Microsoft Internet Explorer has encountered a problem and needs to close. We are sorry for the inconvenience.

If you were in the middle of something, the information you were working on might be lost.

☑ Restart Microsoft Internet Explorer

Please tell Microsoft about this problem.
We have created an error report that you can send to help us improve Microsoft Internet Explorer. We will treat this report as confidential and anonymous.

To see what data this error report contains, click here.

[Send Error Report] [Don't Send]
Software Operation Knowledge

Henk van der Schuur  
Slinger Jansen  
Sjaak Brinkkemper

Department of Information and Computing Sciences  
Utrecht University  
The Netherlands
Introduction

Stabiplan

- Founded in 1994
- StabiCAD: drawing software for building services industry
- Benelux market leader
- Offices in The Netherlands, Romania, Belgium
Introduction

About me

- Bachelor in Computer Science, Master in Business Informatics
- 60/40: external PhD student
  - 3 days at Stabiplan, 2 days at Utrecht University
  - Slinger: daily supervisor
  - Sjaak: promotor
- Basically 2 jobs, but it is fun
Introduction

Goals

Tell you guys about

• My research on Software Operation Knowledge
  - And its role within product software vendors
• How research is performed
  - And how results are evaluated in the field (we don’t have a lab, you know)
• What it is to be a(n external) PhD student
  - And how cool it is compared to the common consultancy crap

Provide you with answers

• Some things might be difficult to understand at once
• Please do ask questions if you want to
Introduction
Introduction
Introduction

Windows Explorer has stopped working

Windows can check online for a solution to the problem and try to restart the program.

- Check online for a solution and restart the program
- Restart the program

View problem details
Introduction
Introduction

Welcome to Windows Internet Explorer 8

Before you begin, we recommend that you save your files and close all programs.

Because Internet Explorer 8 will be updating files that might be in use, you must restart your computer once setup is complete. This ensures that all files are properly updated and installation is completed.

I want to help improve Internet Explorer
I do not want to participate right now
Learn more

Next > Cancel
Introduction
Introduction

Google Chrome Terms of Service

These Terms of Service apply to the executable code version of Google Chrome. Source code for Google Chrome is available free of charge under open source software license agreements at http://code.google.com/chromium/terms.html.

1. Your relationship with Google

1.1 Your use of Google’s products, software, services and web sites (referred to collectively as the “Services” in this document and excluding any services provided to you by Google under a separate written agreement) is subject to the terms of a legal agreement between you and Google. “Google” means Google Inc., whose principal place of business is at 1600 Amphitheatre Parkway, Mountain View, CA 94043, United States. This document explains how the agreement is made up,

Printer-friendly version

☐ Optional: Help make Google Chrome better by automatically sending usage statistics and crash reports to Google.

Accept and Install  Cancel
Introduction

‘Software operation feedback’

- Hot, but what are we actually talking about?
- Types of operation knowledge? Different priorities?
  - Plethora of definitions
- ‘How does this fit into our organization?’
  - Knowledge life cycle?
- Small vendors:
  ✓ Ad hoc solutions (‘log file here, log file there’)
  ✓ No predefined goals

What actually is knowledge of in-the-field software operation? How should vendors use it within their organizations?
Software Operation Knowledge (SOK)

SOK Definition

- Knowledge of in-the-field performance, quality and usage of software, and knowledge of in-the-field end-user software experience feedback
- Literature study: four knowledge types
  - Performance (e.g. operations per time unit, throughput, latency, etc.)
  - Quality (e.g. reliability, usability, efficiency, maintainability, etc.)
  - Usage (e.g. user interface traces, method calls, object initiations, etc.)
  - End-user feedback (e.g. crash comments, satisfaction level, etc.)

Software Operation Knowledge (SOK)

SOK Reference Framework

- Help product software vendors in **gaining insight** in the **potential role of SOK** in advancement of their products, practices and processes

- Model SOK life cycle
  - **Stakeholders**
  - **Processes**
  - **Perspectives**

- Operation data → information → knowledge

Acquisition

Integration

Identification

Legend

Operation information visualisation

Operation knowledge utilization

Feedback

Response

Behavior

Software modification (updates, licenses, etc.)

Customer

Software Vendor

Data Mining + Abstraction Logic

Operation knowledge demands

Data mining logic abstraction logic

Operation data

Software Operation Data

Operation information

Development Perspective

Company Perspective

Customer Perspective

IDE
Bug tracker
Planning tools
Order administration
Management tools
Marketing tools
License activation tools
Support system
Training software
Empirical Evaluation

1. SOK definition + reference framework: Questionnaire
   ‣ Answered by expert focus group of 10 subjects
     • Invitation to professional and educational networks
     • 3 CTOs, 4 development managers, 3 lead software architects
     • Employed by European software vendors
       - 15 - 2,500 employees (626 on average, \( \sigma = 1,065 \))
       - Software on market for 12.3 years on average (\( \sigma = 8.8 \) years)

   ‣ 21 questions over 4 sections
     1. Contextual Information (subject experience, vendor characteristics, etc.)
     2. Identification and Definition (SOK definition evaluation)
     3. Framework Components (SOK framework evaluation)
     4. Improving activities through SOK (evaluation of potential role of SOK)
Empirical Evaluation

2. Framework utility in practice: Case studies

- At 3 vendors that have implemented SOK life cycle processes
- Case study techniques used:
  - Interviews with employees
    - 15 semi-structured interviews to evaluate framework utility in practice
  - Document study
    - E.g. architecture specifications, memo’s, etc.
  - Software study
    - Particularly software of (or with) which the vendor acquired operation data
  - Direct observations
    - Development, design and release management meetings were attended

Empirical Evaluation

2. Framework utility in practice: Case studies

- Introductory session at each of the vendors
  - Before any evidence was gathered
  - To introduce SOK definition and framework...
  - ...and minimize discrepant understanding of concepts (concept validity)

- Triangulation
  - Document and software study findings were cross-checked with interview results
  - Vague answers were clarified with additional interviews
  - Results were reviewed afterwards by peer researchers on completeness and consistency
Empirical Evaluation

2. Framework utility in practice: Case studies

› Wareex
  • 2,500 employees established in 40 countries; 100,000 customers
  • Founded in 1984
  • 8 interviewees
  • Lineex: web accounting software
Empirical Evaluation

2. Framework utility in practice: Case studies

› Sionag
  • 100 employees in Europe; 22,000 licenses
  • Founded in 1985
  • 7 interviewees
  • Eropt: cow diet composition (milk) and synchronization software
Empirical Evaluation

2. Framework utility in practice: Case studies

- Ansta
  - 100 employees 3 countries; 8000 licenses
  - Founded in 1995
  - 3 interviewees
  - Adsta: drawing software for building services industry
Conclusions

The SOK definition is complete in terms of knowledge types
  ‣ No new distinct types were extracted from focus group discussions, interviews or case studies

The SOK framework is sound and useful
  ‣ Helps vendors in gaining insight and establishing a vision concerning effective SOK utilization within their organizations

SOK is rarely integrated with existing tools and processes
  ‣ SMEs initially focus on SOK acquisition and presentation
  ‣ Lack of structural SOK integration hinders effective SOK utilization
    - SOK-based decision making, prioritization
ARE YOU STILL THERE?
OK, so what? And then?

Well, we would be lousy scientists if we wouldn’t try to improve this
  • (that’s what science is about, right?)

  ‣ Product software vendors need help organizing and implementing SOK acquisition, integration and presentation processes

  ‣ We developed tools and methods to provide such help
SOK Acquisition and Presentation

SOK Acquisition
- Only triggered when end-users experience severe operation failures
- Often implemented ad-hoc and application-specific
  - Log file here, trace module there: time-consuming!

SOK Presentation
- Logs are structured inconsistently
- Logs are difficult to compare
  - Again: time-consuming

Can we reduce maintenance effort through generic acquisition and presentation of SOK?
SOK Acquisition and Presentation

Prototype Tool (Nuntia)

- Does SOK acquisition and presentation
  - Generic recording of .NET software operation
  - Visualization of behavior of (end-user on) software
The Tool

Weaving

- Method selection

- SOK assembly generation
Empirical Evaluation

Field study of tool involving 3 frequently-used software packages
- Paint.NET (Windows Forms), 2 million downloads as of May, 2006
- Stabiplan StabiBASE Web (WPF), > 300 customers
- Exact Online (ASP.NET), 12,500 customers

Discussions with Ansta software engineers regarding tool functionality and utility

Expert focus group discussions regarding technique utility
  - Questionnaire was used as a basis for discussions
Empirical Evaluation

Paint.NET 3.35 vs. 3.36

- 3.35 contains ‘fixed ratio selection bug’, fixed in 3.36
Empirical Evaluation

Paint.NET 3.35 vs. 3.36

- 3.35 contains ‘fixed ratio selection bug’, fixed in 3.36
Empirical Evaluation

StabiBASE Web

- Replaced original assembly with SOK assembly at five end-users
- “Use the software just like normal”
- Unknown bug was revealed
  - ~12% of calls to getFullPath resulted in an exception
Cool. So all vendors are using this?

Well, kind of.

- Many software vendors that do acquire SOK, … just acquire it.
  - Very limited or no data mining and analysis
  - No people responsible
- No integration with existing processes (and associated tools)
  - No protocols or workflows to involve and integrate acquired data

How can product software processes be improved through acquired knowledge of in-the-field software operation?
SOK Integration Template Method

The method is designed to guide vendors in:

- Identification of relevant and valuable operation information
- Analysis of integration environment and target processes
- Integration of selected information in, as well as adaption of, target processes
- Presentation of integrated operation information

We assume that both the **software operation information** as well as one or more **target process** concepts are accessible and available for integration, before instantiating the method.
Analyze target process
Identify operation information demands
Select relevant operation information

Determine SOK integration objectives
Identify SOK actors
Estimate SOK utilization frequency
Determine operation information carriers
Identify integration requirements

Integrate operation information
Evaluate integration results

[else] (integration objectives met)

TARGET PROCESS
1..* makes use of, participates in
1..* utilizes, demands

ACTOR
1 has
1..* involves

INTEGRATION OBJECTIVE
1..* integrates with

SOFTWARE OPERATION INFORMATION

INTEGRATION CAPACITY
1..* involves

INTEGRATION REQUIREMENT
1..*

INTEGRATION EVALUATION
1..* involves

DEMAND

FREQUENCY

involves

is utilized with

involves

displays, visualizes

involves

1..*
Information selection

- Analyze target process
- Identify operation information demands
- Select relevant operation information

Integration requirements identification

- Determine SOK integration objectives
- Identify SOK actors
- Estimate SOK utilization frequency
- Determine operation information carriers
- Identify integration requirements

TARGET PROCESS

- makes use of, participates in
- utilizes, demands
- evaluates

ACTOR

- has

INTEGRATION OBJECTIVE

- has

INTEGRATION CAPACITY

INTEGRATION OBJECTIVE

INTEGRATION CAPACITY

INTEGRATION REQUIREMENT
Information integration

Integrate operation information

Evaluate integration results

[else]

[integration objectives met]

[\text{TARGET PROCESS}]

\text{ACT}

\text{SOFTWARE OPERATION}

INFORMATION

Integrate operation information

Identify operation information demands

Select relevant operation information

Evaluate integration results

\text{INTEGRATION OBJECTIVE}

\text{INTEGRATION CAPACITY}

\text{INTEGRATION REQUIREMENT}

INTEGRATION EVALUATION
SOK Integration Template Method

Method Instantiation

- Template method
  - Prescriptive: what, not (or little) how
    - Precise activities will differ in each situation
  - A new method instance can (and should) be created when needed
    - Each with corresponding activity and concept instantiations
  - Typically applied iteratively, continuously, and potentially in parallel with other method instantiations
Empirical Evaluation

Action Research at Stabiplan

- Research is performed on-site
- Errata Garden
  - Error report mining and -analysis tool
  - Provides really valuable operation information, such as
    - Error cause modules, cause locations (code file name and number)
    - Customer-specific error report (history) view
    - Top crashes
Aggregated, unsolved submissions received at least 10 times

- Only show submissions from release builds

<table>
<thead>
<tr>
<th>Occurrence</th>
<th>Source</th>
<th>Module</th>
<th>Location</th>
<th>Version</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>270</td>
<td>StabiCAD</td>
<td>ESULSymbolInserter.dll</td>
<td>ObjectEventListener.cpp:198</td>
<td>8.21</td>
<td></td>
</tr>
<tr>
<td>260</td>
<td>StabiCAD</td>
<td></td>
<td>cadfunction.cpp:269</td>
<td>8.23</td>
<td></td>
</tr>
<tr>
<td>105</td>
<td>StabiCAD</td>
<td></td>
<td>dmojbjectIndex.cpp:271</td>
<td>8.21</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>icad</td>
<td></td>
<td>001b:00440a30</td>
<td>8.23</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>StabiCAD</td>
<td>SCBLHint.dll</td>
<td>HintHandlerManager.cpp:691</td>
<td>8.23</td>
<td></td>
</tr>
<tr>
<td>98</td>
<td>StabiCAD</td>
<td></td>
<td>Startup.cpp:1116</td>
<td>8.21</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>StabiCAD</td>
<td>CADEngine.DLL</td>
<td>CEDL.cpp:257</td>
<td>8.23</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>StabiCAD</td>
<td>ELULSymbolUtils.dll</td>
<td>cadfunction.cpp:143</td>
<td>8.23</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>StabiCAD</td>
<td></td>
<td>001b:7c7e2afb</td>
<td>8.19</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>icad</td>
<td></td>
<td>cadfunction.cpp:352</td>
<td>8.21</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>StabiCAD</td>
<td></td>
<td></td>
<td>8.23</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>StabiCAD</td>
<td>DMCadULCommandsMain.cpp:215</td>
<td></td>
<td>8.21</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>StabiCAD</td>
<td></td>
<td>001b:00000000</td>
<td>8.21</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>icad</td>
<td></td>
<td>dmojbjectIndex.cpp:306</td>
<td>8.21</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>StabiCAD</td>
<td>DMBLCADInterface.dll</td>
<td>dmojbjectIndex.cpp:305</td>
<td>8.23</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>StabiCAD</td>
<td></td>
<td>Layout.cpp:108</td>
<td>8.21</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>icad</td>
<td></td>
<td></td>
<td>8.21</td>
<td></td>
</tr>
</tbody>
</table>
## Customerize: Stabiplan BV

**Customer Details**
- Submissions: 1707
- Sources: 78.108.136.225
- Licenses: L800017 L802097 L802617 N800446 L801512
- First submission: 2-11-2009
- Latest submission: 7-9-2010

**End-user Comments**
- 8:05:23: ab: Als je bij het wijzigen van de hoogte de lijn van hulpvrije aanwijst krijg je deze error
- 8:04:29: ab: Ik was bezig met wijzig hoogte in TR binnen een hulpvrije op een complete straang van een verder
- 31-8-2010: Administrator: Ik was bezig met pijlen in lucht

### Submissions — 1-8 / 1707 (41 + 4 + 1660 + 2; 291 + 1416)

<table>
<thead>
<tr>
<th>Who</th>
<th>When</th>
<th>What</th>
<th>What Details</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12:47:55</td>
<td>AL_ERR_COMBO at STL Various.dll (ImportEx.cpp 118) because of STL Various.dll (Various.cpp:281)</td>
<td></td>
<td>8.26.0.7163</td>
</tr>
<tr>
<td></td>
<td>11:27:46</td>
<td>AL_ERR_ISNOTNULL</td>
<td></td>
<td>8.26.0.7163</td>
</tr>
<tr>
<td></td>
<td>08:05:23</td>
<td>AL_ERR_ISNOTNULL</td>
<td></td>
<td>8.26.0.7147</td>
</tr>
<tr>
<td></td>
<td>08:04:29</td>
<td>AL_ERR_ISNOTNULL</td>
<td></td>
<td>8.26.0.7147</td>
</tr>
<tr>
<td></td>
<td>Yesterday</td>
<td>Access Violation (0xc0000005) at 001b:02eb6fd0</td>
<td></td>
<td>8.26.0.7163</td>
</tr>
</tbody>
</table>

*Ik was bezig met wijzig hoogte in TR binnen een hulpvrije op een complete straang van een verdeler*
Empirical Evaluation

Action Research at Stabiplan

› However, had questions like
  • How do we make people use this information?
    - As effectively as possible: How do we prevent productivity to be decreased by EG monitoring?
  • How frequently should Errata Garden reports be monitored?
  • Who is responsible?
› ..or actually
  • How can information provided by Errata Garden be effectively integrated with our product software processes?
Empirical Evaluation

Action Research at Stabiplan

- Template method was instantiated
  - with product software processes implemented in the vendor’s organization
  - to integrate information acquired by Errata Garden
  - to improve Stabiplan’s product software processes

- Based on observations and interviews, lessons learned are identified
  - What should a vendor do to effectively involve such information in its product software processes?
  - What should it absolutely not do? What are considered pitfalls?

- Interviews sessions are almost completed
Current and Future Work

Vestigia: ‘How do end-users actually use our software?’

What is the value of end-user comments? How are they interpreted? What type of comments is considered the most valuable for vendors?
‘Society is our Lab’

So, how do you guys actually get inside these software companies?
Software Operation Knowledge Workgroup

Characteristics

- 1 of the Software~VOC workgroups
- ~12 members
- 2 meetings per year
  - Initially hosted by UU (‘Beleidslaboratorium’), now hosted by members
- 5th meeting at the end of 2010

Goals

- Meeting
- Discussion
- Knowledge building, -sharing
  - Experiences, best practices
Software Operation Knowledge Workgroup
Software Operation Knowledge Workgroup
Software Operation Knowledge Workgroup
Discussion and Questions

Academia:
My God ... this will mean a half-dozen papers, a thesis or two, and a paragraph in every textbook on queuing theory!

Business:
You got the program to stop jamming up? Great. While you're fixing stuff, can you get Outlook to sync with our new phones?
The End

Henk van der Schuur, MSc.

hw.schuur@cs.uu.nl

http://hwschuur.nl/