7 Impact analysis (IA)

- Determines the strategy and impact of change
- Classes identified in concept location are the *initial impact set*
- Class dependencies are analyzed, and impacted classes are added to the impact set
- Produces *estimated impact set*
Initial and estimated impact set
Example personal schedules

Jacob

Henry

Chuck

Pat

Bobby

James

Jane

© 2012 Václav Rajlich

Software Engineering: The Current Practice  Ch. 7
Example personal schedules
Example personal schedules
Example personal schedules
Example personal schedules

- Jacob
- Henry
- Chuck
- Pat
- Bobby
- James
- Jane
Example: Point of Sale
Change request

• Record cashier sessions
• A cashier session
  – total cash and all sales
  – during the time between the cashier logging in and out.
Example: Point of Sale
Example: Point of Sale
Example: Point of Sale
Class interactions

• Two classes interact if they have something in common
  – One depends on the other
    • There is a contract between them
  – They coordinate
    • They share the same coding, schedule, etc.

• Interactions propagate change
  – In both directions
    • From A to B or from B to A
Class Interaction Graph

- \( G = (X,I) \)
  - \( X \) … set of classes
  - \( I \) … set of interactions

- Neighborhood of class A
  \[ N(A) = \{ B \mid (A,B) \in I \} \]
Interactions caused by dependencies

Diagram:

- Item
  - Price
  - Dependency

- Item
  - Price
  - Interaction
class C
{
  A  a;         // gets the color code
  B  b;         // paints the screen
  void foo()
  {
    b.paint(a.get()); // dataflow between a and b
  }
};
Dependency diagram, Interaction diagram

Dependencies

Interactions
Neighborhood of Item
# Status of components (marks)

<table>
<thead>
<tr>
<th>Blank</th>
<th>The class was never inspected and is not scheduled for an inspection.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changed</td>
<td>The programmers inspected the class and found that it is impacted by the change</td>
</tr>
<tr>
<td>Unchanged</td>
<td>The programmers inspected the class and found that it is not impacted by the change.</td>
</tr>
<tr>
<td>Next</td>
<td>The class is scheduled for inspection</td>
</tr>
</tbody>
</table>
A simplified IA process

Create interaction diagram and mark all classes as BLANK

Mark the class located during concept location as CHANGED

Mark all BLANK neighbors as NEXT

Are there any classes marked as NEXT?

[No]

Mark class as UNCHANGED

[UNCHANGED]

Mark class as CHANGED

[CHANGED]

[Yes]

Select a class among the classes marked as NEXT. What is the new mark for this class?
Propagating class: Mailman

- John loaned money to Paul
  - needs the money back
  - His situation changed
- John writes a letter to Paul
  - Mailman takes the letter from John to Paul
  - Paul must take a part-time job
  - a big change that propagated from John to Paul
Interactions

• John interacts with the mailman
• the mailman interact with Paul
• The change originated with John and propagates through the mailman to Paul.
  – mailman is in the middle of the propagation
  – he does not have to change anything
  – he just keeps delivering the letters from one person to another.
IA including propagating classes

Create interaction diagram and mark all classes as BLANK

Mark the class located during concept location as CHANGED

Mark all BLANK neighbors as NEXT

Are there any classes marked as NEXT?

Mark class as INSPECTED

Mark class as PROPAGATING

Mark class as CHANGED

Select a class marked as NEXT. What is the new mark for this class?

[Yes]

[UNCHANGED]

[PROPAGATING]

[CHANGED]
Iterative IA

Color codes
- Unknown
- Changed
- To be inspected
- Inspected and unchanged
- Propagating

© 2012 Václav Rajlich
Software Engineering: The Current Practice  Ch. 7
Alternatives in software change

• Program displaying a temperature in Fahrenheit
  – change request: display it in Celsius
• Two separate locations deal with temperature
  – sensor data converted to the temperature
  – temperature displayed to the user
• The change can be done in either place
  – impact analysis weights these alternatives
The criteria

• Required effort of the change
• Clarity of the resulting code
• Often, these two criteria contradict each other
  – it is easier to adjust the user interface
  – it is better to have all calculations of the temperature in one place
• Conflict between short-term and long-term goals
Interactive IA

Create interaction diagram and mark all classes as BLANK

Mark the class located during concept location as CHANGED

Mark all BLANK neighbors as NEXT

Are there any classes marked as NEXT?

Mark class as INSPECTED

Mark class as PROPAGATING

Mark class as CHANGED

Select a class marked as NEXT. What is the new mark for this class?

© 2012 Václav Rajlich   Software Engineering: The Current Practice   Ch. 7
Tool support: JRipples

- Automatically identifies and suggests components to be inspected
- Keeps track of:
  - What was done (Changed, Propagating, Unchanged)
  - What needs to be done (Next)
- Eclipse plug-in
  - Java
  - 15,000 LOC
  - 150 Classes
  - 2,500 Methods

http://jripples.sourceforge.net
JRipples GUI
JRipples marks and Eclipse