

IDE Support For **EXAMPLE EMBEDDING**

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Agenda

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- Introduce **software activity** perspective
- Characterize **Example Embedding (EE)** as a software activity
- **IDE support** for Example Embedding from the software activity perspective



Contribution

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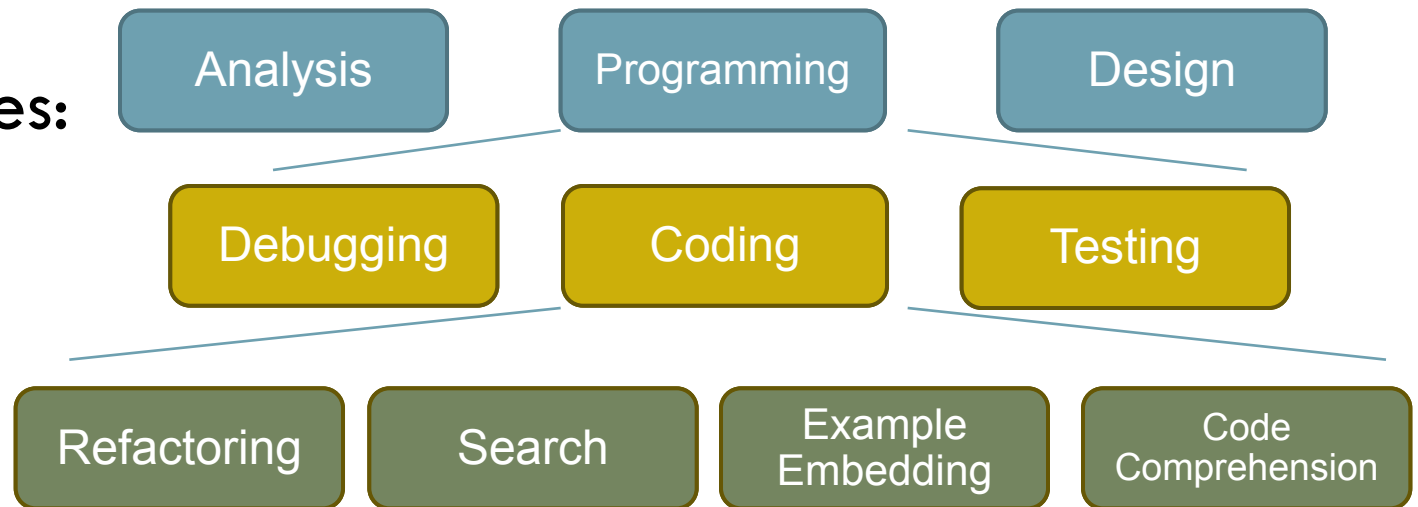
- We define a **methodology** and a **conceptual framework** by which **empirical software engineering research** can be applied to identify and characterize software activities
- We identify and characterize a new software development activity called **Example Embedding (EE)** using the suggested methodology [work in progress]

Software Activity

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- **Software Activity** is a collection of fine grained techniques which together assemble an abstract key notion in software development
- Software activity may be composed of finer grained activities

□ Examples:



Motivation: Refactoring

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- **Refactoring** is a disciplined technique for restructuring an existing body of code, altering its internal structure without changing its external behavior [www.refactoring.com/]
- Although refactoring code has been performed informally for years, William Opdyke's 1993 Ph.D. dissertation is the first known resource to specifically examine refactoring

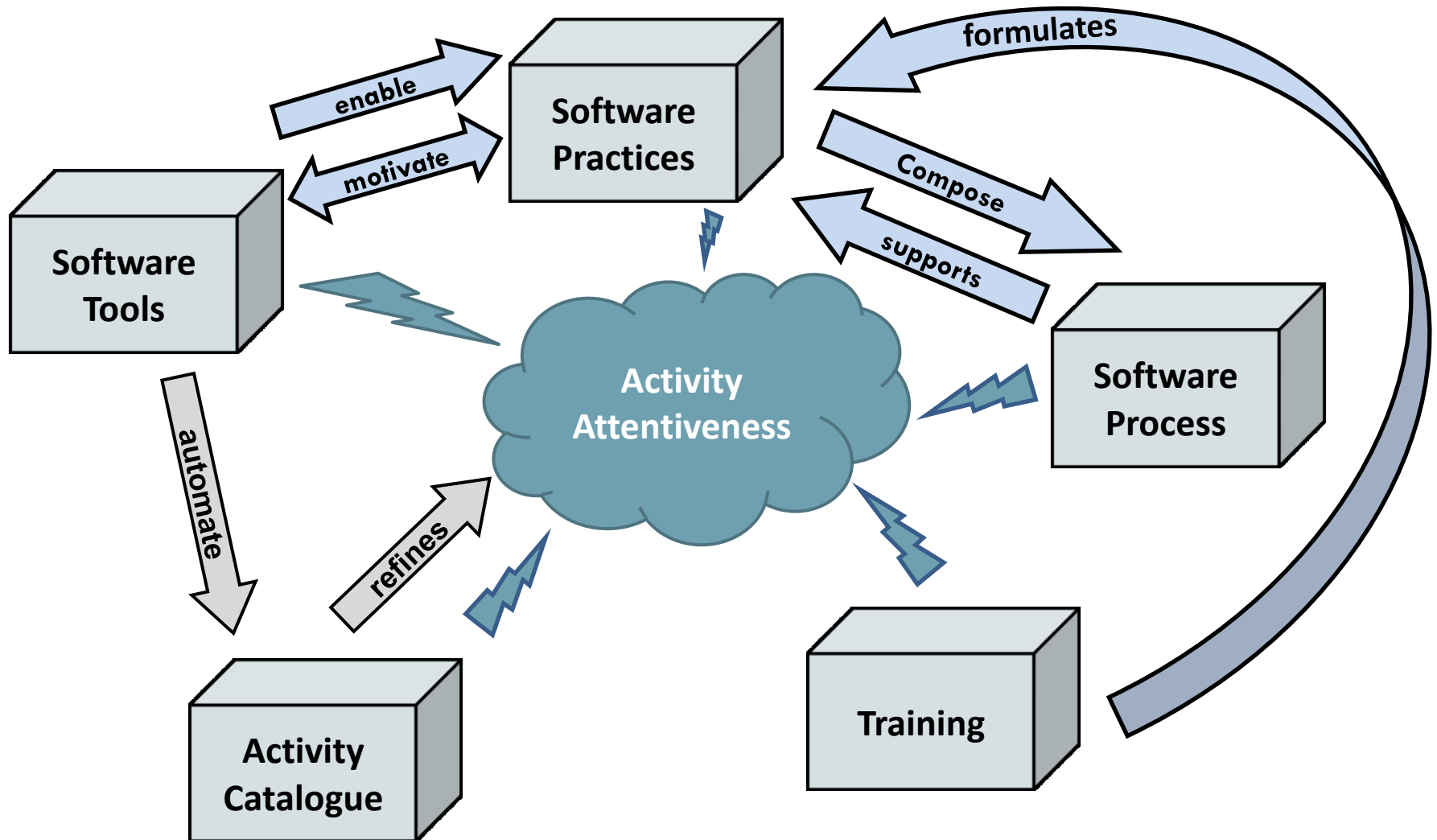
Characterizing Refactoring as a Software Activity

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- **Naming** the activity
- Laid the foundations for others to build a **catalogue**
- Enabled the development of **software tools**
- Promoted new **coding practices**
- Influenced the **development process**

Identifying software activity as such, assists in creating an **ecosystem that would exploit it and eliminate its pitfalls and deficiencies**

Software Activity Ecosystem



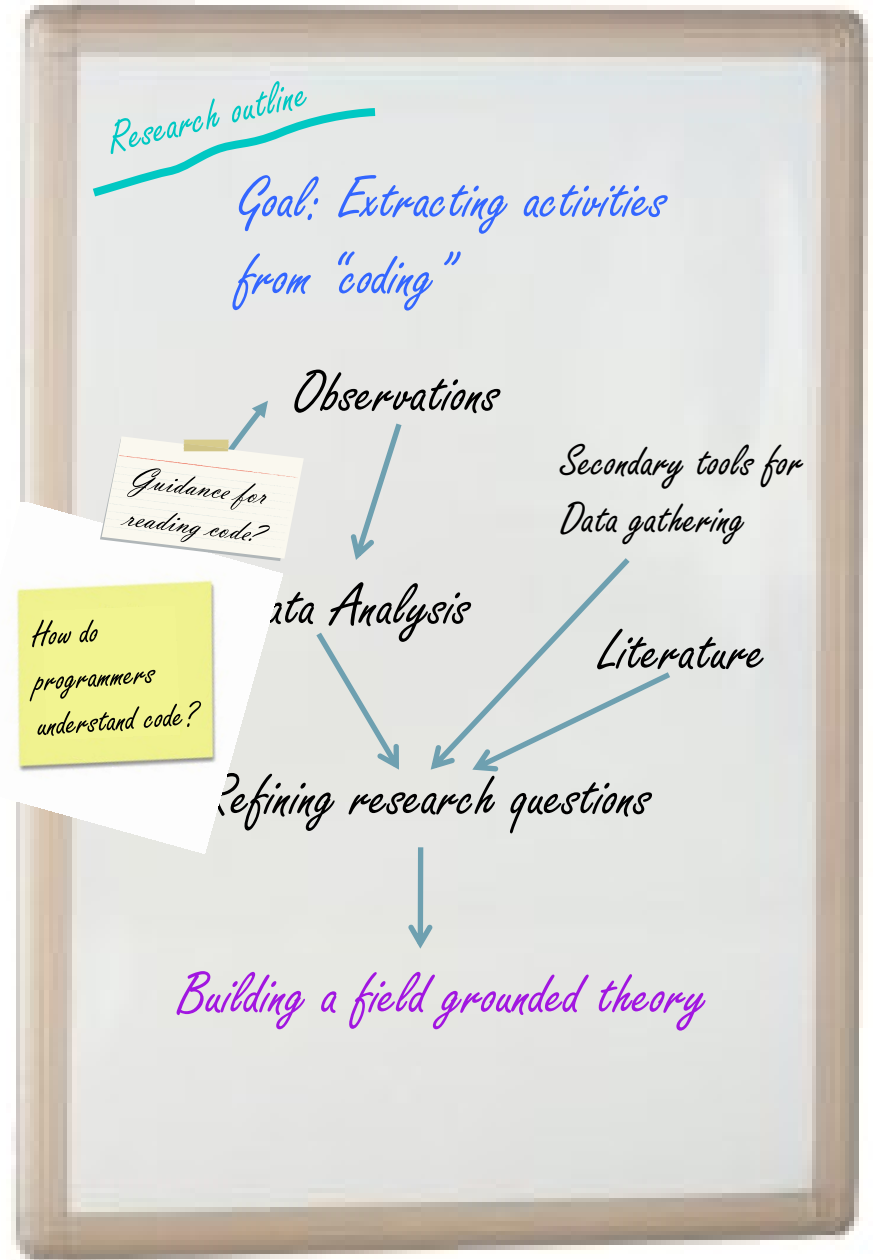
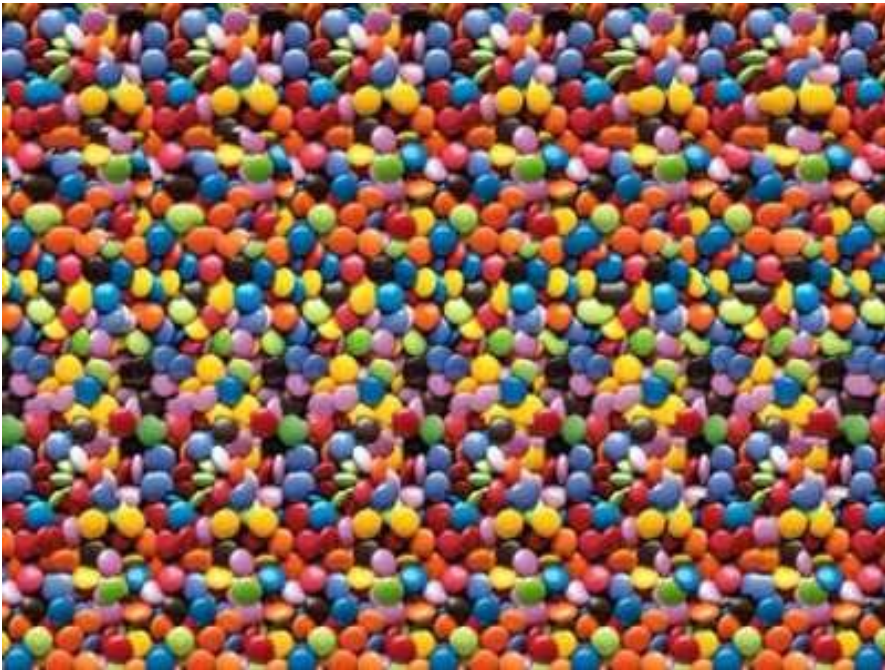
Finding the “Next Refactoring”: Methodology

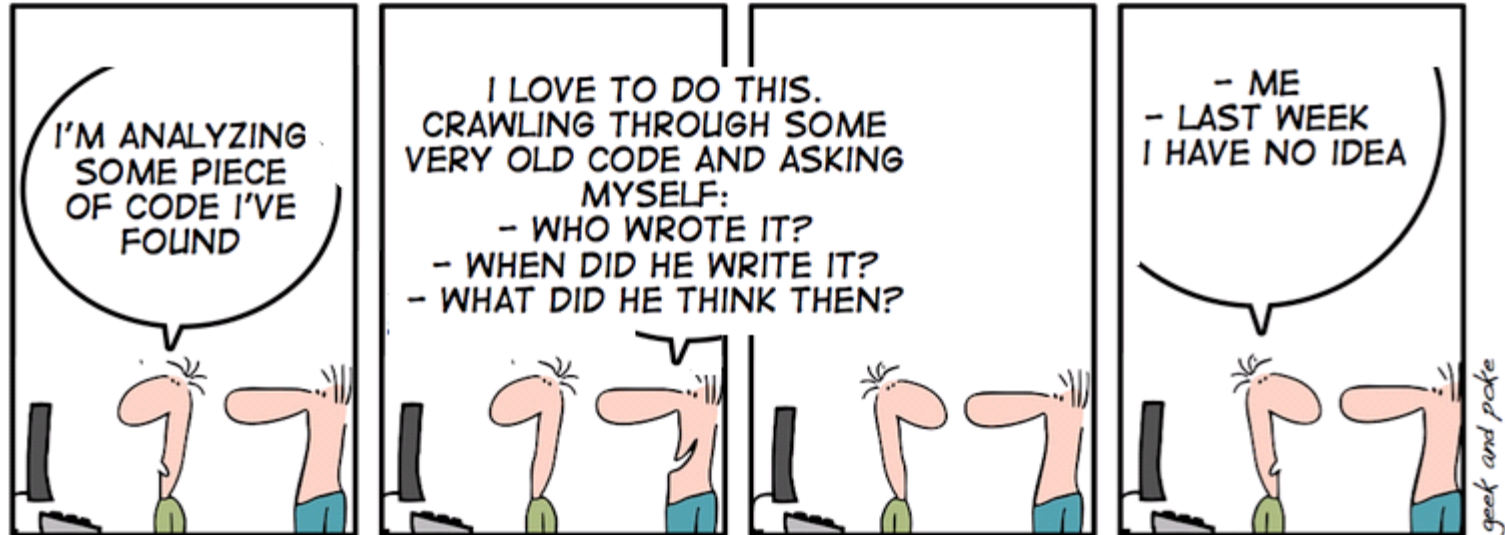
8

- We take an **empirically driven** research methodology
 - ▣ The activities already exist – they just need to be identified

- Identifying and characterizing software activity deals with **human behavior** hence requires corresponding methodology
 - ▣ Both for **gathering the data** and **analyzing** it

- We take a **Qualitative research** approach:
 - ▣ **Holistic** and **context aware**
 - ▣ **Why** and **how** of **decision making**, not just what, where, and when
 - ▣ Smaller but focused samples rather than large random samples
 - ▣ **Categorizes** data into patterns as the primary basis for organizing and reporting results





Example Embedding (EE)



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- **Example Embedding (EE)** is the process of **finding, altering** and **embedding** an already existing code fragment (the example) within a new context

- To address the challenges of EE building blocks, one should address:
 - ▣ **Name** and **definition**
 - ▣ Building a **catalogue**
 - ▣ Software **tools**
 - ▣ Coding **practice**
 - ▣ The development **process**
 - ▣ **Training**

- Further, we elaborate on some these [work in progress]

Building a Catalogue



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- Some programmers use examples only in certain contexts, but not on others
- **Classifying** when/where/how to use examples would raise the level of awareness for using examples and highlight its subtleties
- Should be based on both empirical data and further synthesis
- Some examples:
 - ▣ **Example for what.** programming languages, scripting languages, libraries and APIs and configurations.
 - ▣ **Example purpose.** adding functionality, fixing a syntax error, applying a design pattern, bootstrapping with a new environment ("hello world").
 - ▣ **Example size.** Examples are different in size, scope and complexity: from several characters demonstrating a language operator, through function calls, and complex operations requiring a sequence of several method invocations involving several types.
 - ▣ **Examples source.** From the organization code base, documentation, example set which is provided by the company, web tutorials, blogs, emails and more.
 - ▣ **Searching for example.** Google search, code search, code browsing, asking people, and documentation search; in several occasions, they know upfront where to look.
 - ▣ **Using the example.** Copy and paste, retyping the example, refactoring of the example code and then call it.

Software Practice



- **Software practice** is a set of activities, applied **systematically** following some rationale to perform a software related task
- As opposed to **software activity**, which is **declarative** in nature, **software practice** is a **meaningful imperative unit on the abstraction level of a development process**
- A manifestation of **EE enabled practice** requires further investigation, but one could presume that it would comprise a **testing** phase prior to the embedding and **refactoring** of both the example and the system

Example-Aware Development Process

- Promoting EE enabled practices and taking organizational means to support them
- Adding **example writing** to the development process
- Building and using **example repositories**:
 - ▣ Synthetic examples vs. production code
 - ▣ Public repositories vs. proprietary
 - ▣ Browsible vs. searchable vs. structured
 - ▣ General purpose vs. ad-hoc example collections
 - ▣ Documentation and examples

Human Perspective of EE Tool Support

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- Already existing IDE plug-ins use examples in various ways:
 - **EG** [Edwards, 2004]
 - **Code Conjuror** [Hummel *et al*, 2008]

- Would programmer use these?
 - A programmer doesn't want to **teach/help/assist** the computer
 - She knows Java, hence she would like to **write Java code** and not some query language
 - She could spot a solution when she sees one
 - She could use assistance in the activity she is doing no matter what

- A human perspective of EE tools
 - Favoring good example repositories combined with good but simple indexing/searching tools
 - **Automate repetitive tasks** in finding, altering and embedding examples
 - **Framework to streamline** EE building blocks (find, alter and embed)

IDE – Browser Integration

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swt gc - Google Search

Introduction to SWT Gr... GC « SWT 2D Graphics... SWT GC - hengheng... [news.eclipse.platform.s...]

http://www.google.com/search?rls=ig&hl=en&q=swt+gc&btnG=Google+Search&aq=f&oq=

ohadbr@gmail.com | Web History | My Account | Sign out

Google swt gc Search Advanced Search Preferences

Web Results 1 - 10 of about 306,000 for swt gc. (0.34 seconds)

[Introduction to SWT Graphics](#) [↗](#) [✕](#)
3 Jul 2003 ... The class org.eclipse.swt.graphics.GC is a graphics context that encapsulates the gc.drawText("Hello&t&There&nWide&tWorld",5,5,SWT. ...
www.eclipse.org/articles/Article-SWT-graphics/SWT_graphics.html - 41k -
[Cached](#) - [Similar pages](#) - [☺](#)

[GC « SWT 2D Graphics « Java Tutorial](#) [↗](#) [✕](#)
GC « SWT 2D Graphics « Java Tutorial. ... 18. 1. GC. 18. 1. 1. Graphics - Graphics. 18. 1. 2.
Avoid creating a GC - Avoid creating a GC ...
www.java2s.com/Tutorial/Java/0300__SWT-2D-Graphics/0020__GC.htm - 19k -
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[More results from www.java2s.com »](#)

[SWT GC - hengheng123456789 - BlogJava](#) [↗](#) [✕](#) [Translate this page]
SWT GC. 10000000shell0000 GC gc = new GC(image); gc.
setBackground(display.getSystemColor(SWT.COLOR_RED)); gc. ...
www.blogjava.net/hengheng123456789/articles/79610.html - 49k - [Cached](#) - [Similar pages](#) - [☺](#)

[\[news.eclipse.platform.swt\] Re: GC.copyArea not implemented on ...](#) [↗](#) [✕](#)
GC.copyArea is not implemented for Mac in swt-cocoa now. Can you provide any information
on when this functionality will be available? Thanks in advance, ...
dev.eclipse.org/newslists/news.eclipse.platform.swt/msg44497.html - 5k -
[Cached](#) - [Similar pages](#) - [☺](#)

[\[news.eclipse.platform.swt\] Re: Disposed GC makes my RCP ...](#) [↗](#) [✕](#)

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Context Lost!

We wish we had IDE – Browser Integration with Extract Example support

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The screenshot shows the Eclipse IDE interface. The top toolbar includes icons for File, Edit, Navigate, Search, Project, Fiver, Run, Window, and Help. The left sidebar shows a project tree with folders like 'com.example.feature', 'ConverterProj', and 'AnimationDemo.java'. The main editor displays the following Java code:

```
public static void main(String[] args) {
    final Display display = new Display();
    final Shell shell = new Shell(display);
    shell.setText("Animator");

    shell.setLayout(new FillLayout());
    canvas = new Canvas(shell, SWT.NO_BACKGROUND);
    canvas.addPaintListener(new PaintListener() {
        public void paintControl(PaintEvent event) {
            // Create the image to fill the canvas
            Image image = new Image(shell.getDisplay(), canvas.getBounds());
        }
    });
}
```

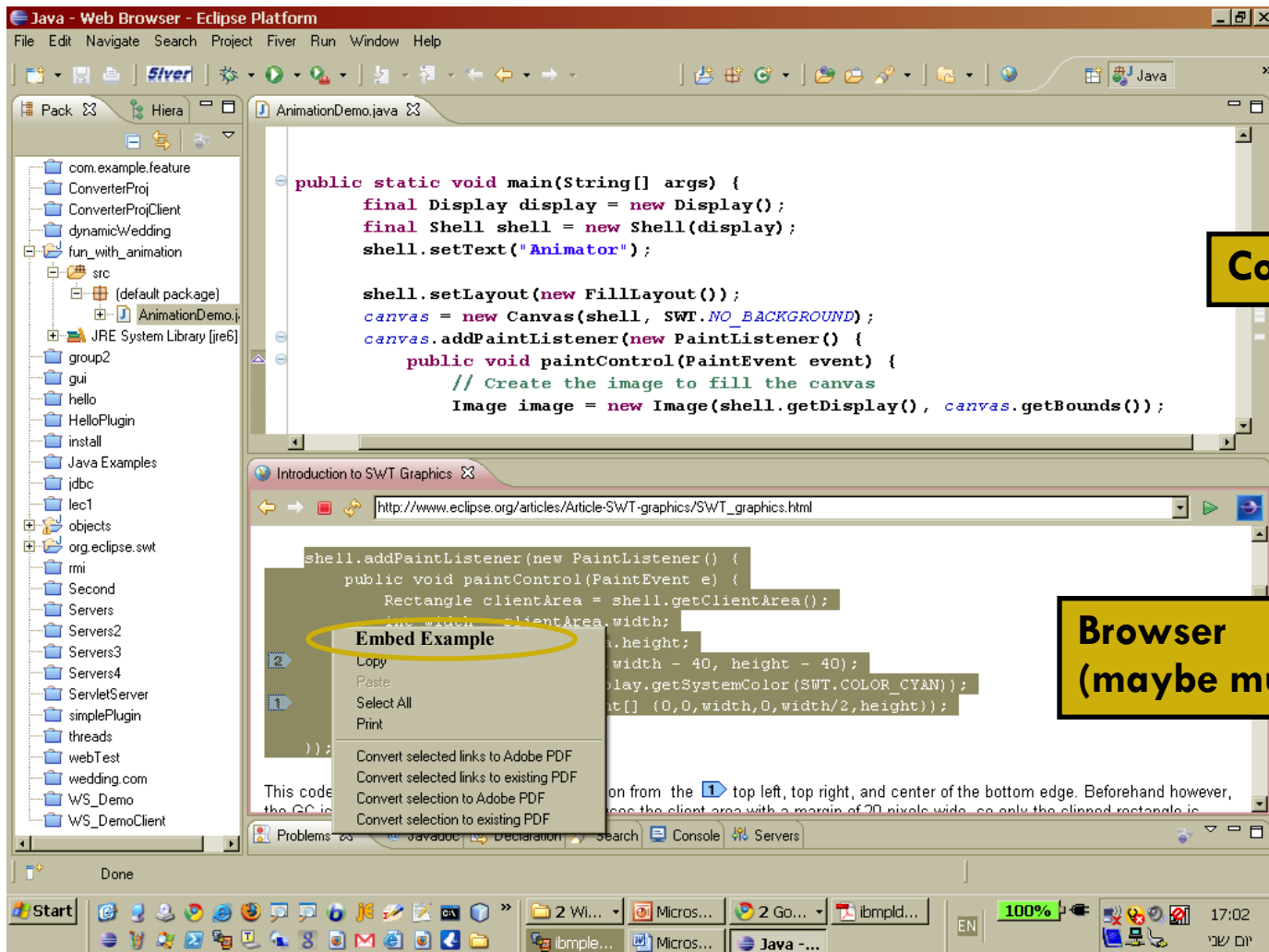
A yellow box labeled "Code" points to this code. Below the editor, a browser window titled "Introduction to SWT Graphics" is open, showing a URL: http://www.eclipse.org/articles/Article-SWT-graphics/SWT_graphics.html. The browser content shows a code snippet:

```
shell.addPaintListener(new PaintListener() {
    public void paintControl(PaintEvent e) {
        Rectangle clientArea = shell.getClientArea();
        int width = clientArea.width;
        int height = clientArea.height;
        e.gc.setClipping(20,20,width - 40, height - 40);
        e.gc.setBackground(display.getSystemColor(SWT.COLOR_CYAN));
        e.gc.fillPolygon(new int[] {0,0,width,0,width/2,height});
    }
});
```

Two blue arrows labeled "1" and "2" point to the first and second lines of the paintControl method, respectively. A yellow box labeled "Browser (maybe multiple)" points to the browser window. Below the browser content, a paragraph of text reads: "This code draws a triangle on a Shell as a polygon from the 1 top left, top right, and center of the bottom edge. Beforehand however, the GC is clipped with a rectangle 2 that reduces the client area with a margin of 20 pixels wide, so only the clipped rectangle is..."

We wish we had IDE – Browser Integration with **Extract Example** support

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Summary

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- We introduced the **software activity** perspective and explained its benefits using **Refactoring** and **Example Embedding**
- We motivated considering **human aspects** in software engineering research in general and **empirical** and **qualitative research methodology** in particular