Extracting Software Security Concerns of Problem Frames Based on A Mapping Study

Shuhui Wu
Cheng Zhang
Futian Wang
A problem frame is a kind of pattern, it defines an identifiable problem class in terms of its context and the characteristics of its domains, interfaces, and requirements[1]. And it consists of frame diagrams, domain characteristics and framework concerns[2].

Concern is one aspect of the problem that developers need to attention[2].

The Medical Information System (MIS) is associated with an access control list (ACL). Patient records are related to the ACL, allowing record, access, and modify for clinicians not on the ACL. The MIS system prevents access for clinicians not on the ACL. The process of diagnosing patients is also represented in the diagram.
Is there any authority

Ensure access at any time

Access Control List (ACL)

Monitor (MON)

Clinician (CL)

Message (NW)

Patient Record (PR)

Display the records correctly

Display Patient Records

Patient Record Display (PRD)

Background (4/7) —— The Problem Context Diagram
Software requirement analysis

- Functional requirements
- Non-functional requirements
  - Security
  - Reliability
  - Accessibility
  - ...

Concerns:
- Concern 1
- Concern 2
- Concern 3

Security

- Index 1
  - Concern 1
  - Concern 2
- Index 2
  - Concern 3
- Index 3
  - Concern 4
  - Concern 5
RQ1: Whether the three security indexes can provide a good support for software security requirements and what are the security concerns of software security indexes?

RQ2: How to match security concerns correctly based on Problem Frames approach?
METHOD
A systematic mapping study provides a structure of the type of research reports and results that have been published by categorizing them and often gives a visual summary, the map, of its results[4].

Method (3/4) —— Primary Study

Step One: Collecting Papers
   ① electronic search
   ② manual search
   ③ snowball search

Step Two: Protocol

Step Three: Collating Papers
   ① annotation information
   ② classification indexes

Step Four: Reading Literature

Step Five: Get Conclusion
Method(4/4) —— The Extraction Process of Concerns

1. Keyword
2. Mapping Study
3. Conformity with Retention Criteria
   - Y: Extract Concerns
   - N: Delete Articles
4. Contains Security Concerns
   - Y: Extract Concerns
   - N: Delete Articles
5. Sum Up Concerns
6. Match Index
3 RESULTS & ANALYSIS
Results & Analysis

The Result of Mapping Study

Electronic search: 406
Title/abstract inclusion: 287
Journal inclusion: 263
Security indexes: 184
Security concerns: 18
RQ1: Whether the three security indexes can provide a good support for software security requirements and what are the security concerns of software security indexes?
We divided 184 articles with security indexes, the quantity of each index is as follows:

- Confidentiality: 109
- Integrity: 58
- Availability: 53
- Non-repudiation: 9
- Accountability: 7
- Others: 3
ISO/IEC 25010-2011[5] defines the five security indexes of security requirement including Confidentiality, Integrity, Non-repudiation, Accountability and Authenticity, the Golden Triangle Framework (CIA model), and it includes three core sub-properties: Confidentiality, Integrity and Availability.

Confidentiality, Integrity and Availability are the core principles of information security and are used in many areas[6].

The basic attributes of information security are confidentiality, integrity and availability[7].
<table>
<thead>
<tr>
<th>Security Concerns</th>
<th>A description of the security concerns</th>
<th>Representative literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authentication Concern</td>
<td>Authentication is the process that the system verifies the identities of visitors before sharing information with them.</td>
<td>[6][7][8][9][10][11][12][13][14][15]</td>
</tr>
<tr>
<td>Access Control Concern</td>
<td>Access Control is to limit access to the system resources only if the user has been authorized.</td>
<td>[7][9][11][13][15][16][17][18][19]</td>
</tr>
<tr>
<td>Information Encryption Concern</td>
<td>Data integrity is vulnerable to a variety of attacks, then we encrypt the information in order to prevent unauthorized users from stealing and tampering.</td>
<td>[20][21][14][15][16][17][18][19]</td>
</tr>
<tr>
<td>Storage Log Concern</td>
<td>We back up the data into the log.</td>
<td>[21][23]</td>
</tr>
</tbody>
</table>
RQ2: How to match security concerns correctly based on Problem Frames approach?
Results & Analysis (8/9) —— Security Concerns combine with Problem Frames

The Problem Frame Diagram

- Machine Domain
- Problem Domain
- Causal Domain
- Biddable Domain
- Lexical Domain

Security Concerns

apply
A Description of The Security Concerns

<table>
<thead>
<tr>
<th>Focus on whether the biddable domain has access competence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus on access authorize to machine domain and problem domain</td>
</tr>
<tr>
<td>Focus on unauthorized users tamper or forge the information to lexical domain or interface</td>
</tr>
<tr>
<td>Focus on authorizing users to access information</td>
</tr>
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REFERENCES
References


Thank you