FACILITATING INFORMATION MANAGEMENT IN INTEGRATED DEVELOPMENT ENVIRONMENTS THROUGH VISUAL INTERFACE ENHANCEMENTS

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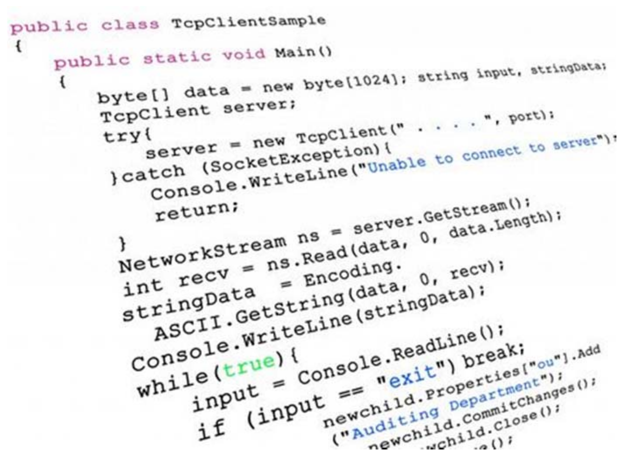
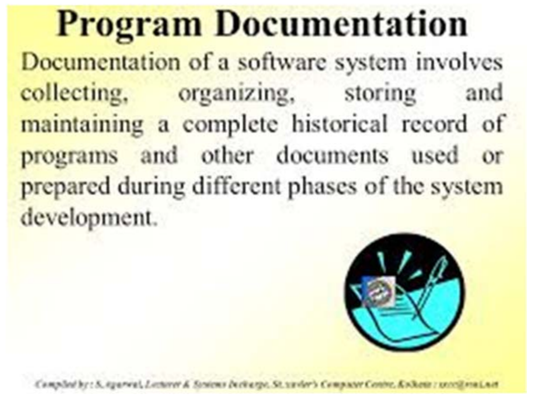
Developers deal with deluge of information



```
public class TcpClientSample
 {
    public static void Main()
    {
        byte[] data = new byte[1024]; string input, stringData;
        TcpClient server;
        try{
           server = new TcpClient(" . . . . ", port);
        }catch (SocketException){
           Console.WriteLine("Unable to connect to server");
           return;

        }
        NetworkStream ns = server.GetStream();
        int recv = ns.Read(data, 0, data.Length);
        stringData  = Encoding.
           ASCII.GetString(data, 0, recv);
        Console.WriteLine(stringData);
        while(true){
           input = Console.ReadLine();
           if (input == "exit") break;
                 newchild.Properties["ou"].Add
                 ("Auditing Department");
                 newchild.CommitChanges();
                 newchild.Close();
```



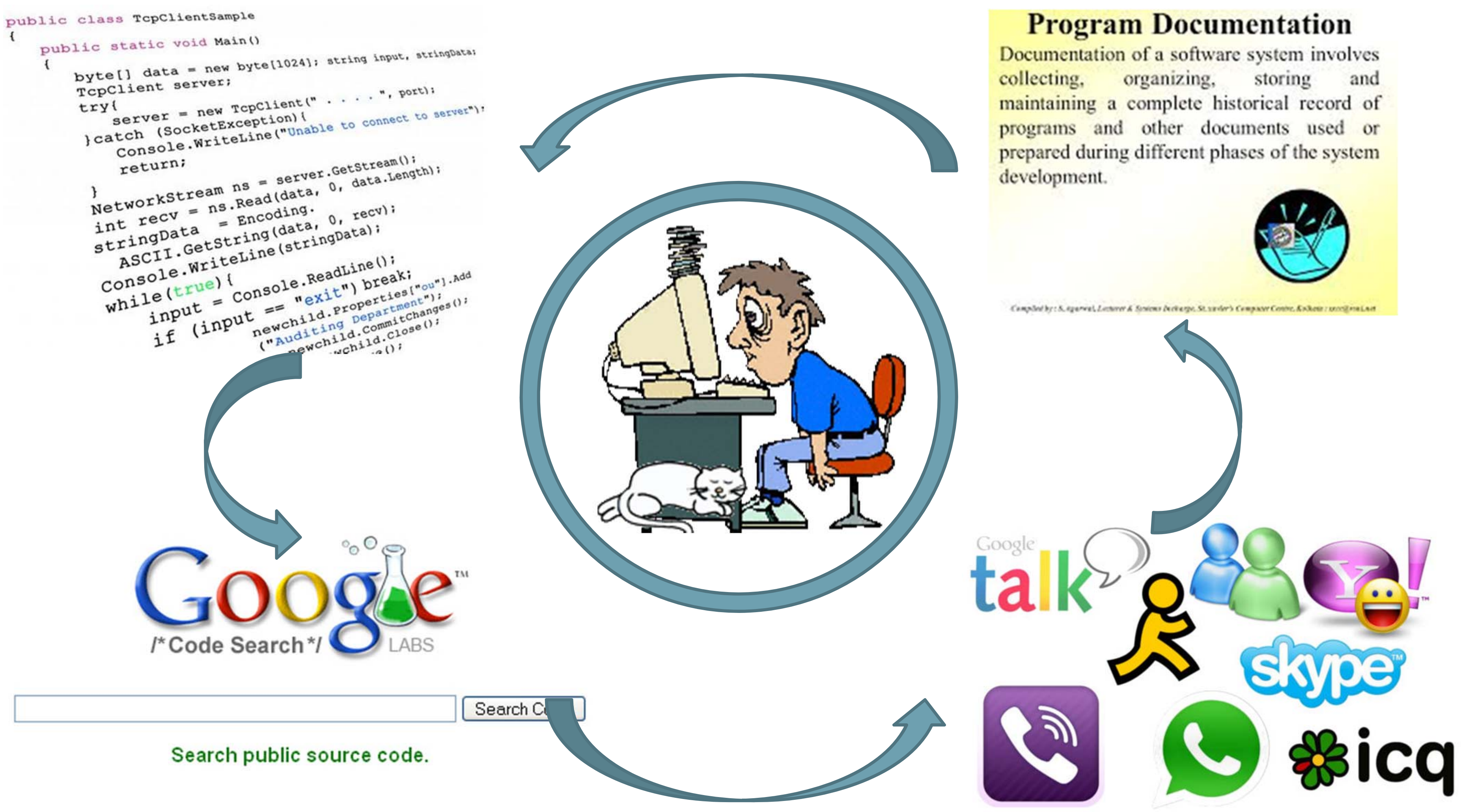
Program Documentation

Documentation of a software system involves collecting, organizing, storing and maintaining a complete historical record of programs and other documents used or prepared during different phases of the system development.

Compiled by : S. Agarwal, Lecturer & Systems Incharge, St. Xavier's Computer Centre, Kolkata : [illegible]

Pictures courtesy of *Google Image Search*

And switch among different information sources



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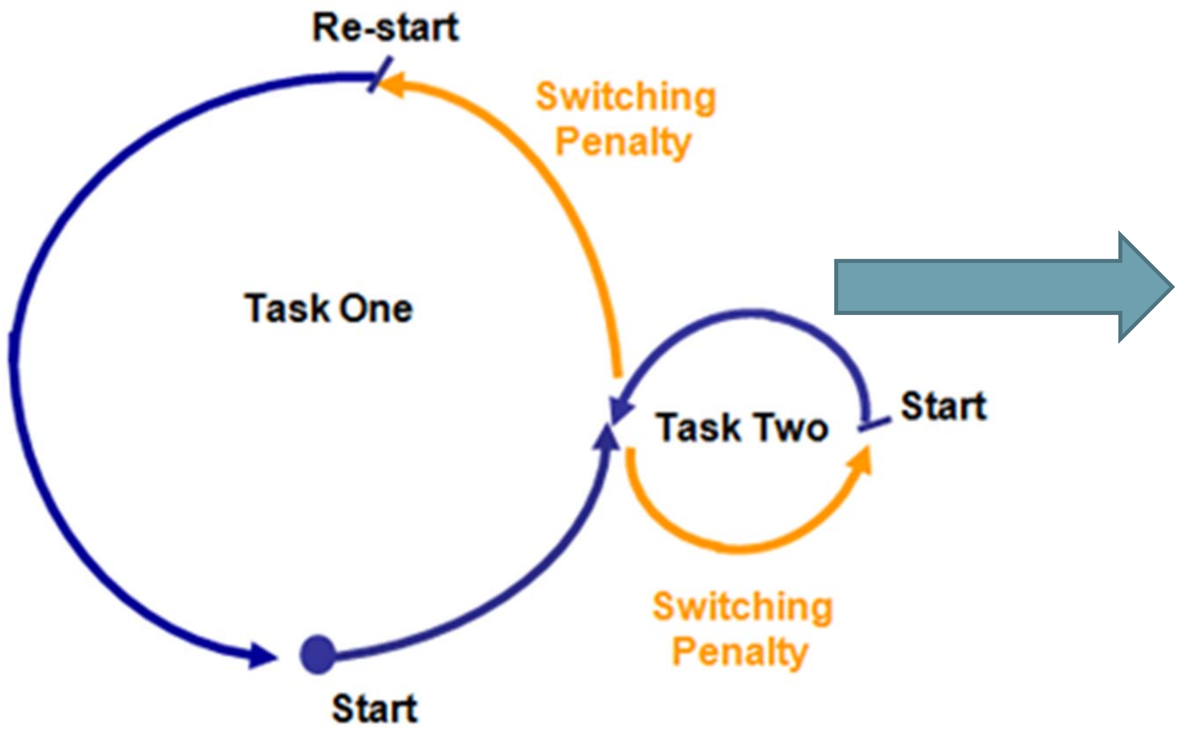
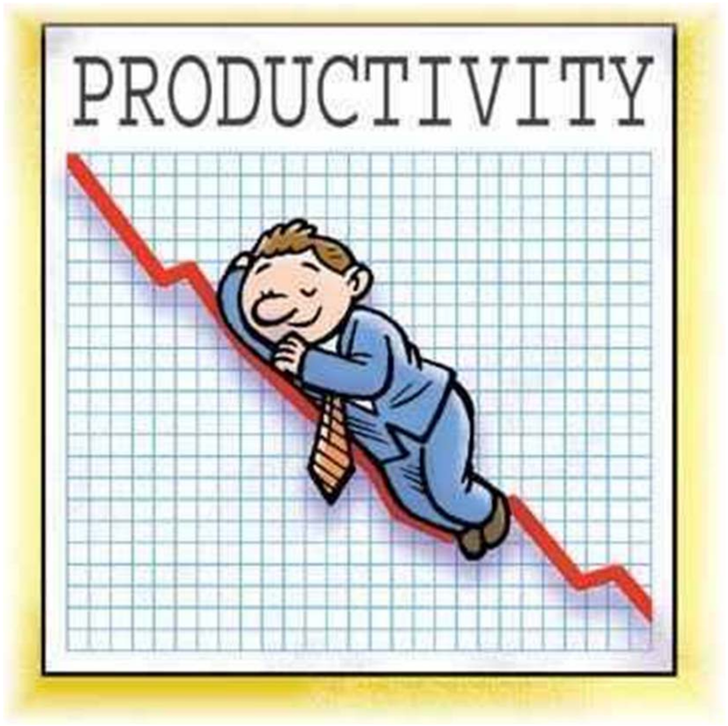
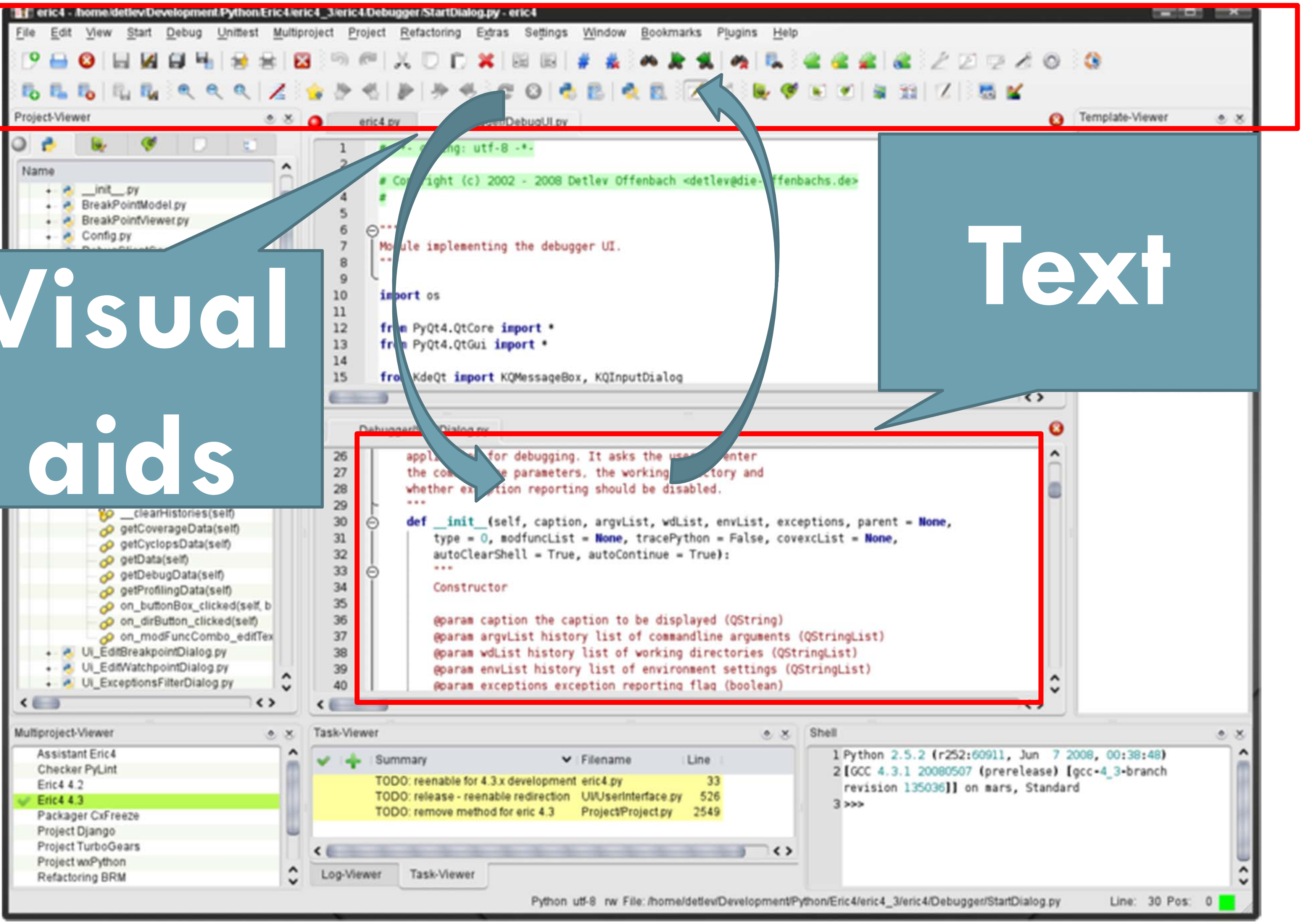
Frequent switches reduce productivity

- Mental-model interruption
- Individual-task latency
- ……





Modern IDEs help yet still suffer


eric4 - /home/detlev/Development/Python/Eric4/eric4_3/eric4/Debugger/StartDialog.py - eric4
File Edit View Start Debug Unittest Multiproject Project Refactoring Extras Settings Window Bookmarks Plugins Help
Project-Viewer
Template-Viewer
eric4.py
DebugUI.py
Name
__init__.py
BreakPointModel.py
BreakPointViewer.py
Config.py
clearHistories(self)
getCoverageData(self)
getCyclopsData(self)
getData(self)
getDebugData(self)
getProfilingData(self)
on_buttonBox_clicked(self, b
on_dirButton_clicked(self)
on_modFuncCombo_editTex
Ui_EditBreakpointDialog.py
Ui_EditWatchpointDialog.py
Ui_ExceptionsFilterDialog.py
Multiproject-Viewer
Assistant Eric4
Checker PyLint
Eric4 4.2
Eric4 4.3
Packager CxFreeze
Project Django
Project TurboGears
Project wxPython
Refactoring BRM
Task-Viewer
Log-Viewer
Shell
Python utf-8 rw File: /home/detlev/Development/Python/Eric4/eric4_3/eric4/Debugger/StartDialog.py Line: 30 Pos: 0

Visual aids

Text

```
#-*- c    ng: utf-8 -*-

# Co    ight (c) 2002 - 2008 Detlev Offenbach <detlev@die-    ffenbachs.de>
#

'''
Mo ule implementing the debugger UI.
''

import os

fr  PyQt4.QtCore import *
fr  PyQt4.QtGui import *

fro KdeQt import KQMessageBox, KQInputDialog
```

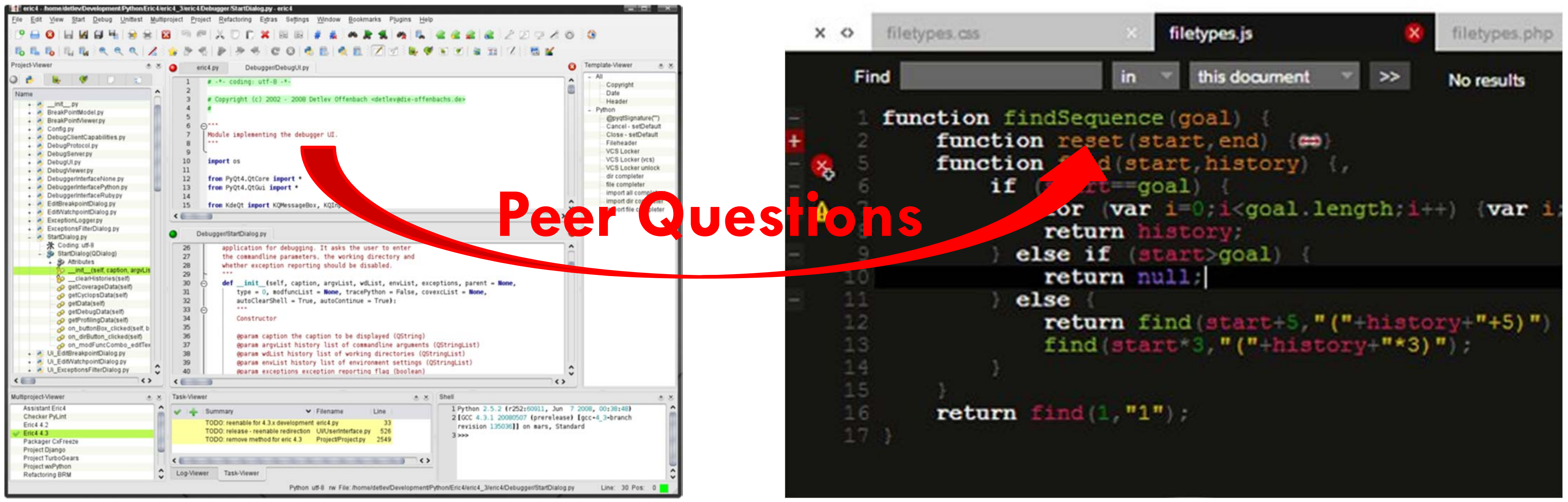
```
    appl       for debugging. It asks the use    enter
    the co       e parameters, the working     ctory and
    whether ex    tion reporting should be disabled.
    '''
    def __init__(self, caption, argvList, wdList, envList, exceptions, parent = None,
        type = 0, modfuncList = None, tracePython = False, covexcList = None,
        autoClearShell = True, autoContinue = True):
        '''
        Constructor

        @param caption the caption to be displayed (QString)
        @param argvList history list of commandline arguments (QStringList)
        @param wdList history list of working directories (QStringList)
        @param envList history list of environment settings (QStringList)
        @param exceptions exception reporting flag (boolean)
```

Summary	Filename	Line
TODO: reenable for 4.3.x development	eric4.py	33
TODO: release - reenable redirection	UI/UserInterface.py	526
TODO: remove method for eric 4.3	Project/Project.py	2549

```
1 Python 2.5.2 (r252:60911, Jun  7 2008, 00:38:48)
2 [GCC 4.3.1 20080507 (prerelease) [gcc-4_3-branch
  revision 135036]] on mars, Standard
3 >>>
```

Modern IDEs help yet still suffer



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# -*- coding: utf-8 -*-

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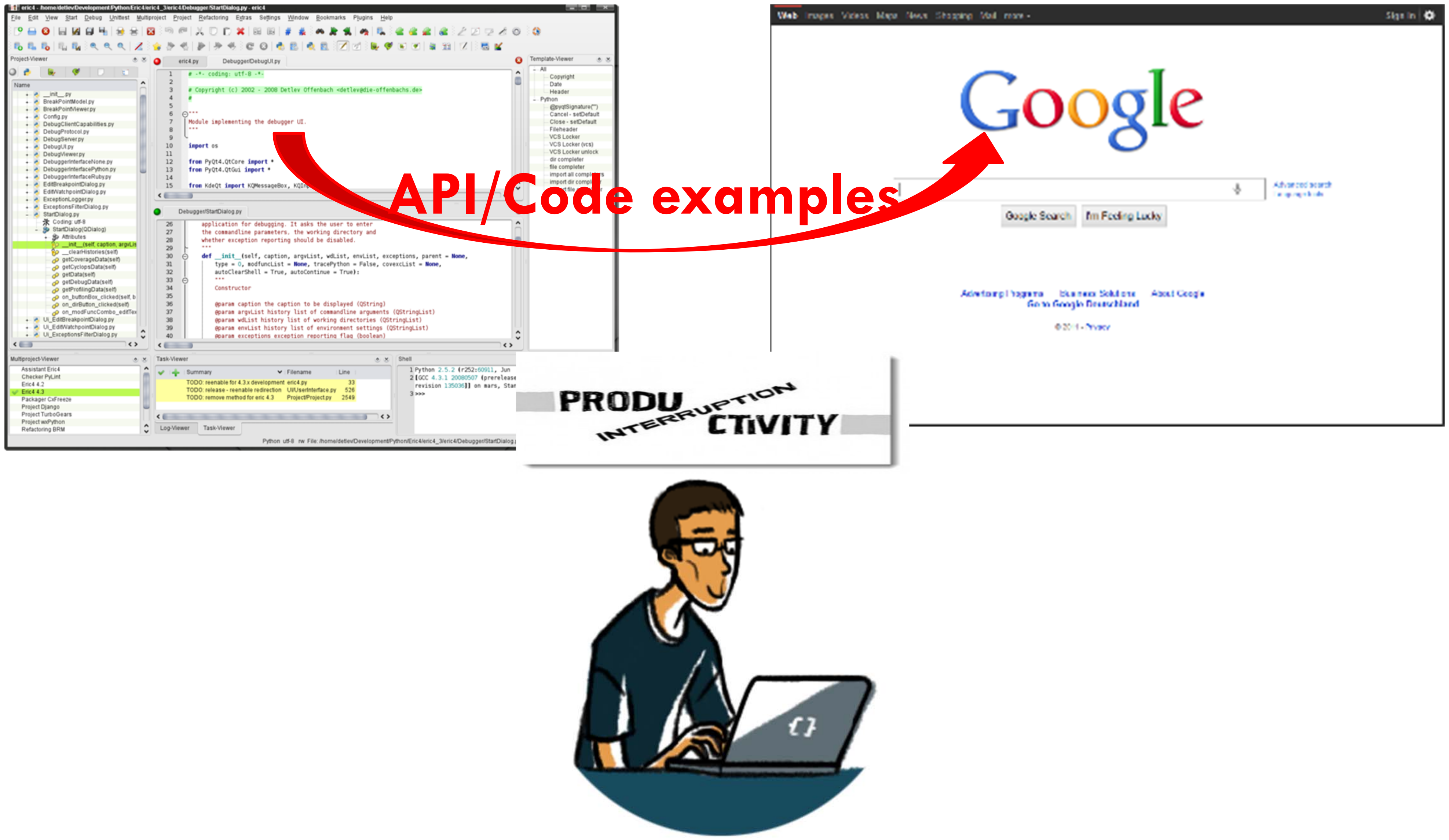
revision 135036]] on mars, Standard
3 >>>
```

```
function findSequence(goal) {
  function reset(start,end) {⟺}
  function find(start,history) {,
    if (start==goal) {
      for (var i=0;i<goal.length;i++) {var i;
      return history;
    } else if (start>goal) {
      return null;
    } else {
      return find(start+5,"("+history+"+5)")
      find(start*3,"("+history+"*3)");
    }
  }
  return find(1,"1");
}
```

Modern IDEs help yet still suffer



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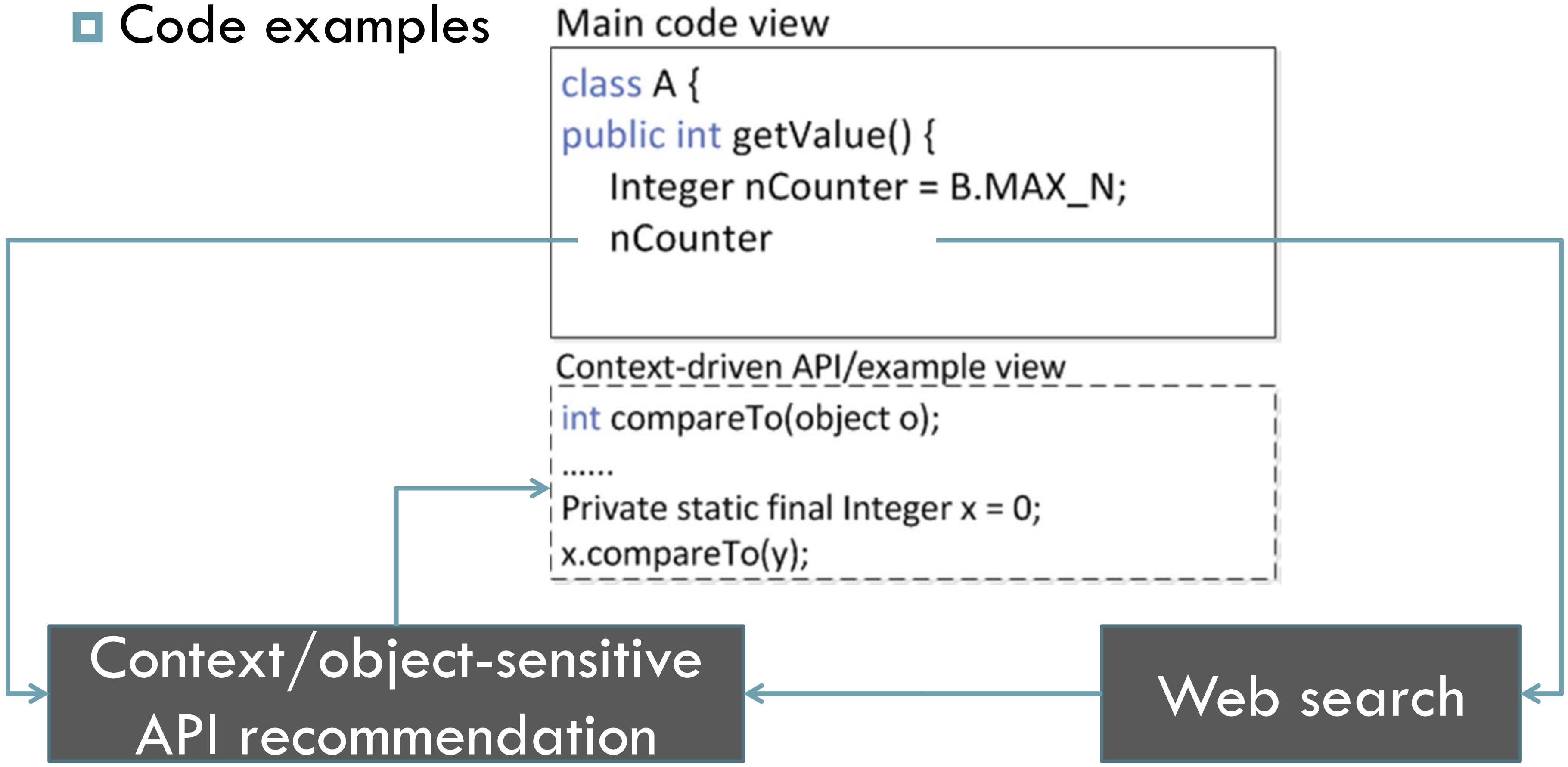
[GCC 4.3.1 20080507 (prerelease
revision 135036)] on mars, Stan
>>>
```

Facilitating information management in IDEs

- Interface enhancements
  - Context-driven API/code example views
  - Coworker views
  - In-situ interface
- Software visualization
  - Multiple code visualizations
  - Interactive linked visualization

Context-driven API/Code example views

- Automatic context-driven information foraging
  - API usage
  - Code examples

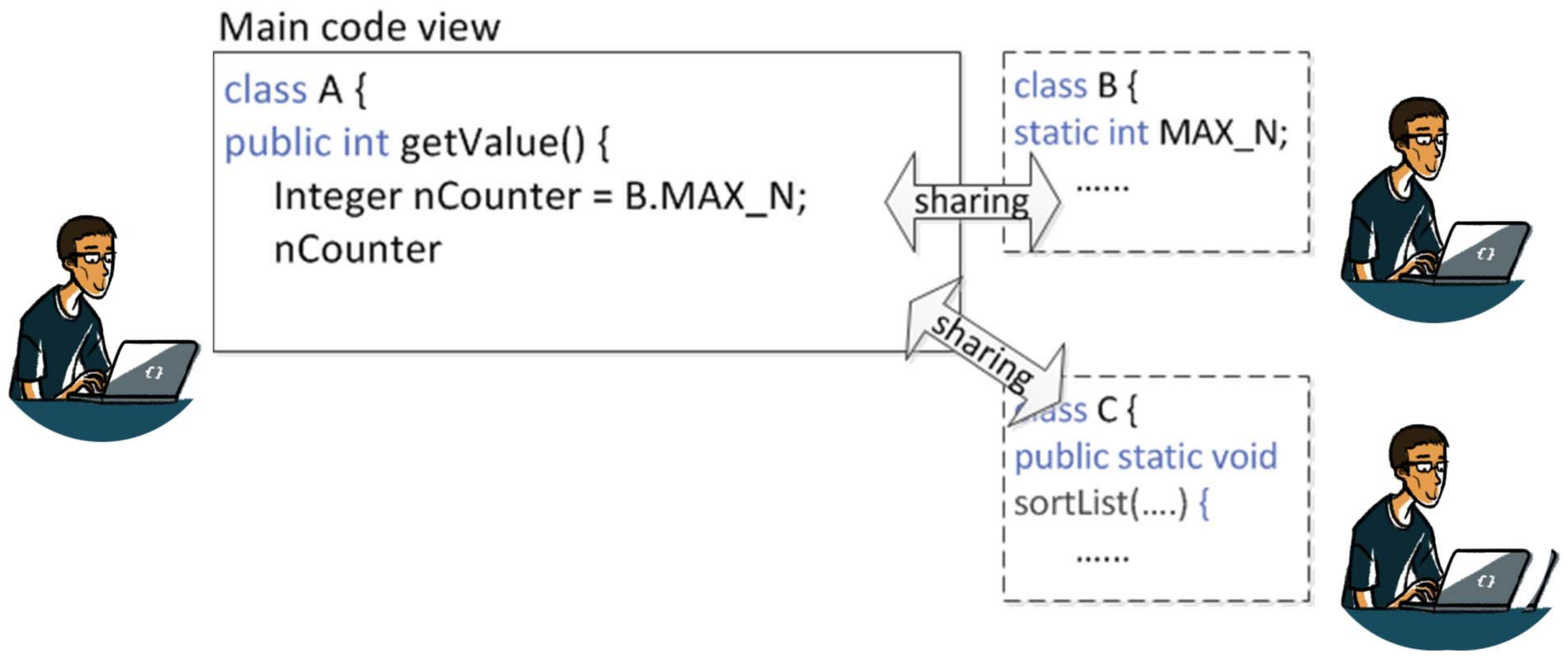

Main code view
Context-driven API/example view
Context/object-sensitive API recommendation
Web search

```
class A {
public int getValue() {
    Integer nCounter = B.MAX_N;
    nCounter
```

```
int compareTo(object o);
……
Private static final Integer x = 0;
x.compareTo(y);
```

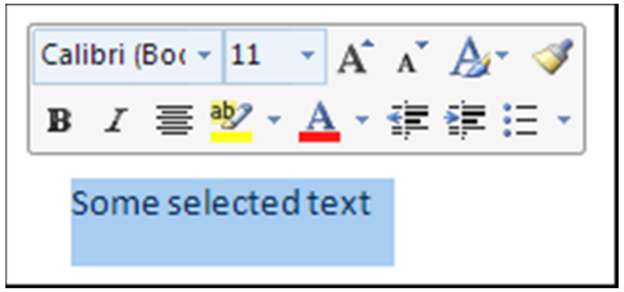
Co-worker views

- On-demand co-worker teaming up
  - Real-time coaching / demonstration
  - Online discussion

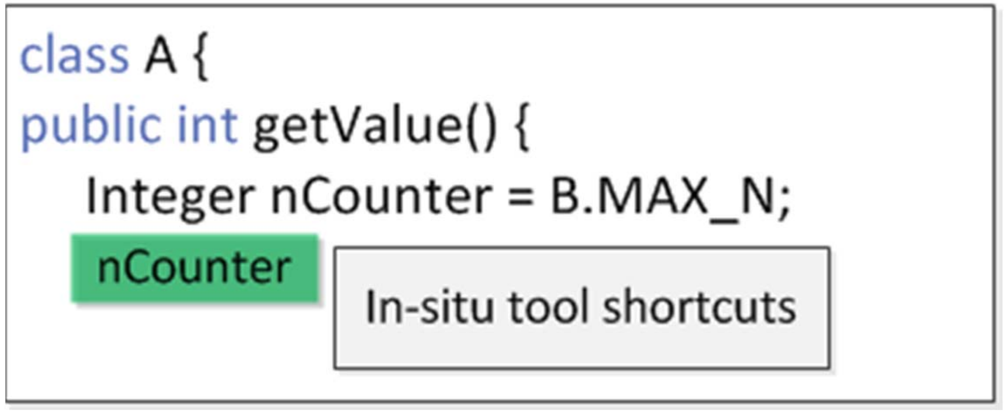


In-situ interface over code editing

- Integrate visual aids with source code editing
  - Automatic push/hiding of commonly used shortcuts
  - Object-sensitive recommendation



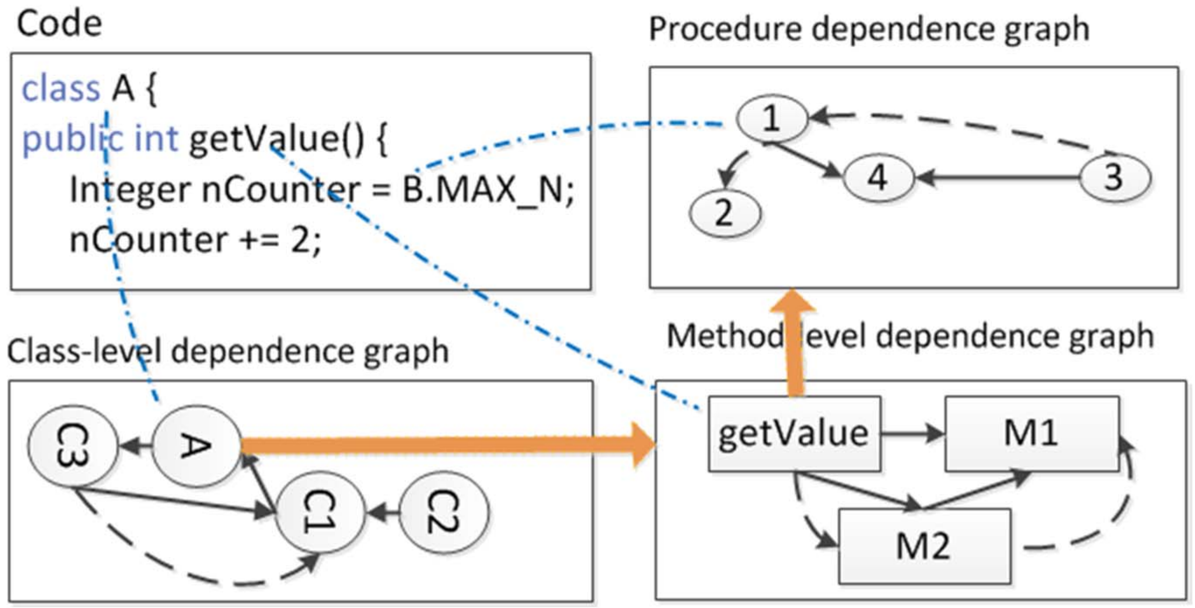
Main code view



```
class A {
public int getValue() {
    Integer nCounter = B.MAX_N;
```

Multiple visualizations of source code

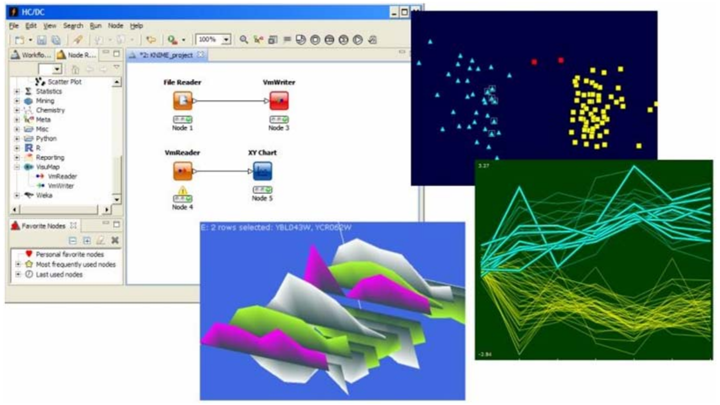
- Different representations of code in separate views
  - Same data
  - Alternative visual depiction (textual and graphical)

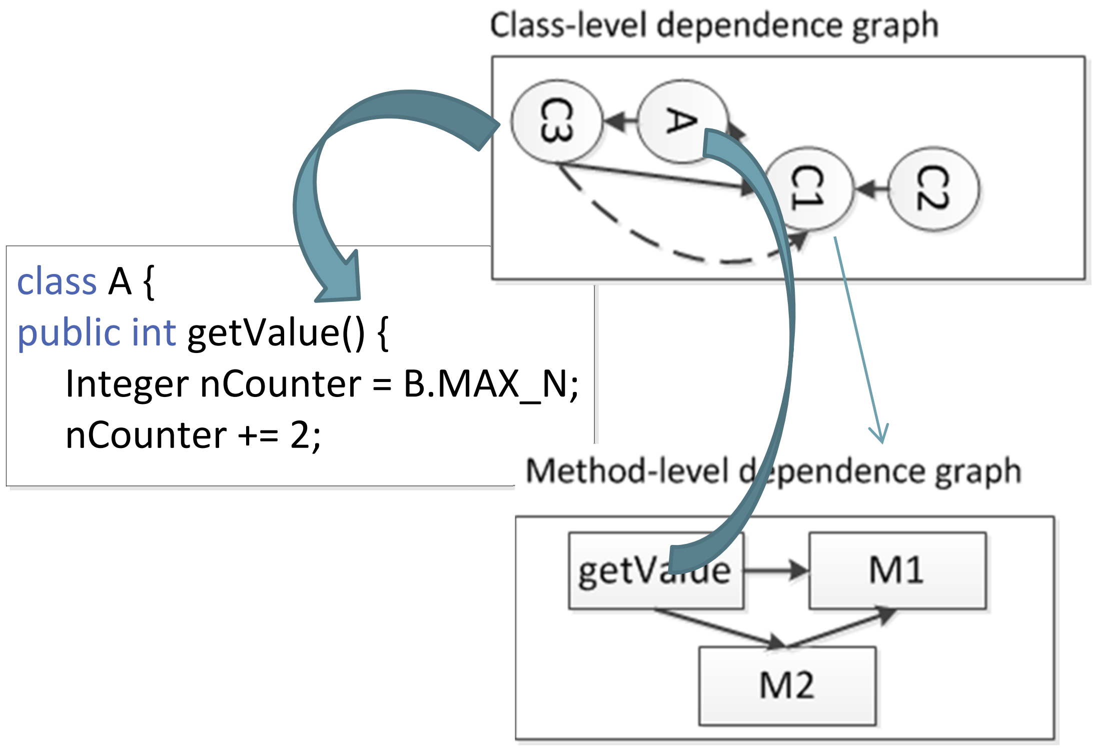

Code
Procedure dependence graph
1
2
3
4
Class-level dependence graph
C3
A
C1
C2
Method level dependence graph
getValue
M1
M2

```
class A {
public int getValue() {
    Integer nCounter = B.MAX_N;
    nCounter += 2;
```

Interactions over linked visualizations

- Linked operations across multiple views
  - Trigger an operation where it is most efficient to do
  - Map the operation to other representations





```
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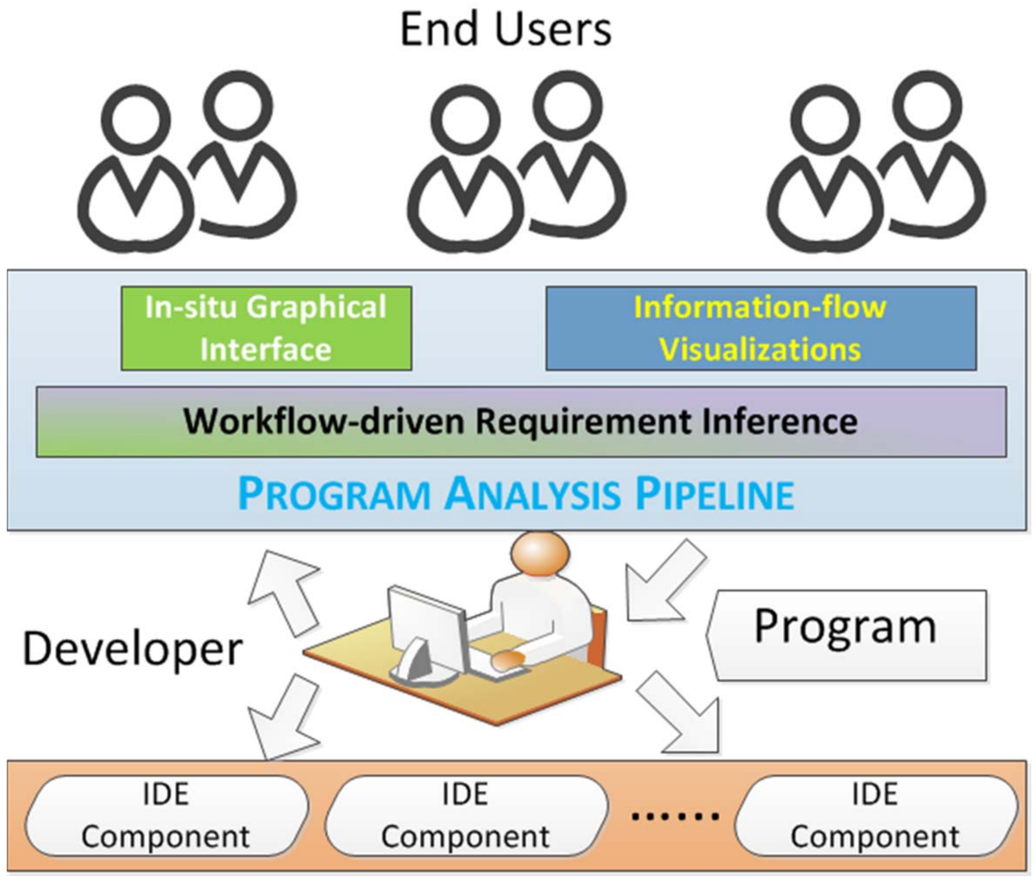
Beyond the visual enhancements

- Incorporating program analysis in IDEs
  - Information extracted from programs is more often needed than external sources --- outputs of program analysis


End Users
In-situ Graphical Interface
Information-flow Visualizations
Workflow-driven Requirement Inference
PROGRAM ANALYSIS PIPELINE
Developer
Program
IDE Component
IDE Component
......
IDE Component

Summing up

- Proposal
  - Motivation
    - Reduce context switching in dealing with multiple information needs with modern IDEs
  - Solution
    - Interface enhancements
    - Interactive code visualization
  - Approach
    - Reduce switching within an IDE
      - Multiple-view interactive linked visualization
      - In-situ interface
    - Reduce switching over an IDE
      - Co-worker views
      - API/code example views

Summing up

- Future work
  - Implementation
    - Via IDE plug-ins to start with
  - Evaluation
    - User studies
      - Groups using the enhanced IDE versus a traditional IDE
      - Coding and comprehension tasks
      - Differences in developer performance
      - Quality and time of task completion

Acknowledgements

“Facilitating Information Management in Integrated Development Environments through Visual Interface Enhancements”

Haipeng Cai

http://cse.nd.edu/~hcai/

hcai@nd.edu

Take-away

Three *interface* features and two *visualization* enhancements are proposed to facilitate information management in modern IDEs.