Lecture 14: [Construction I] High Quality Code & Object Orientation

Inf2: SEPP

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Last lectures

Building on what we've covered so far...

- Requirements Engineering — understanding what the system must do
- Design — planning the structure and architecture of the system

This Lecture: Construction — High Quality Code

- What is high quality code?
- Why is high quality code more important for large systems?
  - Bracketing conventions
  - Indentation
  - Naming
  - Commenting & Javadoc
  - Use of OO features
  - Packages
  - Other practical advice

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- Intimately connected with requirements engineering and design.
- Today we focus on the code itself.

Why high quality code matters (for large systems)

- Other people will have to read and modify your code:
  - Staff movement — team members come and go
  - Code reviews — peers inspect your work
  - Debugging following testing
  - Maintenance over months and years
- Even you in a year's time count as 'other people'!

How to write good code

Starting with some examples…

Bracketing conventions

Style A

```
public Double getVolumeAsMicrolitres() {
  if (m_volumeType.equals(
      VolumeType.Millilitres))
    return m_volume * 1000;
  return m_volume;
}
```

Style B

```
public Double getVolumeAsMicrolitres()
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      VolumeType.Millilitres))
  {
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      VolumeType.Millilitres))
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  return m_volume;
}
```

✓ *Settle on ONE convention and follow it throughout the project.*

Indentation

```
for(double counterY = -8; y<8; counterY+=0.5){
  x = counterX;
   y = counterY;
  if (y>0) counterY++;
  r = 0.33 - Math.sqrt(x*x+y*y)/33;
    r += sinAnim/8;
     g.fillCircle( x, y, r );
}
```

```
for(double counterY = -8; y<8; counterY+=0.5){
  x = counterX;
  y = counterY;
  if (y>0)
    counterY++;  // ← clearly in if
  r = 0.33 - Math.sqrt(x*x+y*y)/33;
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Indentation

❌ **Misleading (if body on same line)**

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✅ **Consistent indentation**

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}
```

✓ *Be consistent. Don't rely on default TABs — use spaces.*

Naming conventions

```
c.add(o);
```

```
customer.add(order);
```

Naming conventions

❌ **Cryptic names**

```
c.add(o);


// What is c? What is o?
// Reader must trace the whole file
// to understand this line.
```

✅ **Descriptive names**

```
customer.add(order);


// Intent is immediately clear.
// No mental overhead for the reader.
```

✓ *8–20 chars is a good target. Follow conventions: i/j/k for loop indices.*

Consistent whitespace

```
r = 0.33 - Math.sqrt(x*x + y*y)/33;
r += sinAnim/8;
g.fillCircle( x, y, r );
```

Consistent whitespace

❌ **Inconsistent spacing**

```
r = 0.33 - Math.sqrt(x*x + y*y)/33;
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✅ **Consistent spacing**

```
r = 0.33 - Math.sqrt(x * x + y * y) / 33;
r += sinAnim / 8;
g.fillCircle(x, y, r);
```

✓ *Apply spacing rules uniformly — around operators, inside calls, etc.*

Commenting — when comments help

Is the comment below helpful?

```
if (moveShapeMap != null) {
    // Need to find the current position.
    // All shapes have the same source position,
    // so just pick the first one.
    Position pos = ((Move) moveShapeSet.toArray()[0]).getSource();
    Hashtable legalMovesToShape = (Hashtable) moveShapeMap.get(pos);
    return (Move) legalMovesToShape.get(moveShapeSet);
}
```

Commenting — when comments help

Comments are valuable when they explain *why*, not *what*

Use them sparingly when they're useful

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Commenting II

Is the comment below helpful?

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Commenting — avoid the obvious

- Comments that simply restate the code add noise, not clarity:
- Too many comments is a more common problem than too few.
- Good code in a modern high-level language shouldn't need many explanatory comments.
- "If the code and the comments disagree, both are probably wrong." — Anon
- But there is another valuable use for comments: documentation (Javadoc).

```
// if the move shape map is not null     ← redundant!
if (moveShapeMap != null) {
    ...
}
```

Javadoc

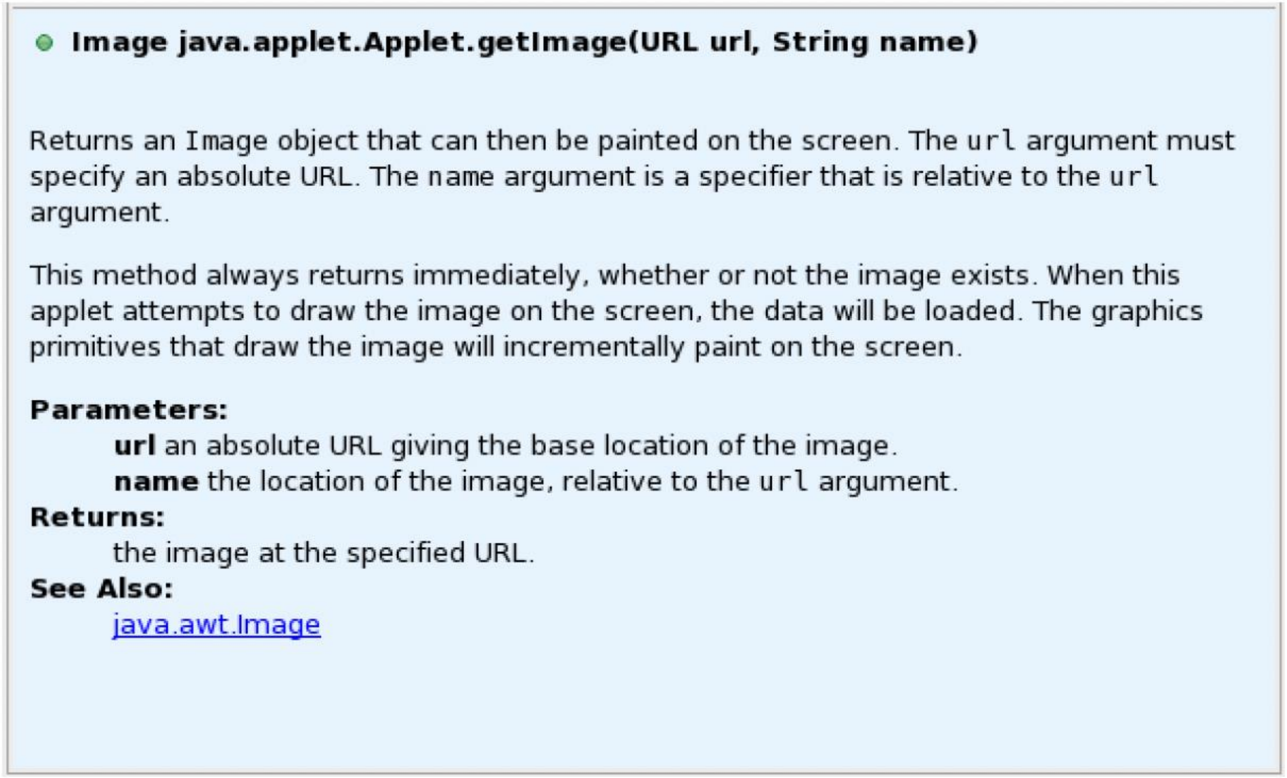
- Any system needs documentation aimed at users of its components (methods, classes, packages).
- Documentation held separately from code tends not to get updated.
- Javadoc (from Sun/Oracle) lets you write stylised comments that generate pretty, hyperlinked HTML docs.
- See the Java 8 API docs: docs.oracle.com/javase/8/docs/api/
- Doxygen (doxygen.org) is the equivalent tool for C++.

Javadoc example

```
/**
 * Returns an Image object that can then be painted on the screen.
 * The url argument must specify an absolute {@link URL}.
 * The name argument is relative to the url argument.
 *<p>
 * @param url   an absolute URL giving the base location of the image
 * @param name  the location of the image, relative to the url argument
 * @return      the image at the specified URL
 * @see Image
 */
public Image getImage(URL url, String name) {
    try {
        return getImage(new URL(url, name));
    } catch (MalformedURLException e) {
        return null;
    }
}
```

Javadoc produces hyperlinked HTML docs. Doxygen is the C++ equivalent.

Rendered Javadoc (Eclipse)



● **Image java.applet.Applet.getImage(URL url, String name)**

Returns an `Image` object that can then be painted on the screen. The `url` argument must specify an absolute URL. The `name` argument is a specifier that is relative to the `url` argument.

This method always returns immediately, whether or not the image exists. When this applet attempts to draw the image on the screen, the data will be loaded. The graphics primitives that draw the image will incrementally paint on the screen.

Parameters:
  url an absolute URL giving the base location of the image.
  name the location of the image, relative to the `url` argument.
Returns:
  the image at the specified URL.
See Also:
  java.awt.Image

Rendered Javadoc (Eclipse / IntelliJ)

- Javadoc turns the structured comment tags into formatted HTML documentation.
- Sections rendered: method signature, description, Parameters, Returns, See Also.
- @param — documents each parameter with name and description
- @return — describes the return value
- @see — links to related classes or methods
- {@link URL} — inline hyperlink to another class
- IntelliJ and Eclipse both render Javadoc inline as you hover over methods.

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- Revise classes, interfaces and inheritance in Java before proceeding.

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- They are units of encapsulation: by default, fields and methods are visible within the same package.
- They organise the namespace — avoiding name clashes between large components.
- **Caution**: the package 'hierarchy' is NOT a true hierarchy for access-restriction purposes.
- A package and its sub-packages have no special access relationship — they are like any other packages.

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- Comments & Documentation:
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  - Use Javadoc for public APIs
  - Make code self-documenting
- OO & Structure:
  - Use classes, interfaces, inheritance appropriately
  - Use packages for encapsulation

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- Use assertions and handle errors with defensive programming.
- Apply OO design practices: principles and patterns.

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- Don't use deprecated, obscure, or unstable language features unless absolutely necessary.

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- Remove dead code, unused imports, commented-out blocks.
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- Don't use deprecated, obscure, or unstable language features unless absolutely necessary.
- Excellent resource: Code Complete 2nd Ed. — Steve McConnell.

Reading & Resources

- Essential: Online introductory Javadoc tutorials
- Reference: Oracle's official JavaDoc documentation
- IntelliJ: Using JavaDoc in IntelliJ (see course materials)
- Recommended: Code Complete 2nd Ed. — Steve McConnell
- Recommended: Java packages documentation (Oracle)
- Revision: Java/programming resources on course page