

# Attacking information overload in software development

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University of British Columbia  
Tasktop Technologies

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2400-2200 BC



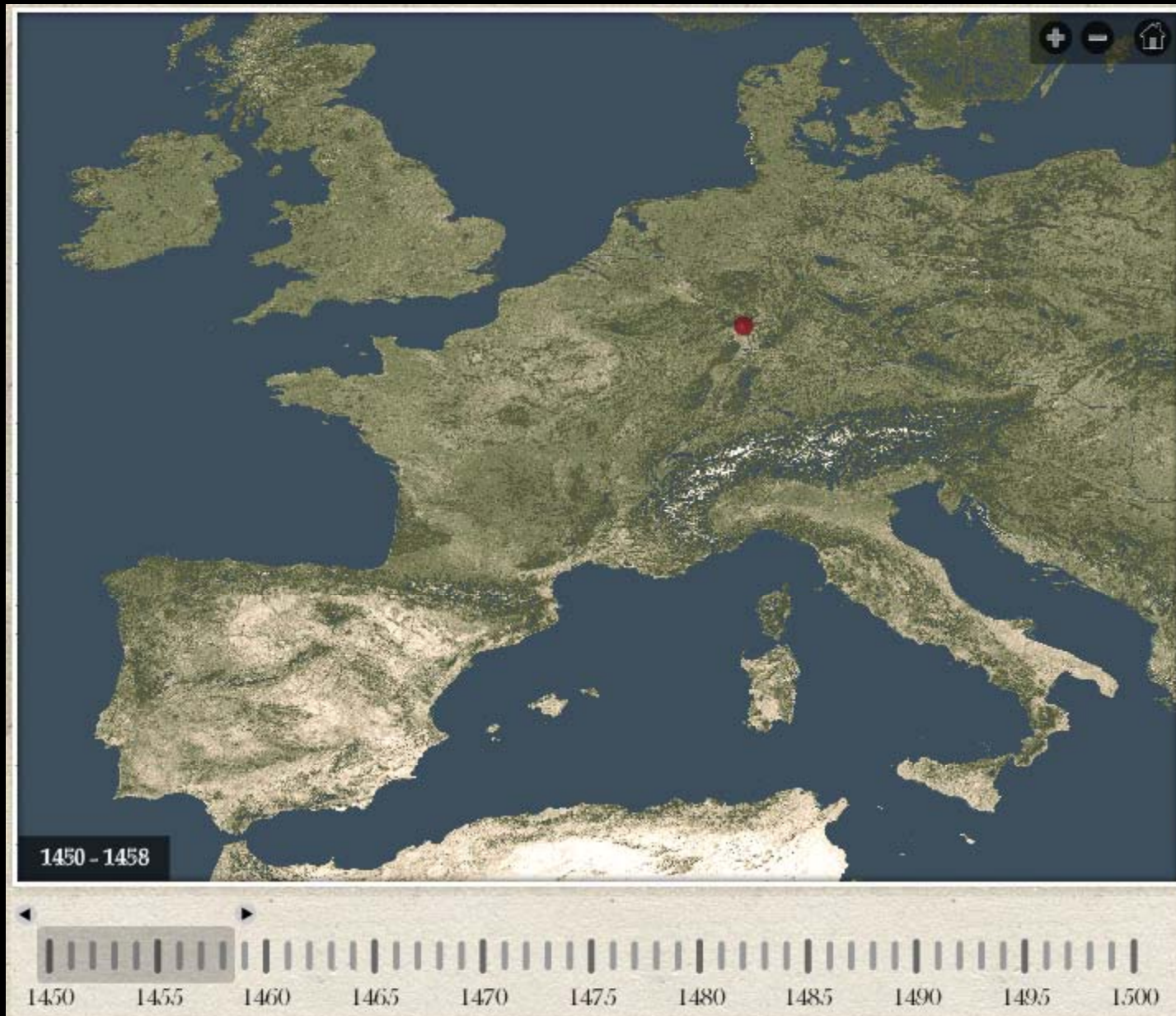
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# THE ATLAS *of* EARLY PRINTING

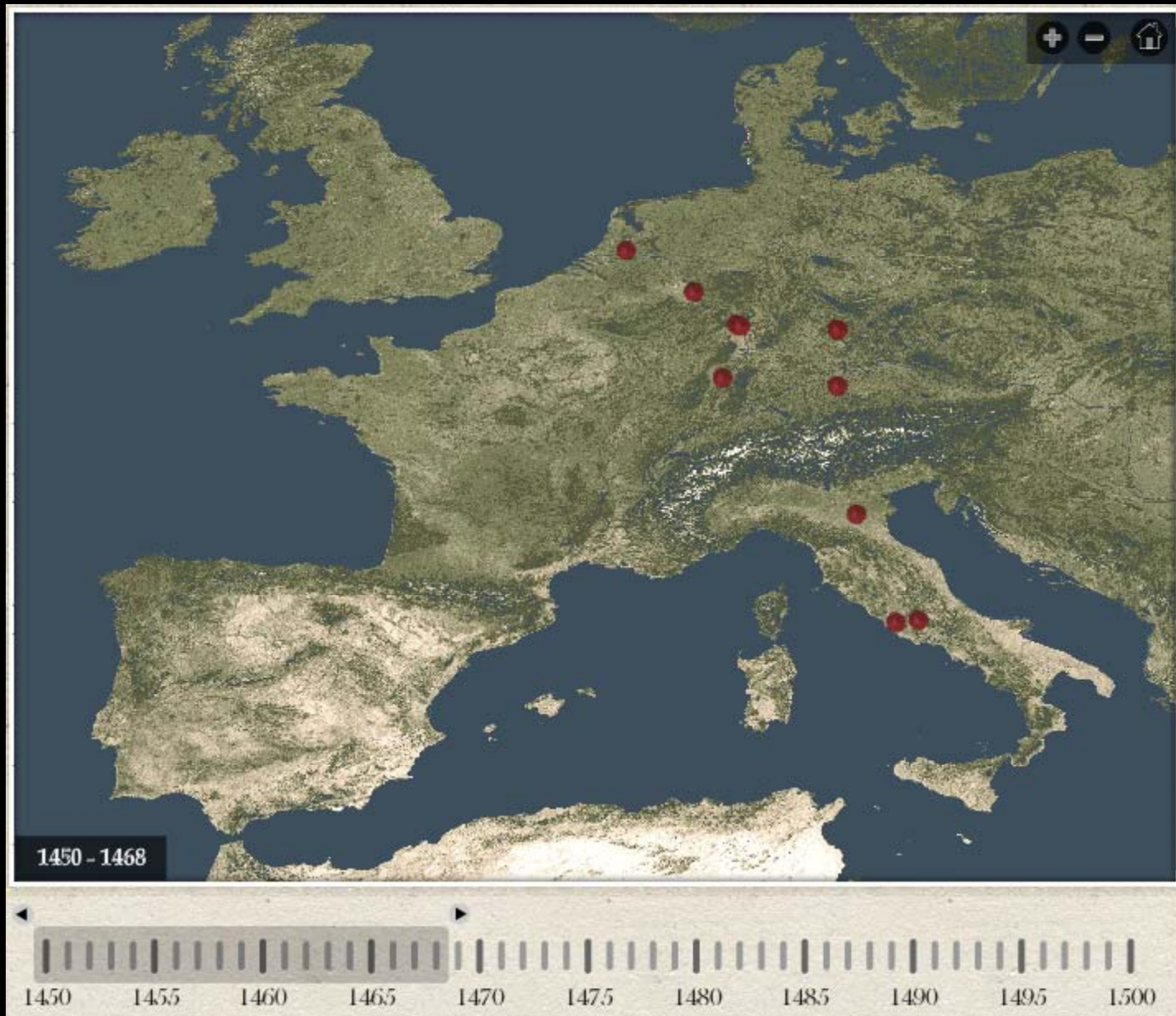
*about the atlas*   *fifteenth century printing*   *the fifteenth century book*   *sources*   *links*





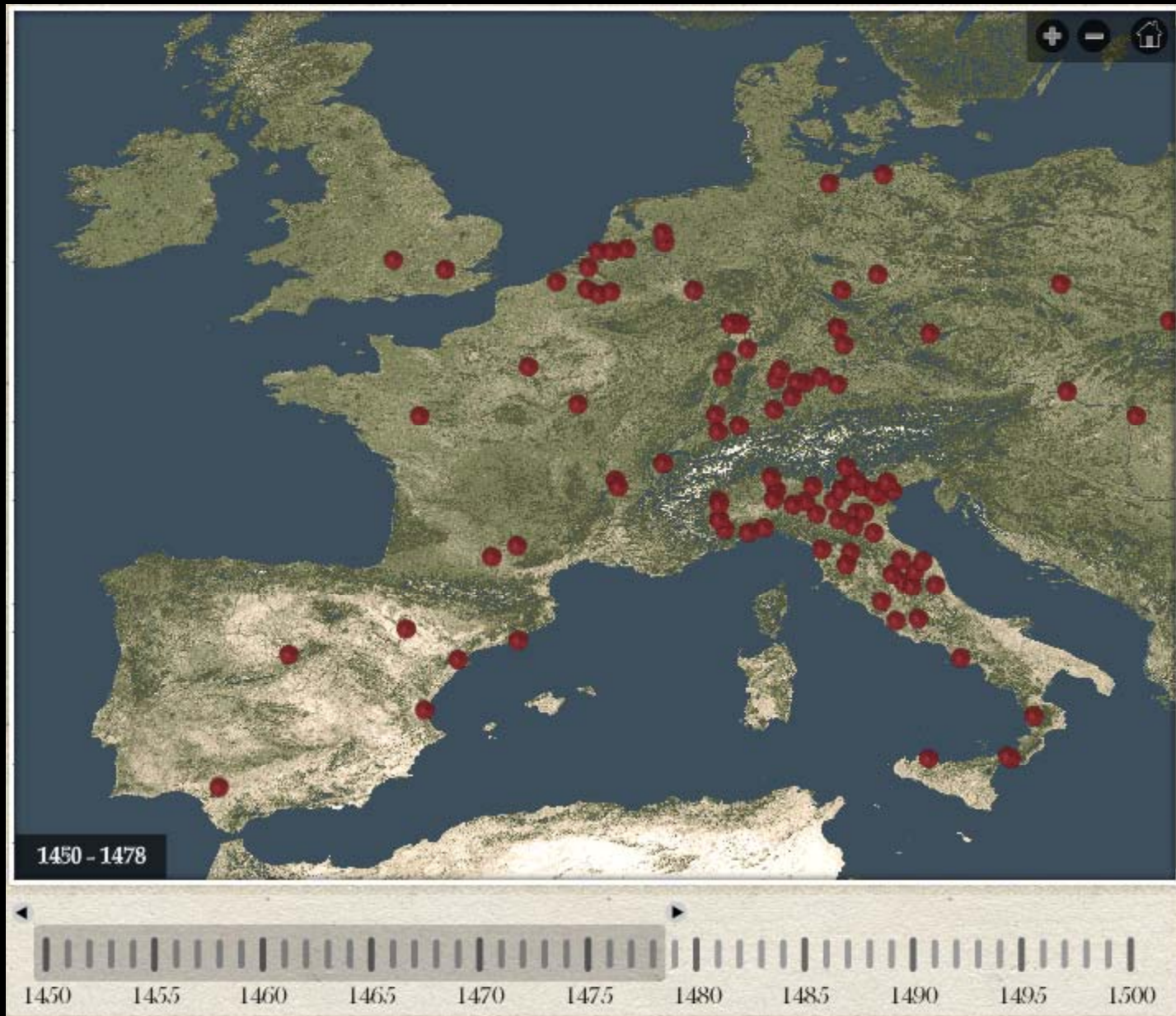


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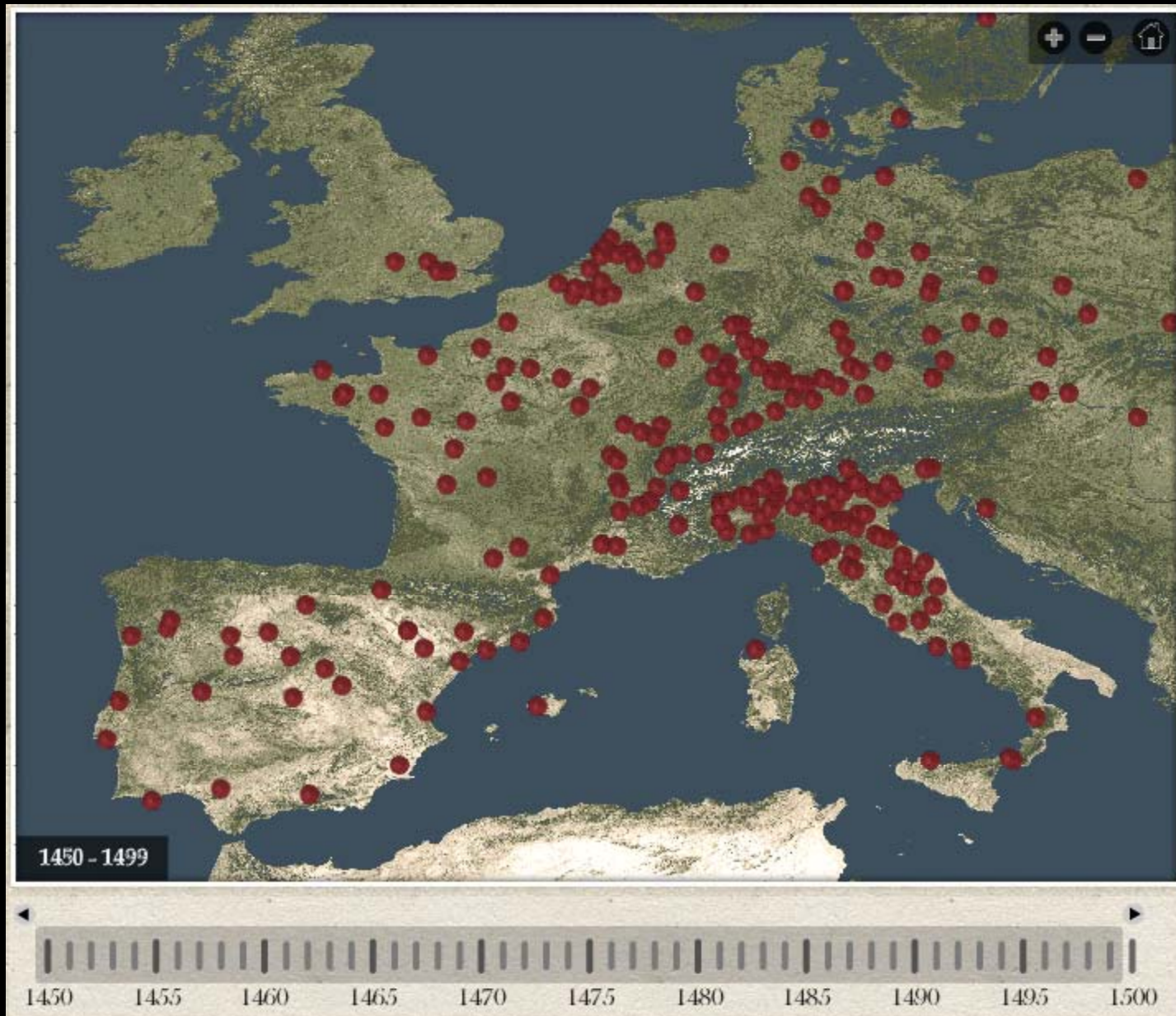


source: The University of Iowa Libraries





source: The University of Iowa Libraries



source: The University of Iowa Libraries

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VANCOUVER - Another shooting rocked Vancouver on Tuesday, leaving one man dead and adding to a grim tally that includes a young mother gunned down Monday as she drove with her four-year-old son in the back seat.

[Vancouver mayor calls for metro police force](#) CTV.ca

[Vancouver mayor wants Metro Vancouver police force](#) The Province

[The Canadian Press](#) - [News1130](#) - [Global](#) -

[PR-Inside.com \(Pressemitteilung\)](#)

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**[GM, Chrysler seek nearly \\$22 billion more US loans](#)**

Reuters - 4 hours ago

By Kevin Krolicki and Poornima Gupta DETROIT (Reuters) - General Motors Corp and Chrysler LLC requested nearly \$22 billion in additional US government loans and said they had reached tentative deals with the United Auto Workers union to reduce labor ...

[Video: Automakers Face Deadline](#) CBS

[GM, Chrysler ask for more government aid](#) Financial Post

[CNNMoney.com](#) - [Bloomberg](#) - [International Herald Tribune](#) -



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DIGITAL DOMAIN

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By RANDALL STROSS  
Published: April 20, 2008



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## GM, Chrysler seek nearly \$22 billion more US loans



ington Post

(Reuters) - General Motors Corp and Chrysler LLC requested nearly \$22 billion in additional US government loans and said they had reached union to reduce labor.  
[Video: Automakers](#)  
[GM, Chrysler ask for](#)  
[CNNMoney.com - Blo](#)

## Declare Email Bankruptcy

Copyright wonk (and *Wired* columnist) **Lawrence Lessig** hit upon a novel tactic after spending 80 hours trying to clear out his backlogged inbox: surrender. "Bankruptcy is now my only option," he wrote in a mass message to his correspondence creditors. Here's how Lessig erased his debts and turned over a new leaf.

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Toronto Star - 16 hours ago - [all 761 articles »](#)

[Doctors call for weight loss industry regulation](#)  
CBC.ca - 12 hours ago - [all 31 articles »](#)



## Social Network Exhaustion (or Facebook Bankruptcy Redux)

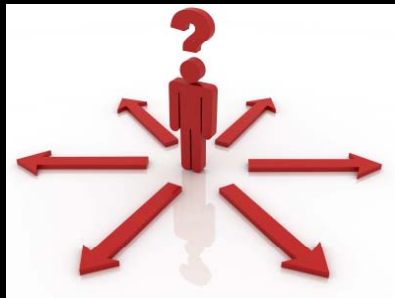


## 14 million people interacted with Facebook Applications in August

Written by [Max Friert](#) (contact - e-mail) -- September 14th, 2007 | [Share](#) - [Save](#) - [E-mail](#)

information explosion

information overload



indecision



repetition



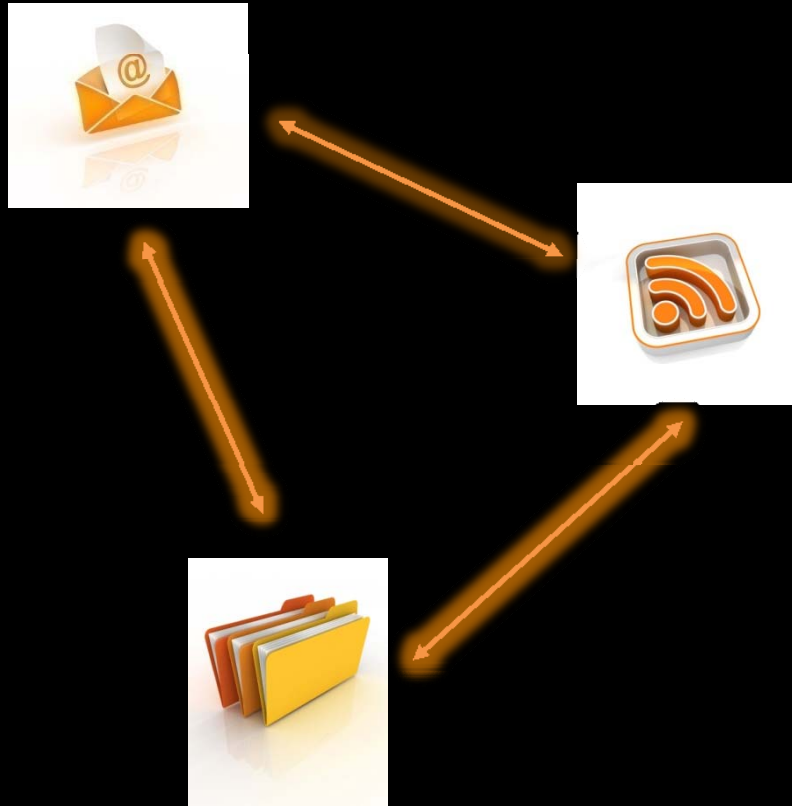
from

anywhere, anytime, anyone

to

the right information at the right time,  
in the right place, in the right way  
to the right person

# challenge: weak structure



some explicit  
connections

many inferred  
connections



**Bugzilla – Bug 246929**

SWT\_AWT.new\_Shell not working in Cocoa

Last modified: 2009-02-09 11:30:02 -0400

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Details

**Summary:** SWT\_AWT.new\_Shell not working in Cocoa

**[Eclipse] Bug#:** [246929](#)

**Hardware:** Macintosh

**Product:** Platform

**OS:** Mac OS X - Cocoa

**Component:** SWT

**Version:** 3.5

**Status:** ASSIGNED

**Priority:** P3

**Resolution:**

**Severity:** normal

**Target Milestone:** ---

**URL:**

**Whiteboard:**

**Keywords:**

**Depends on:**

**Blocks:**

[Show dependency tree](#)

People

**Reporter:** [Scott Kovatch <skovatch@adobe.com>](#)

**Assigned To:** [Scott Kovatch <skovatch@adobe.com>](#)

**QA Contact:**

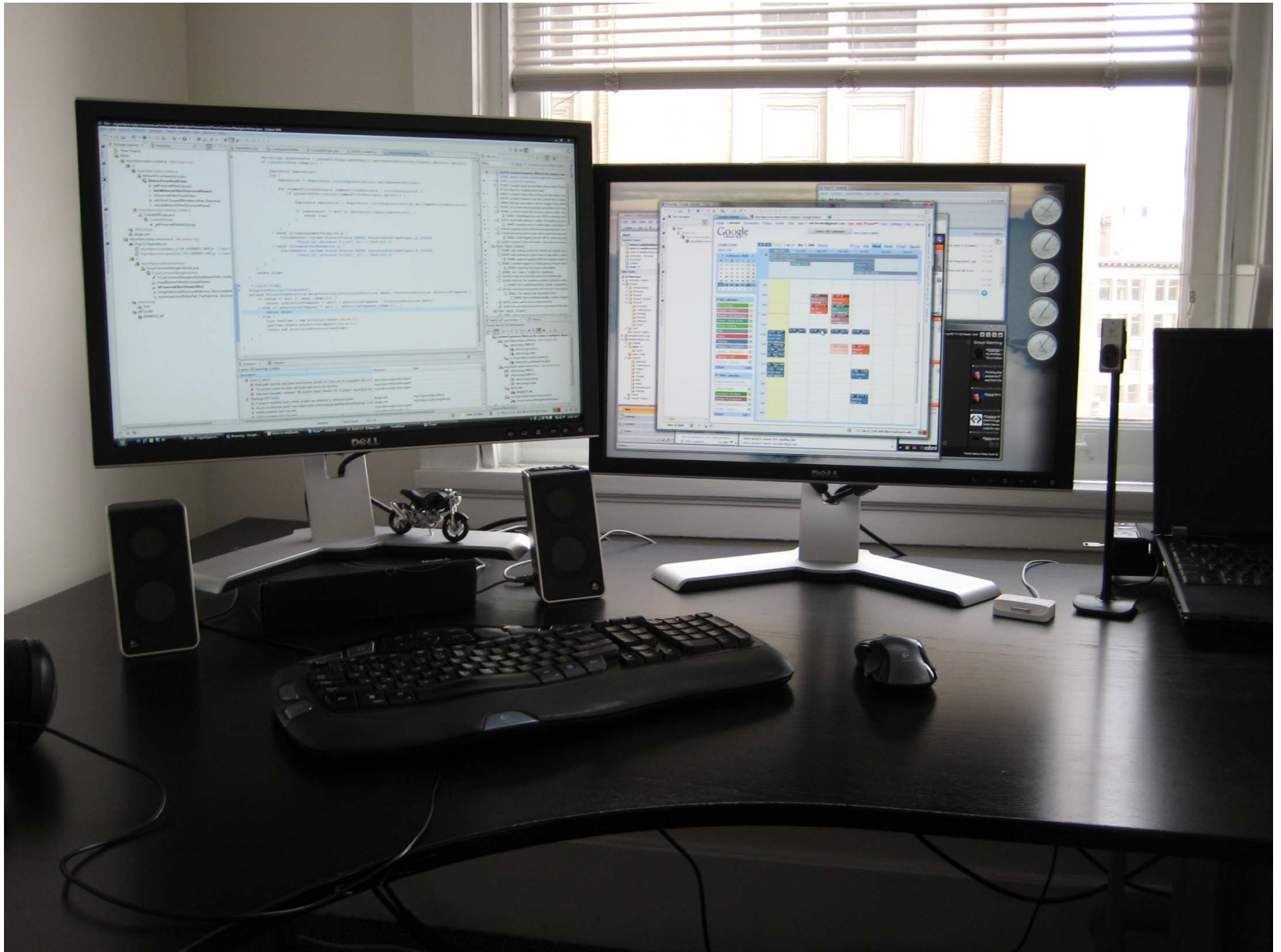
**CC:** [al451@pobox.com](#)  
[antoine@lunar-ocean.com](#)  
[c.hauser@active.ch](#)  
[codex69@gmail.com](#)  
[eclipse@gerdcastan.de](#)

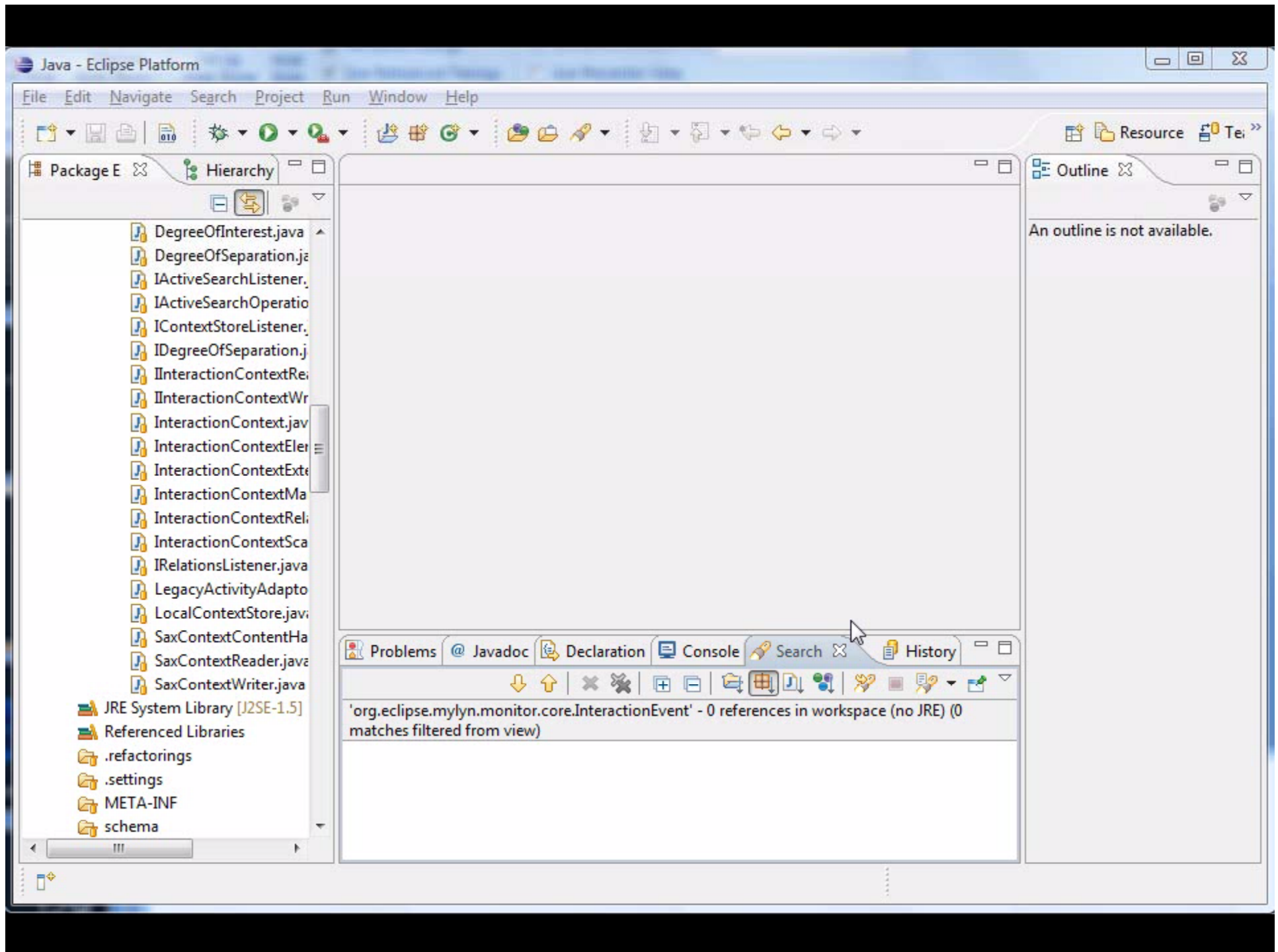
Attachments

[Add an attachment](#) (proposed patch, testcase, etc.)











right information

right time

right place



right way

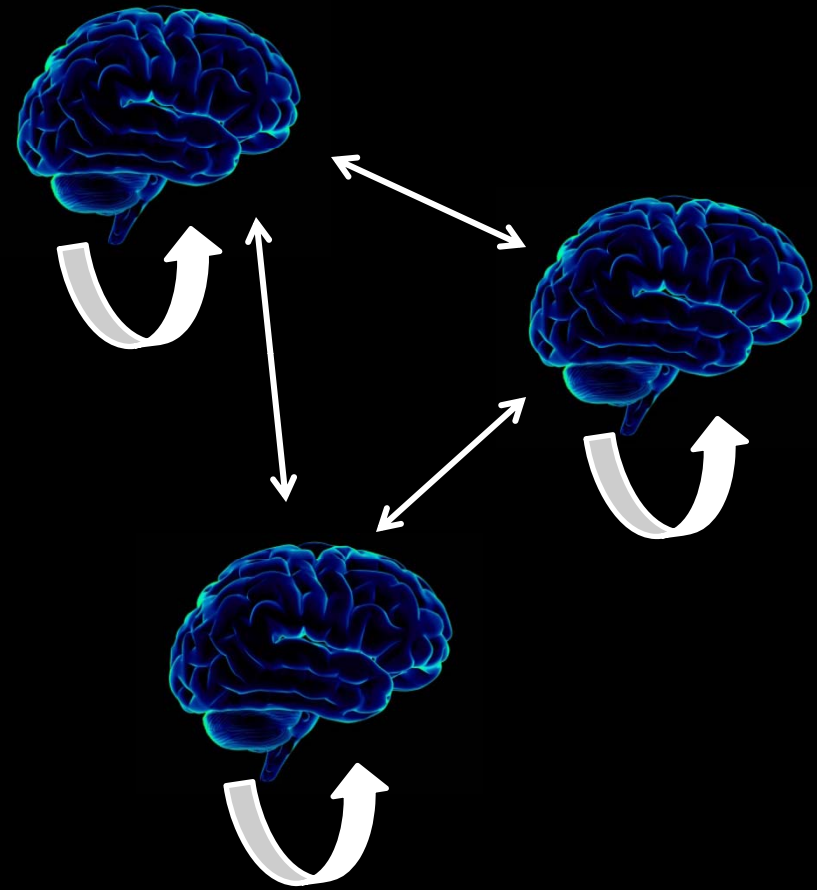
right person

group memory



Hipikat

episodic memory



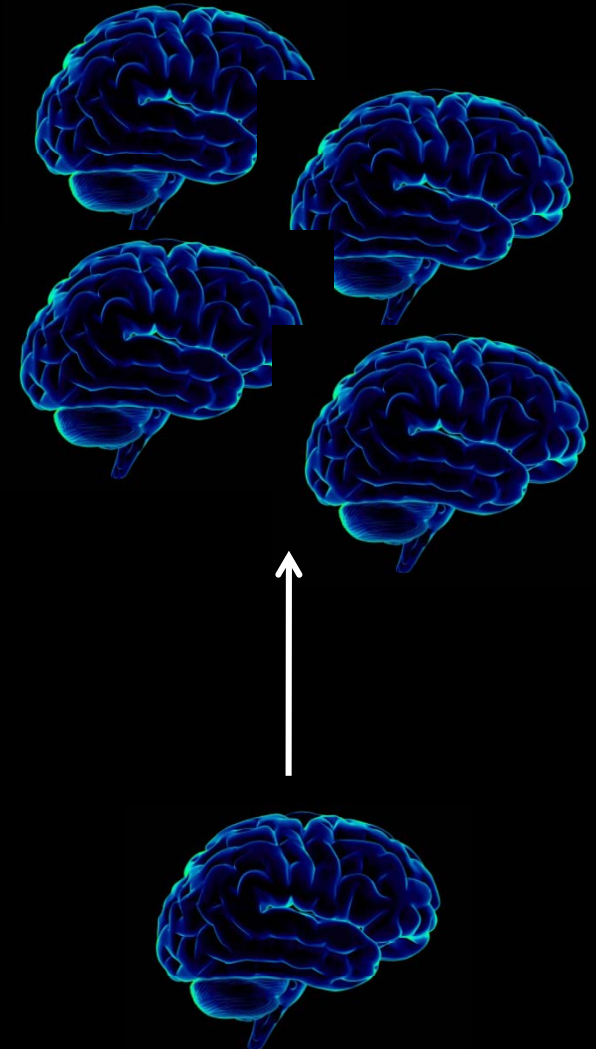
Mylyn

# group memory: Hipikat

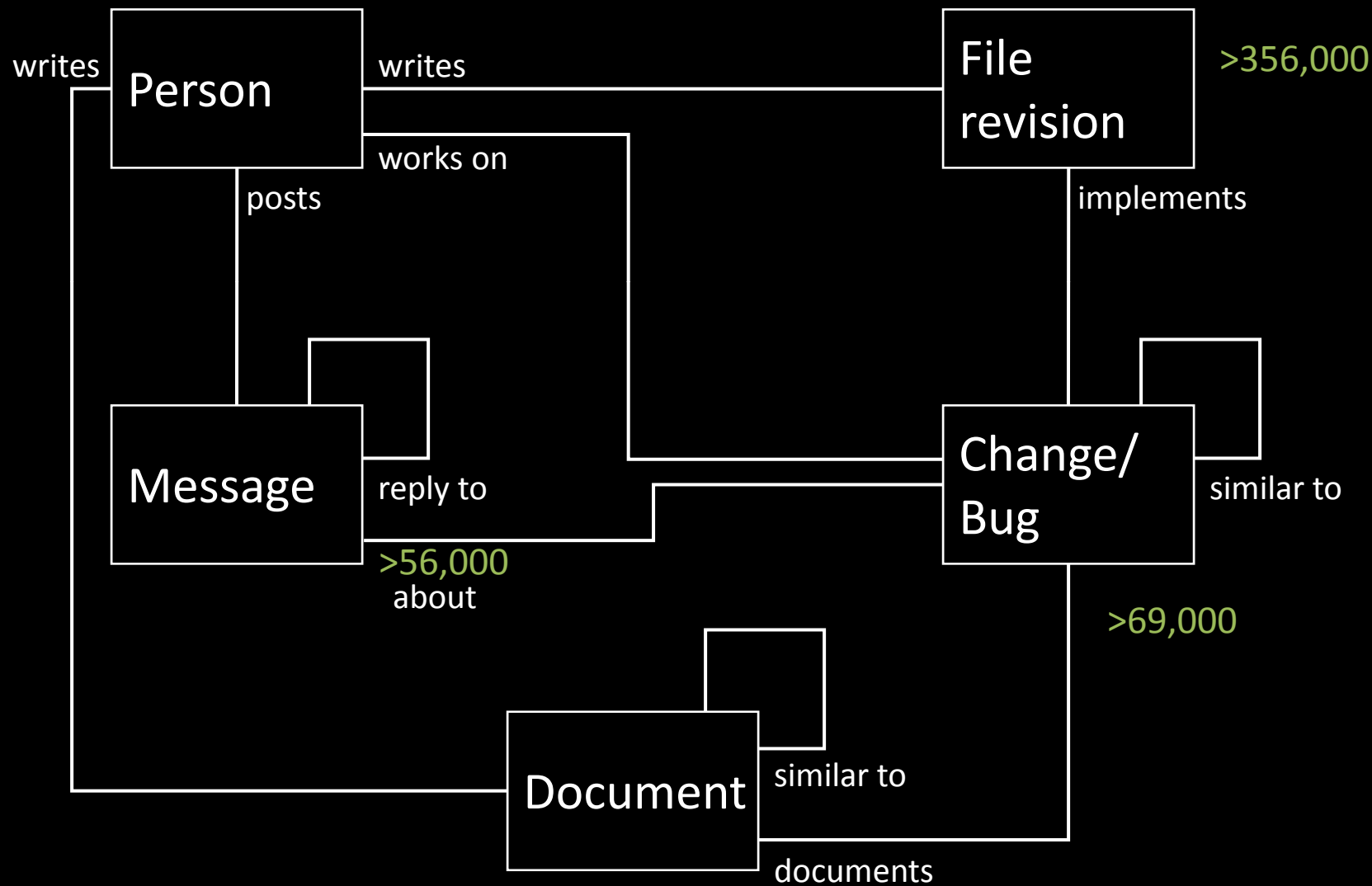
across time and space, developers leave  
a digital trail of information  
about a project

form an implicit group memory  
from the digital trail

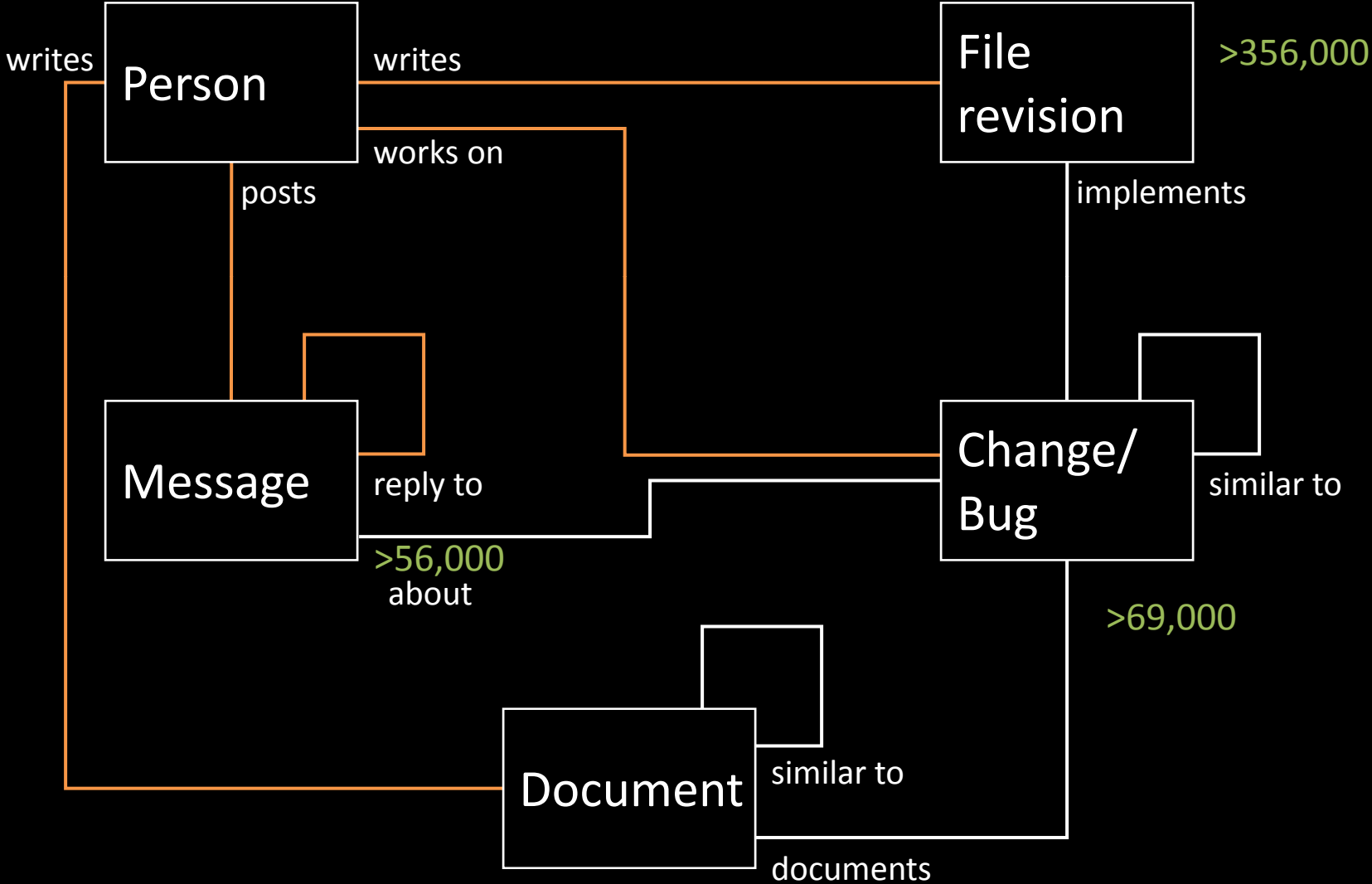
enable a developer to  
query the group memory  
for pertinent information



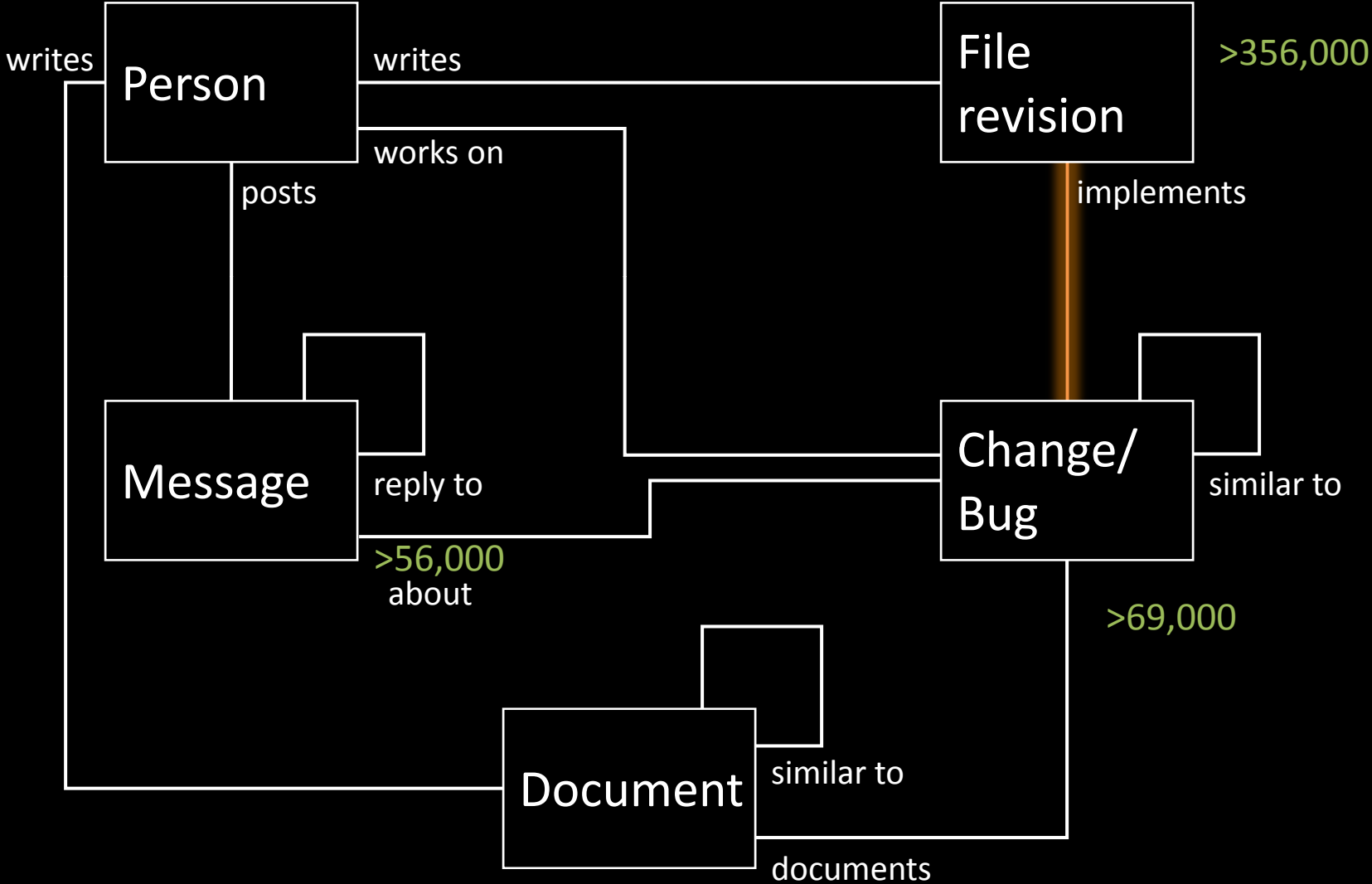




# metadata

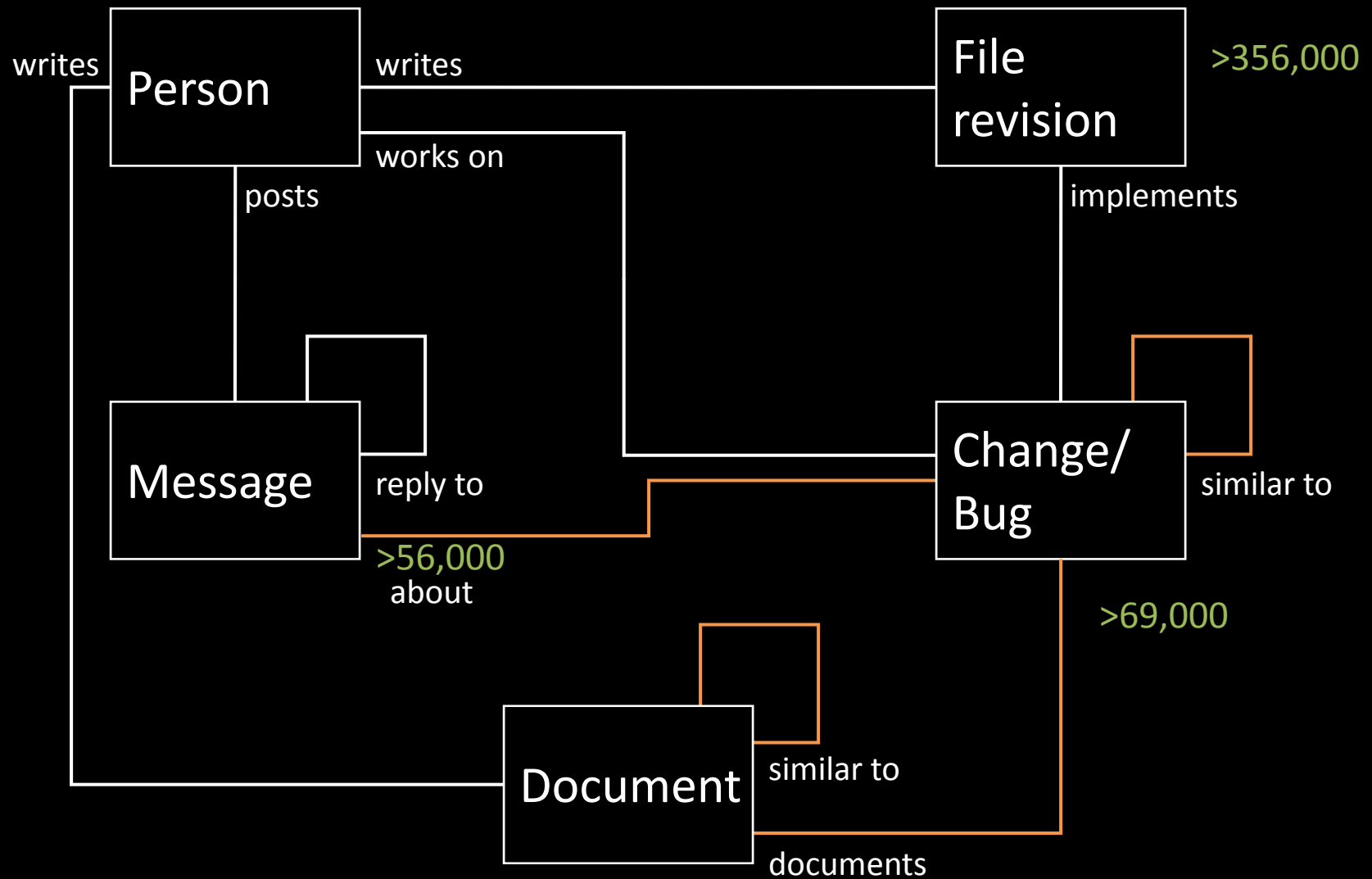


# heuristic

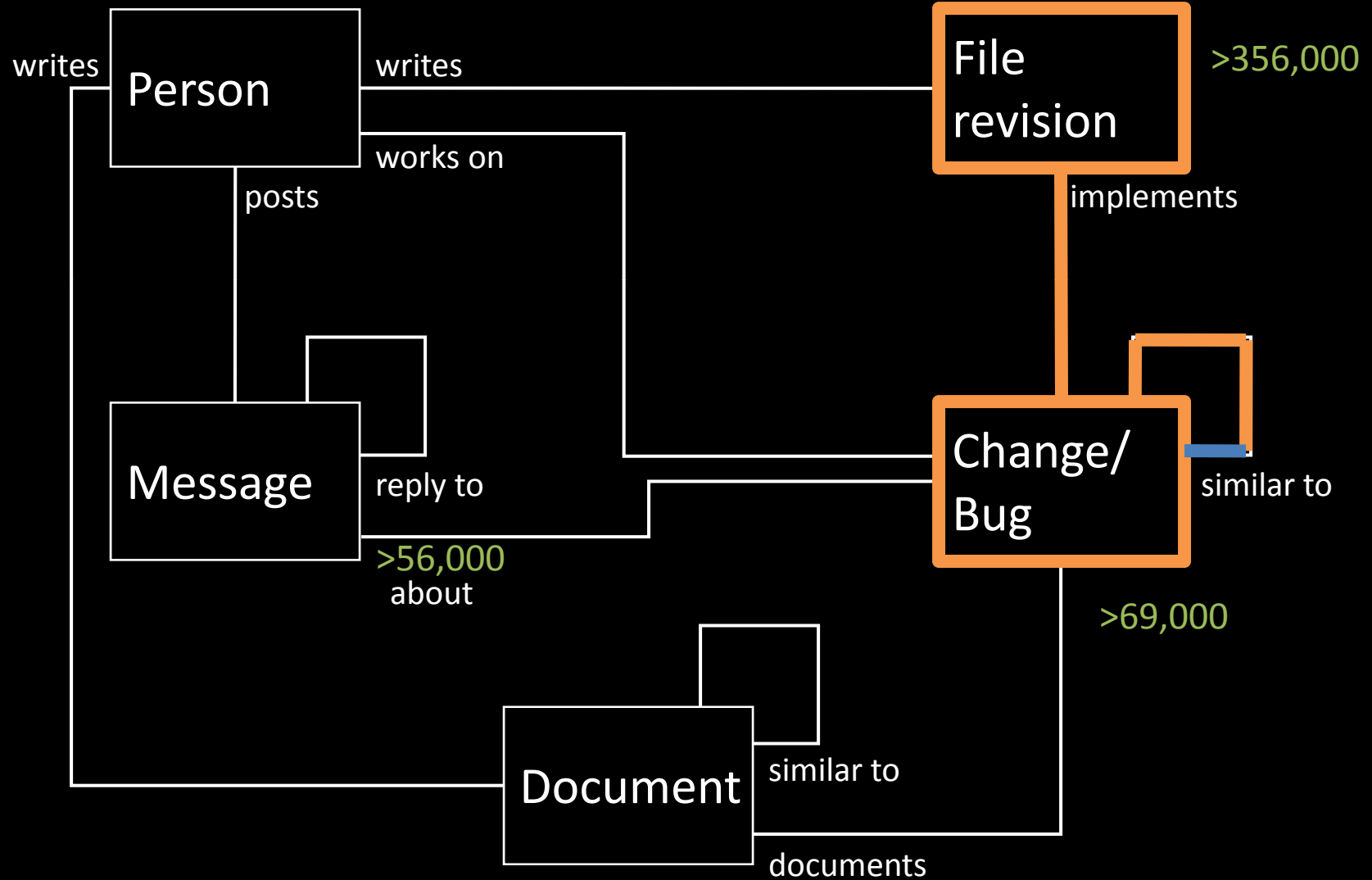




# information retrieval



# recommending



Package Explorer

- JHotDraw
  - CH.ifa.draw.applet
  - CH.ifa.draw.application
  - CH.ifa.draw.contrib
  - CH.ifa.draw.figures
  - CH.ifa.draw.framework
  - CH.ifa.draw.images
  - CH.ifa.draw.samples.javadraw
  - CH.ifa.draw.samples.javadraw.sampleimages
  - CH.ifa.draw.samples.net
  - CH.ifa.draw.samples.nothing
  - CH.ifa.draw.samples.pert
  - CH.ifa.draw.samples.pert.images
  - CH.ifa.draw.standard
  - CH.ifa.draw.test
  - CH.ifa.draw.util
  - JRE System Library [j2re1.4.1\_01]
  - JUnit.jar - C:\local\eclipse3.0M3\eclipse\plugins\o
  - AttributeMenuGreying.crn
- JHotDraw5.4
  - CH.ifa.draw
  - CH.ifa.draw.applet
  - CH.ifa.draw.application
  - CH.ifa.draw.contrib
  - CH.ifa.draw.contrib.dnd
  - CH.ifa.draw.contrib.html

Bug 6660: Feature: Hover over breakpoints give line number

**Bug 6660: Feature: Hover over breakpoints give line number**

**Bug#:** 6660      **Platform:** PC  
**Reporter:** Darin\_Swanson@us.ibm.com (Darin Swanson)      **Product:** JDT  
**OS:** Windows 2000      **Component:** Debug  
**Version:** 2.0      **Status:** VERIFIED  
**Priority:** P3      **Resolution:** FIXED  
**Severity:** normal      **Assigned To:** jaredburns@acm.org (Jared Burns)  
**Target Milestone:** 2.1      **URL:**

**Keywords:**

**Description:**  
 Hovering over a breakpoint in the vertical ruler of the Java editor could show the line number of the breakpoint (or other interesting information...such as access or modification for a watchpoint).

**Additional comment from Darin Wright on 2002-02-26 15:27**  
 Deferred

Outline

An outline is not available.

dev.eclipse.org;/home/eclipse/org.eclipse.jdt.ui.tests.refactoring/test cases/org/eclipse/jdt/ui/tests/refa...	Check-in close to bug resolution	High - checked-in within 2 m.
Restored old template icon (2002-05-21 00:40:41.0)	Text similarity	0.322573579313666

Name	Reason	Confidence
dev.eclipse.org;/home/eclipse/org.eclipse.jdt.ui.tests.refactoring/test cases/org/eclipse/jdt/ui/tests/refa...	Check-in close to bug resolution	High - checked-in within 2 m
Restored old template icon (2002-05-21 00:40:41.0)	Text similarity	0.322573579313666
bug with arrays (2002-04-12 11:37:32.0)	Text similarity	0.25609721669331
bug in stubgen with arrays (2002-03-12 10:32:06.0)	Text similarity	0.25609721669331
API changes for arrays (2001-11-02 10:07:12.0)	Text similarity	0.238044218031918
API changes for arrays (2001-11-02 10:24:51.0)	Text similarity	0.238044218031918
templates (http://download.eclipse.org/downloads/documentation/2.0/html/plugins/org.eclipse.jdt.doc.u...	Text similarity	0.373300544889591
'Re: How do you invoke the templates?', posted by developer_dude@hotmail.com on 2002-04-17 17:46:...	Text similarity	0.344573761161167

Tasks Properties Console Search Hipikat Results

Package Explorer Hierarchy

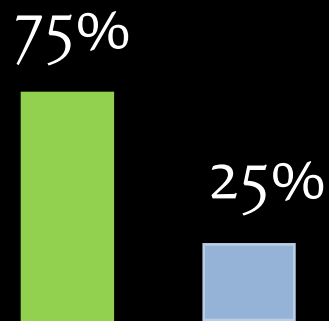
Tasks Search Problems Hipikat Results

# does it work?

20 random bugs from Eclipse ; assess files recommended  
precision: 0 to 0.56 ; recall: 0 to 1

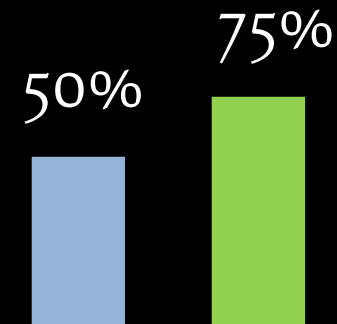
---

easy task



75% of newcomers handled special cases correctly compared to only 25% of experts

difficult task



50% of newcomers met basic req. compared to 75% of experts



right information?

right time?

right place?



right way?

right person?

# right way?

```
Java Source Compare

TagAction.java 1.13
monitor.beginTask("", keySet.size() * 1000);
Iterator iterator = keySet.iterator();

while (iterator.hasNext()) {
    IProgressMonitor subMonitor = new SubProgressMonitor(m
    CVSTeamProvider provider = (CVSTeamProvider)iterator.n
    List list = (List)table.get(provider);
    IResource[] providerResources = (IResource[])list.toAr
    CVSTag tag = new CVSTag(result[0], CVSTag.VERSION);
    IStatus status = provider.tag(providerResources, IReso
    if (status.getCode() != CVSStatus.OK) {
        messages.add(status);
    }
    // Cache the new tag creation even if the tag may of h
    CVSUIPlugin.getPlugin().getRepositoryManager().addVers
    CVSWorkspaceRoot.getCVSFolderFor(provi
    new CVSTag[] {tag});
}
previousTag = result[0];
catch (TeamException e) {
    throw new InvocationTargetException(e);
}
bind("TagAction.tagProblemsMessage", this.PROGRESS_DIALOG);

TagAction.java 1.12
monitor.beginTask("", keySet.s
Iterator iterator = keySet.ite

while (iterator.hasNext()) {
    IProgressMonitor subMonito
    CVSTeamProvider provider =
    List list = (List)table.ge
    IResource[] providerResour
    IStatus status = provider.
    if (status.getCode() != CV
        messages.add(status);
    }
}
previousTag = result[0];
catch (TeamException e) {
    throw new InvocationTargetExc
}
bind("TagAction.tagProblemsMessa
or any status messages and displ
messages.isEmpty() {
    on error e:
    status of status = new Multi
    nt : messages.size());
```

current

past

right way?



weak rationale for  
recommendations

significant cognitive  
effort to apply  
information overload

cognitive overload

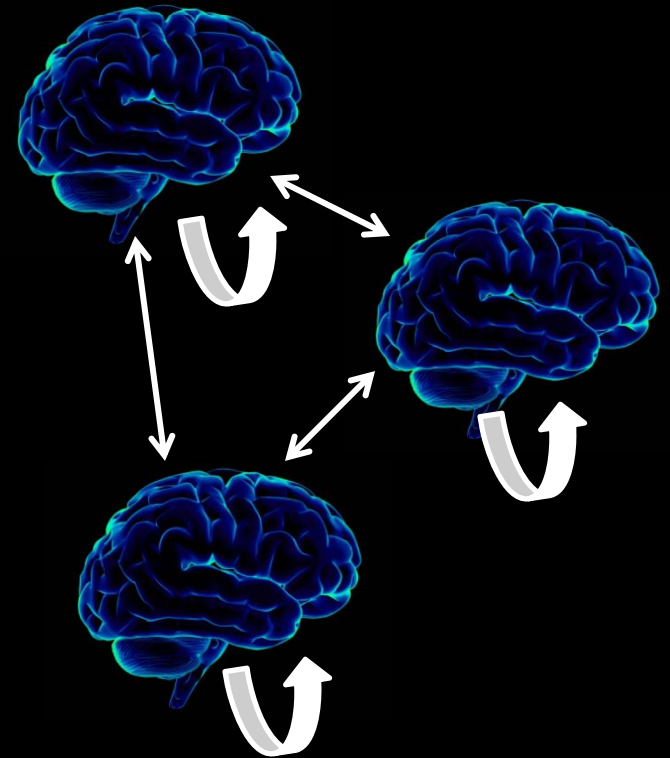


## episodic memory: Mylyn

as a developer works, build a *task context* that includes a *degree-of-interest* (DOI) for each item of information interacted with

focus the display of information using a task's context

support collaboration through sharing of task contexts





The screenshot displays the Eclipse IDE interface. The main window shows a Java project named 'org.eclipse.myllyn.context.core'. The package explorer on the left shows the project structure, including a 'src' directory with various Java files. The code editor in the center shows the 'processInteract' method in 'AttachmentFlag.java', which is currently selected. The console at the bottom shows the search results for 'org.eclipse.myllyn.monitor.core.InteractionEvent', listing several references in the workspace. An inset image in the top right corner shows a desk setup with two monitors, a keyboard, and a mouse.

```
public IInteractionElement processInteract
return processInteractionEvent(event,
}

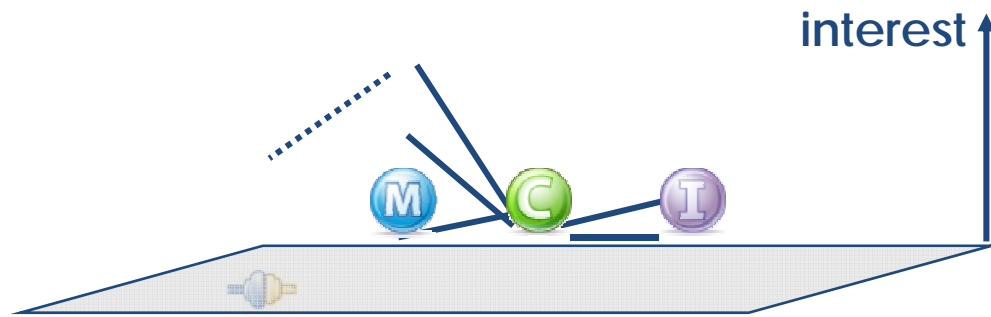
public IInteractionElement processInteract
return processInteractionEvent(event,
}

public IInteractionElement processInteract
boolean notifyListeners) {
boolean alreadyNotified = false;
if (isContextActive()) {
List<IInteractionElement> interestDelta = internalF
propagateToParents);
if (notifyListeners) {
notifyInterestDelta (interestDelta);
}
}
```

Search Results: 'org.eclipse.myllyn.monitor.core.InteractionEvent' - 657 references in workspace (no JRE) (83 matches filtered from view)

- org.eclipse.myllyn.context.core - src - org.eclipse.myllyn.context.core
  - IDegreeOfInterest 1.8
    - getEvents()
  - IInteractionContext 1.13
  - IInteractionContextManager 1.12

- loadActivityMetaContext()
- saveActivityMetaContext()
- takeSnapshot(File)
- restoreSnapshot(File)
- manipulateInterestForEler
- manipulateInterestForEler
- manipulateInterestForEler
- migrateLegacyActivity(Int
- notifyElementsDeleted(Lis
- notifyInterestDelta(List<I
- notifyRelationshipsChang
- processActivityMetaCont
- processInteractionEvent(I
- processInteractionEvent(I
- processInteractionEvent(C
- processInteractionEvent(
- propagateInterestToParer
- removeActivityMetaCont



Ready



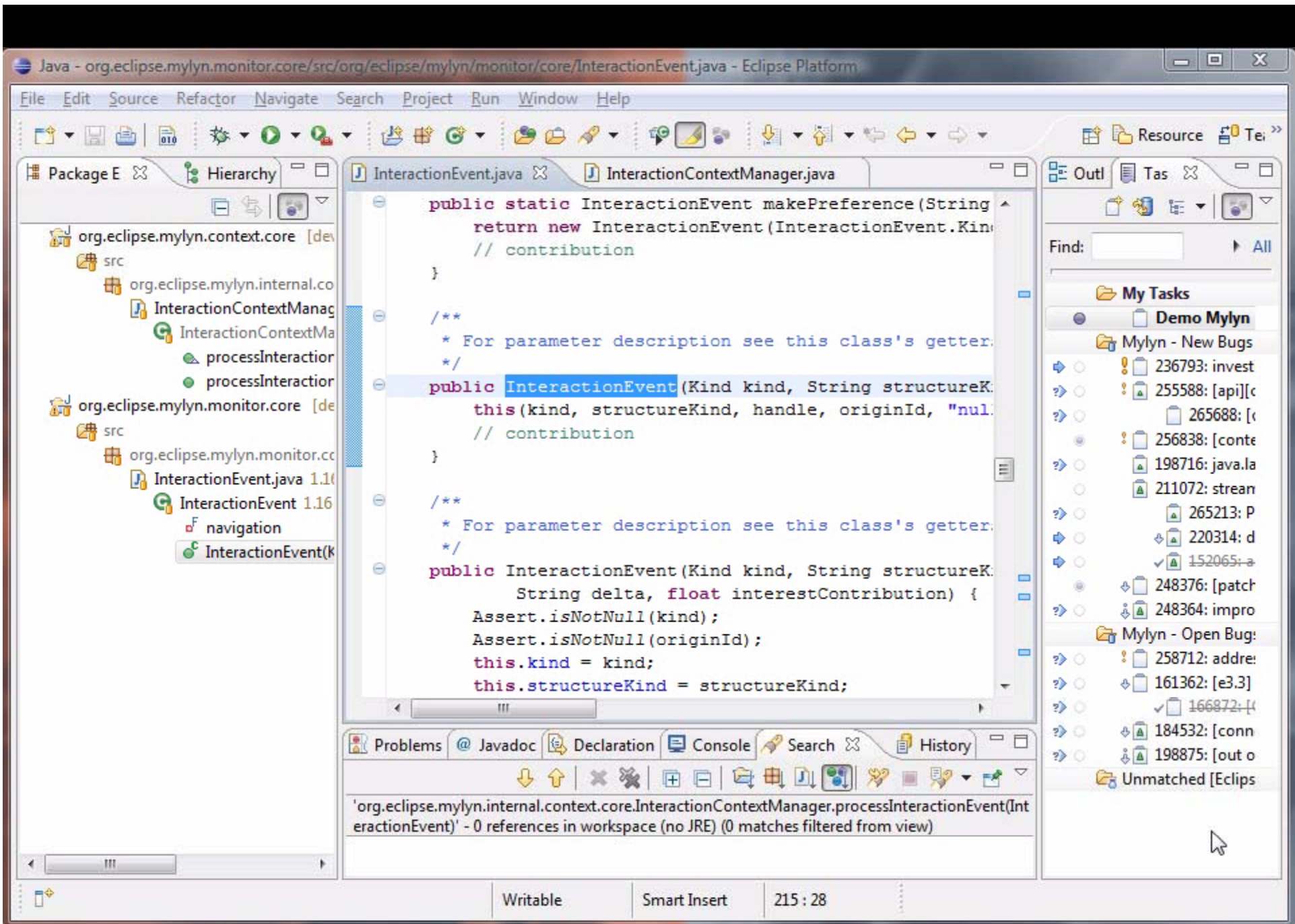


task (bug) #1



task (bug) #2





<b>Mechanism</b>	<b>Description</b>	<b>Applies to</b>
Filtering	Exclude display of elements with DOI below a threshold	List, tree, graphical views
Ranking	Display elements sorted by DOI values	List views, children within tree nodes
Decoration	Indicate DOI values with foreground or background colour	Any view
Expansion management	Expand tree nodes to show elements with certain properties	Any tree view



task (bug) #1



task (bug) #2

Ready

00:46

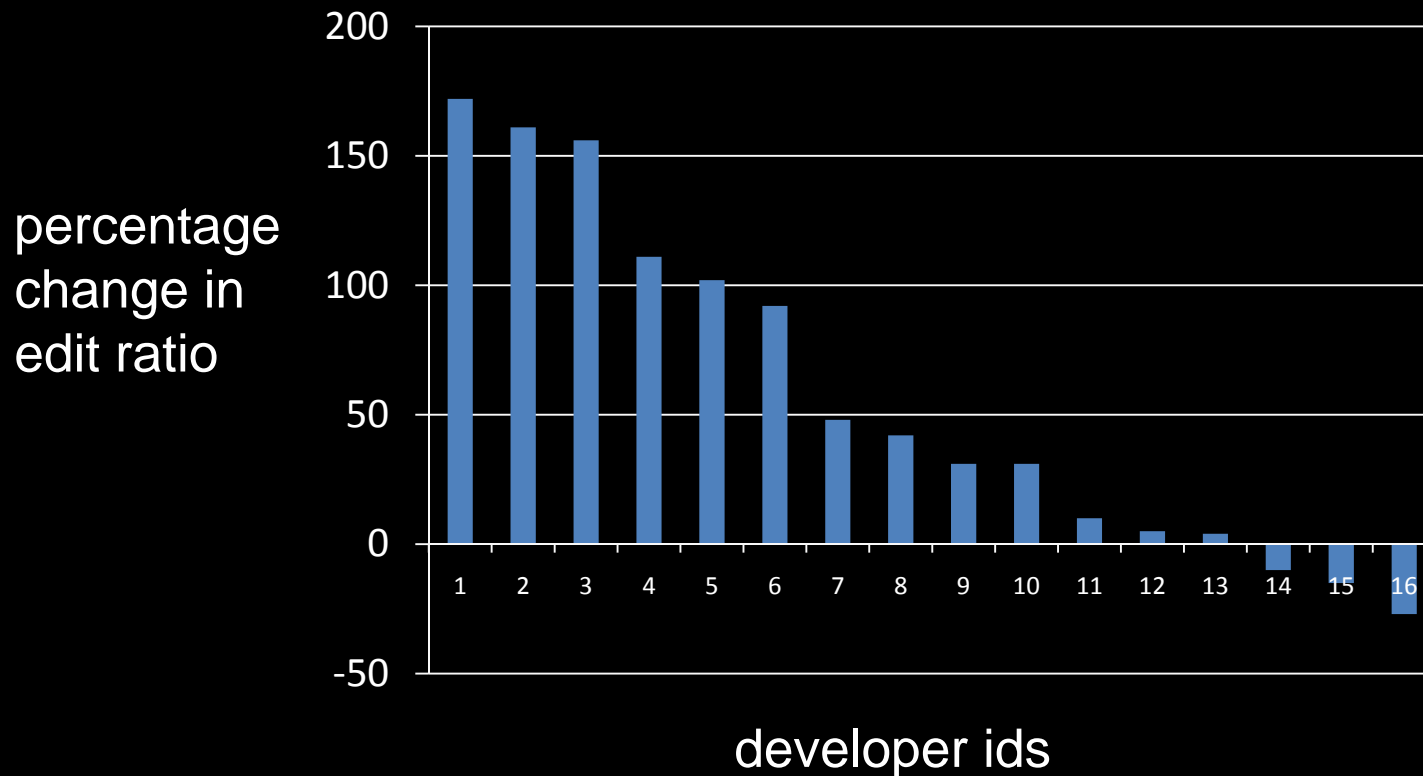




does it work?

field study with 16 industry participants

edit ratio = # edits / # selections



right information?

right time?

right place?



right way?

right person?

# instead of

The screenshot displays the Eclipse IDE interface for a Java project. The main window shows the source code for `InteractionContextManager.java`. The code defines a class `InteractionContextManager` that implements the `IInteractionElement` interface. The `processInteractionEvent` method is highlighted in blue. The code is as follows:

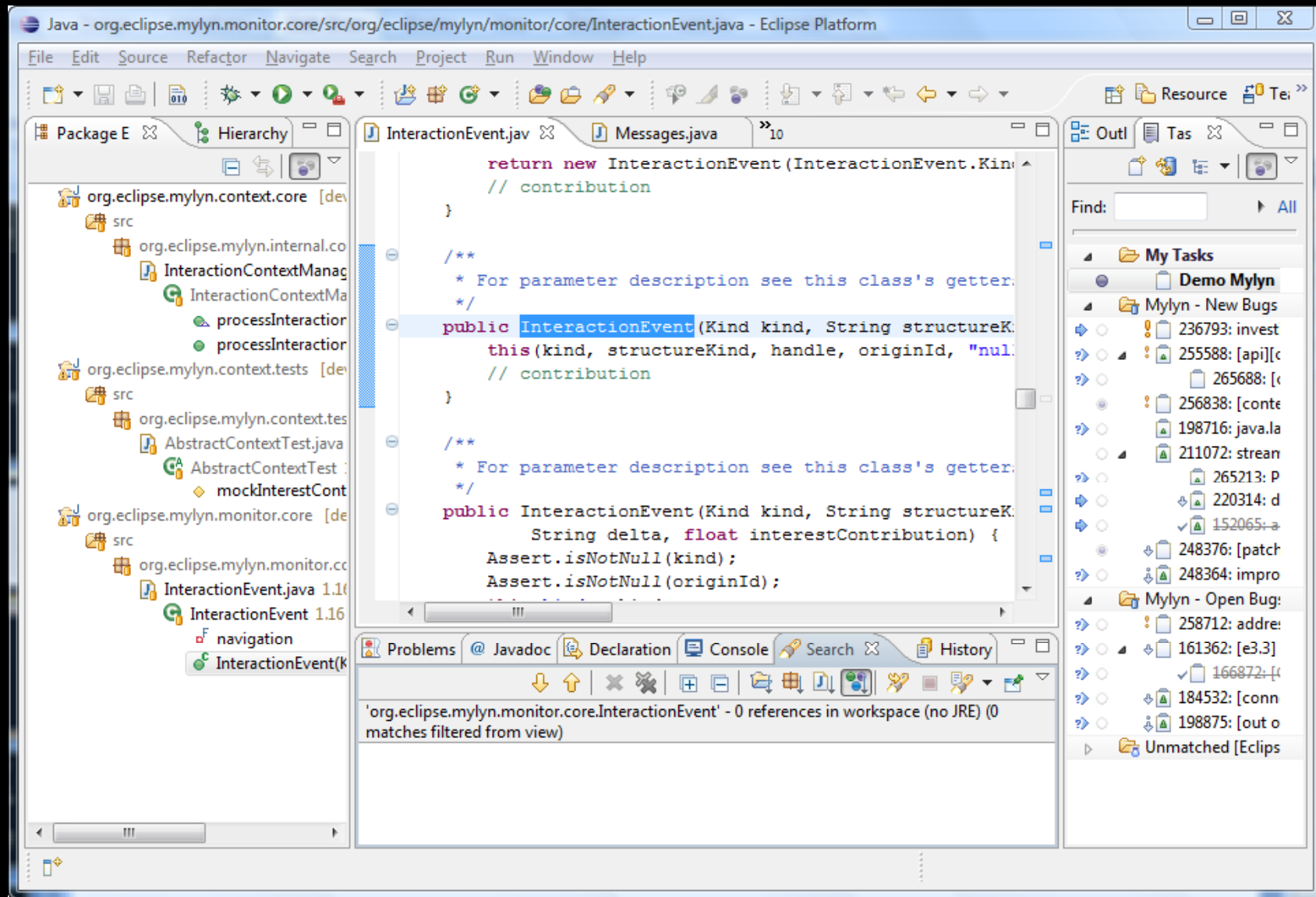
```
public IInteractionElement processInteractionEvent (InteractionContextManager context, IInteractionEvent event, boolean propagateToParent) {  
    return processInteractionEvent(event, true);  
}  
  
public IInteractionElement processInteractionEvent (InteractionContextManager context, IInteractionEvent event, boolean propagateToParent) {  
    return processInteractionEvent(event, propagateToParent);  
}  
  
public IInteractionElement processInteractionEvent (InteractionContextManager context, IInteractionEvent event, boolean propagateToParent, boolean notifyListeners) {  
    boolean alreadyNotified = false;  
    if (isContextActive()) {  
        List<IInteractionElement> interestDelta = internalProcessInteractionEvent(event, propagateToParents);  
        if (notifyListeners) {  
            notifyInterestDelta(interestDelta);  
        }  
    }  
}
```

The Package Explorer on the left shows the project structure, including the `org.eclipse.mylyn.bugzilla.core` package and its sub-packages. The Outline view on the right shows the class hierarchy, including `getActiveDocuments(IInteractionContext)`, `getListeners()`, `hasContext(String)`, `internalActivateContext(IInteractionContext)`, `internalProcessInteractionEvent(IInteractionContext, IInteractionEvent, boolean, boolean)`, `isActivationHistorySupported()`, `isContextActive()`, `isContextActivePropertySupported()`, `isContextCapturePaused()`, `isInterestDelta(float, boolean)`, `loadActivityMetaContext(IInteractionContext, File)`, `saveActivityMetaContext(IInteractionContext, File)`, `takeSnapshot(File)`, `restoreSnapshot(File)`, `manipulateInterestForElement(IInteractionContext, IInteractionElement, boolean)`, `manipulateInterestForElement(IInteractionContext, IInteractionElement, boolean, boolean)`, `migrateLegacyActivity(IInteractionContext, IInteractionElement)`, `notifyElementsDeleted(List<IInteractionElement>)`, `notifyInterestDelta(List<IInteractionElement>)`, `notifyRelationshipsChanged(IInteractionContext, IInteractionElement)`, `processActivityMetaContext(IInteractionContext, File)`, `processInteractionEvent(IInteractionContext, IInteractionEvent, boolean)`, `processInteractionEvent(IInteractionContext, IInteractionEvent, boolean, boolean)`, `processInteractionEvent(IInteractionContext, IInteractionEvent, boolean, boolean, boolean)`, `processInteractionEvent(IInteractionContext, IInteractionEvent, boolean, boolean, boolean, boolean)`, `propagateInterestToParent(IInteractionContext, IInteractionElement)`, and `removeActivityMetaContext(IInteractionContext, File)`.

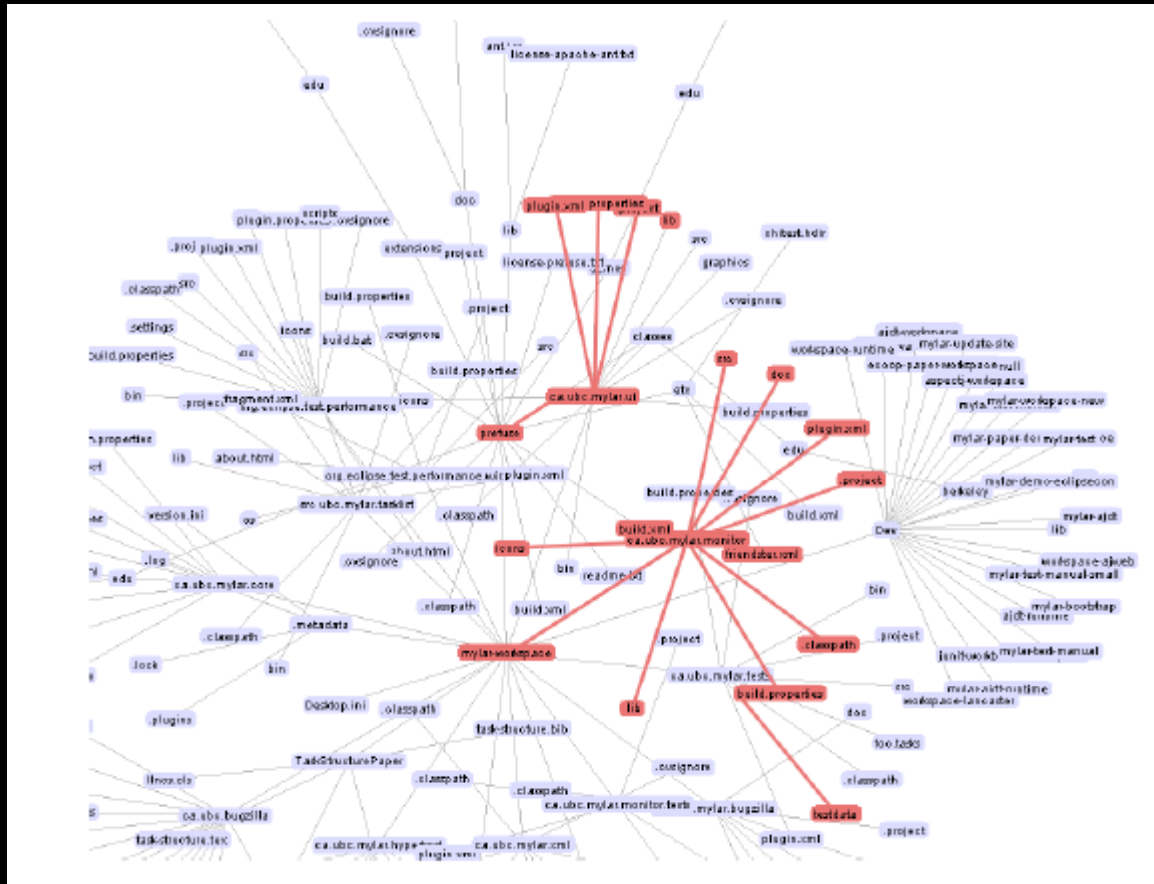
The Problems view at the bottom shows a warning for the `InteractionContextManager` class, indicating 657 references in the workspace (no JRE) and 83 matches filtered from the view. The references are listed as follows:

- `org.eclipse.mylyn.monitor.core.InteractionEvent` - 657 references in workspace (no JRE) (83 matches filtered from view)
- `org.eclipse.mylyn.context.core - src - org.eclipse.mylyn.context.core`
  - `IDegreeOfInterest` 1.8
    - `getEvents()`
  - `InteractionContext` 1.13
  - `InteractionContextManager` 1.12

# 500,000 programmers are working like this

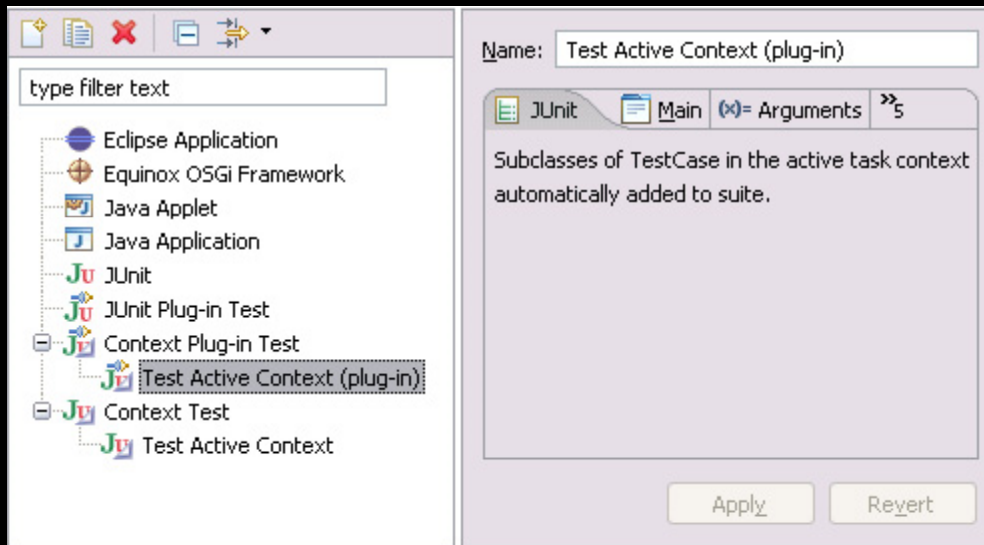


# development tasks have emergent structure





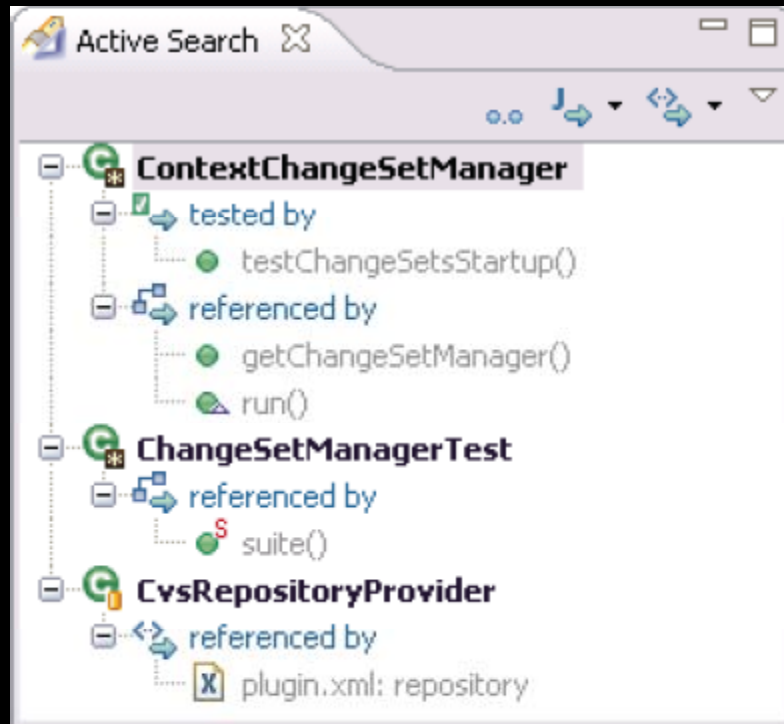
# an anchor for other recommendations



run unit tests  
related to task  
context

+ enables  
easier running  
of more cases

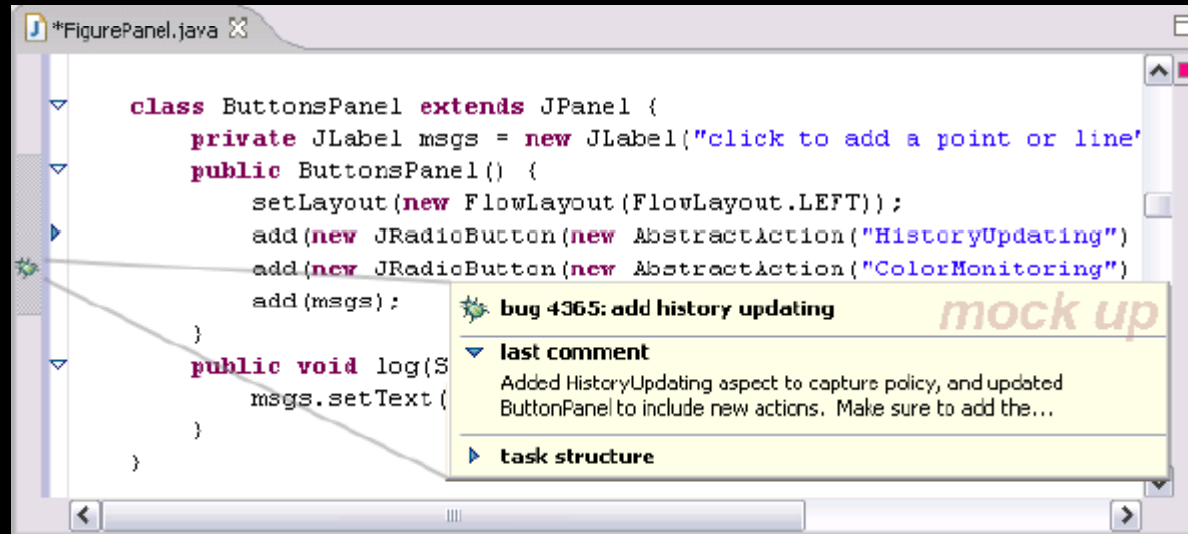
an anchor for other recommendations



active search

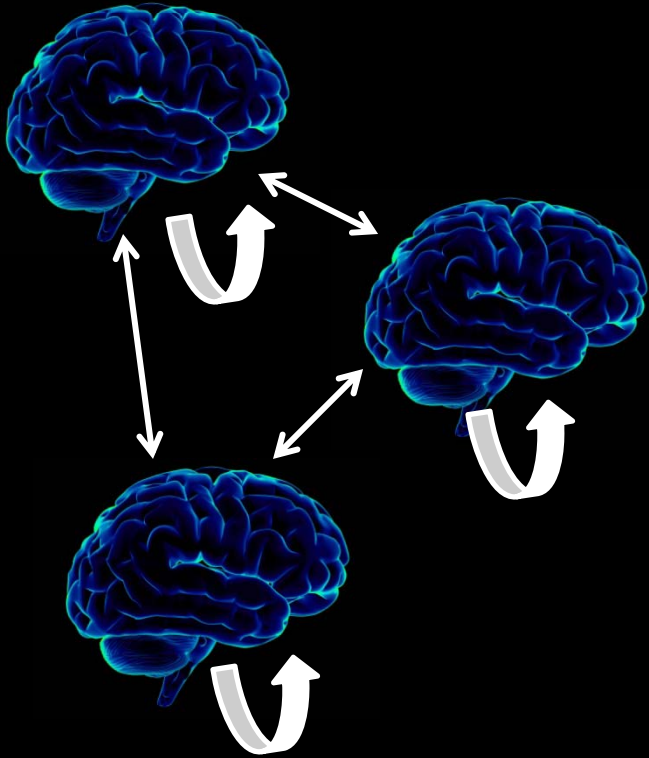
- difficult to scope

an anchor for other recommendations



Hipikat-like  
yet to be built!

right way?



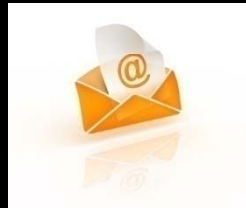
reduces friction

encourages flow

information overload ↓

cognitive overload ↓

what about other knowledge workers?



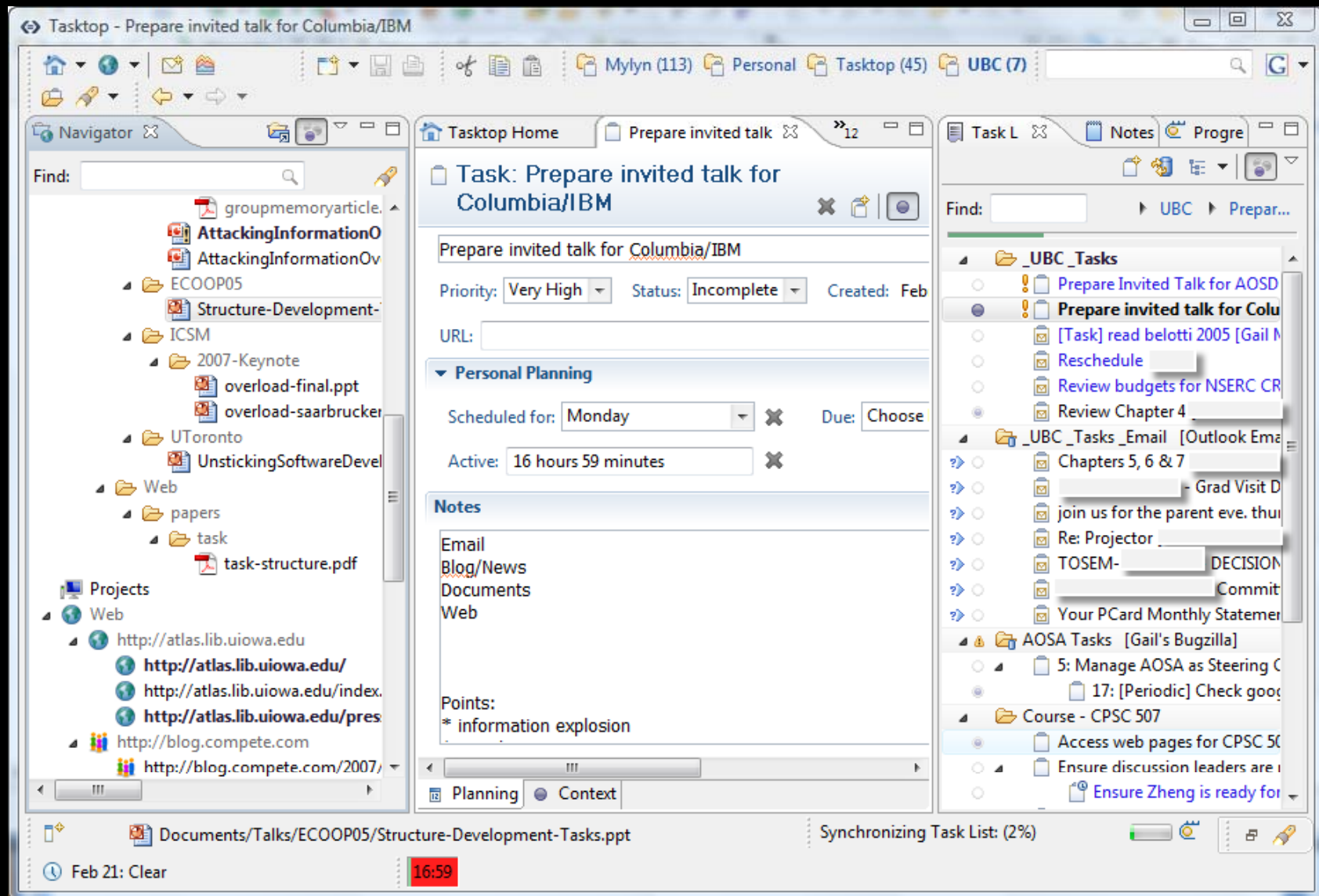
interaction  
relatively agnostic  
to target



# knowledge worker field study (early Mylyn)

average path length	average directory density	scattering	tagging ratio
5.5	0.1	1.5	0.3
2.7	0.2	1.1	0.9
3	0.1	1.4	0.4
2	0.3	0	0
1	0.01	1	0.4

# Tasktop (extend Mylyn beyond programming)





john anvik  
 elisa baniassad  
 wesley coelho  
 davor cubranic  
 brian de alwis  
 rob elves  
 thomas fritz  
 jan hannemann  
 lyndon hiew  
 reid holmes  
 mik kersten  
 seonah lee  
 shawn minto  
 martin robillard  
 izzet safer  
 david shepherd  
 ducky sherwood  
 annie ying  
 trevor young  
 robert waiker  
*and others!*



SO...

information

information

information

information

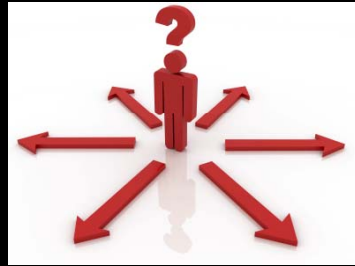
information

Information

information



overload leads to



indecision



repetition



memory-model inspired attacks

Hipikat and Mylyn



recommendations can be about  
less and not just about more

[www.cs.ubc.ca/~murphy](http://www.cs.ubc.ca/~murphy)  
[www.tasktop.com](http://www.tasktop.com)