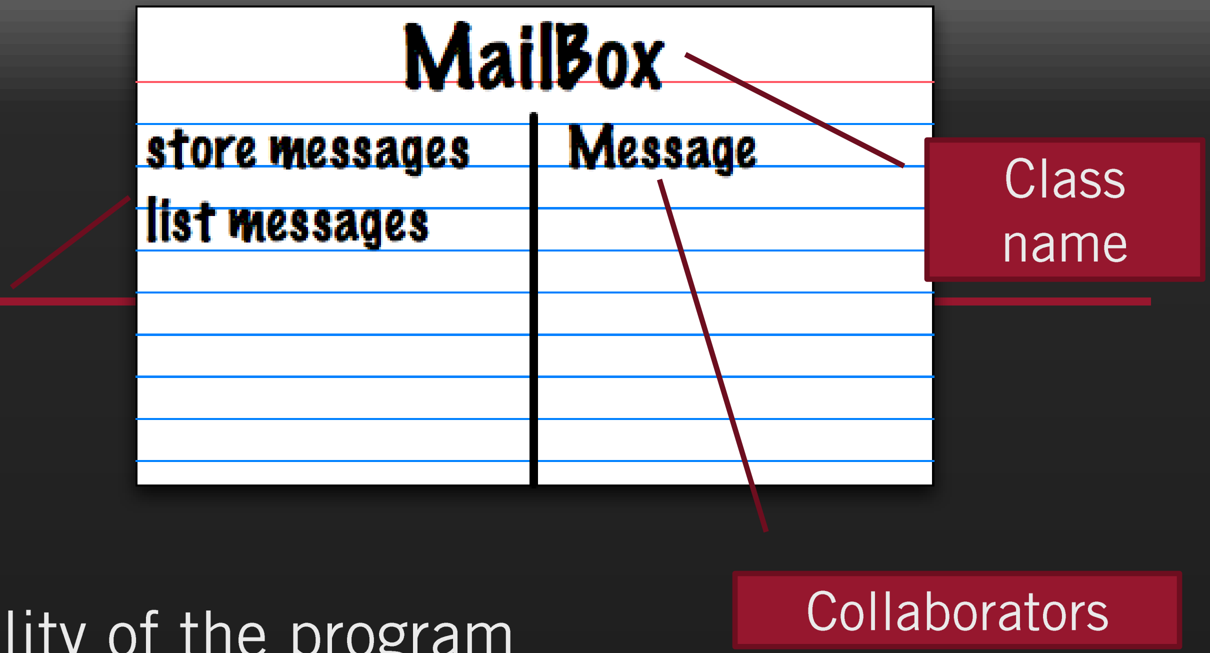
Be actors

`Scanner`

Be utilities

`Math`

CRC Card Technique



1. Pick a responsibility of the program
2. Pick a class to carry out that responsibility
   - Add that responsibility to the class's card
3. Can that class carry out the responsibility by itself?
   - Yes → Return to step 1
   - No →
     - Decide which classes should help
     - List them as collaborators on the first card
     - Add additional responsibilities to the collaborators' cards

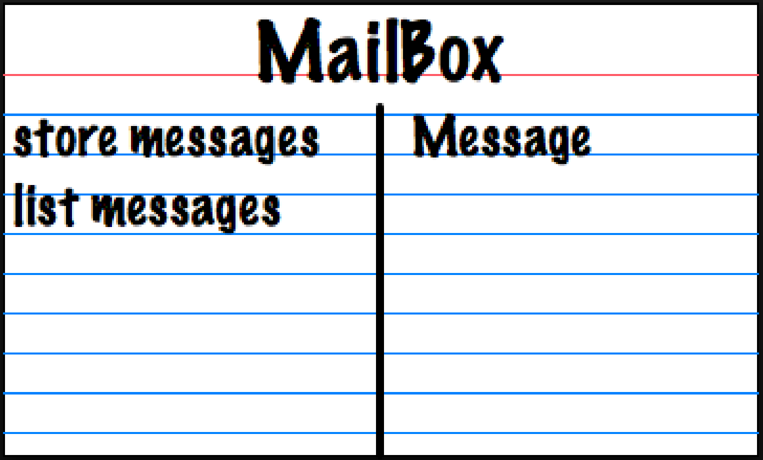
CRC Card Tips

- **Spread the cards out** on a table
  - Or sticky notes on a whiteboard instead of cards
- **Use a “token”** to keep your place
  - A quarter or a magnet
- **Focus on high-level responsibilities**
  - Some say < 3 per card
- **Keep it informal**
  - Rewrite cards if they get to sloppy
  - Tear up mistakes
  - Shuffle cards around to keep “friends” together

Make CRC cards for your VectorGraphics project

1. Pick a responsibility of the program
2. Pick a class to carry out that responsibility
   - Add that responsibility to the class's card
3. Can that class carry out the responsibility by itself?
   - Yes → Return to step 1
   - No →
     - Decide which classes should help
     - List them as collaborators on the first card
     - Add additional responsibilities to the collaborators' cards

- High cohesion
- Low coupling
- Immutable where practical
  - Document where not
- Inheritance for code reuse
- Interfaces to allow others to interact with your code



MailBox

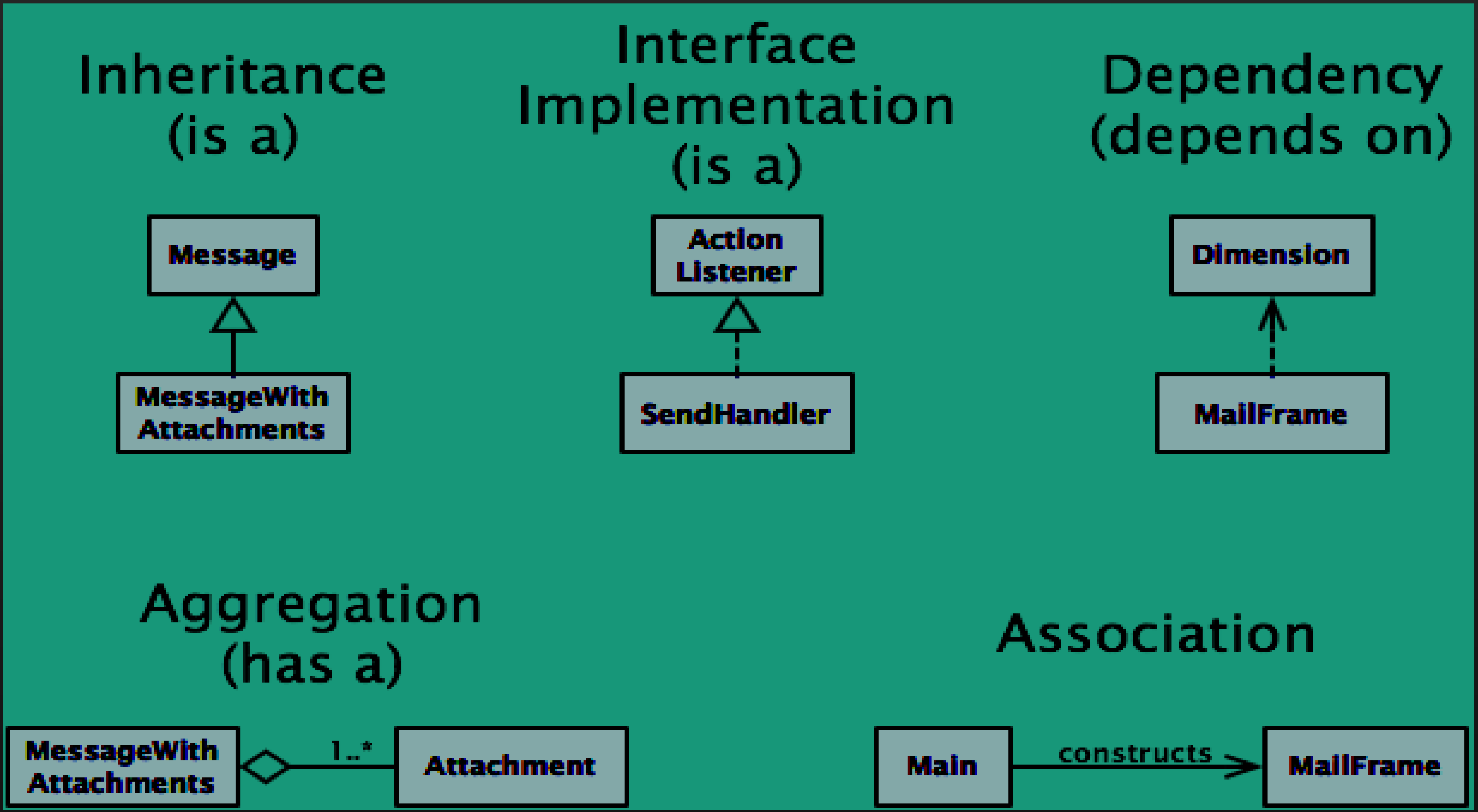
store messages	Message
list messages	

Convert your CRC Cards to a UML class diagram

- Classes stay classes
- Responsibilities become properties (methods)
- If attributes (fields) are obvious, add them
- Collaborators are usually has-a relationships
- If is-a relationships are obvious, add them

- You can probably work in parallel as two pairs
  - Or a subteam can begin work on your Screen Layout sketch

Summary of UML Class Diagram Arrows



Inheritance
(is a)

Message

MessageWith Attachments

Interface Implementation
(is a)

Action Listener

SendHandler

Dependency
(depends on)

Dimension

MailFrame

Aggregation
(has a)

MessageWith Attachments

1..*

Attachment

Association

Main

constructs

MailFrame