Second Committee Meeting

Updated Progress Report

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McMaster University

Fall 2025

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Introduction

Where Were We?

- We wanted to generate test cases in **Drasil**, our software artifact generation framework
  - Started writing test cases manually

Introduction

Where Were We?

- We wanted to generate test cases in **Drasil**, our software artifact generation framework
  - Started writing test cases manually
  - We stopped to understand software testing to follow existing standards
- What happened?
  - The domain of software testing is *much* larger than we expected
  - Software testing terminology and standards are *not* standardized

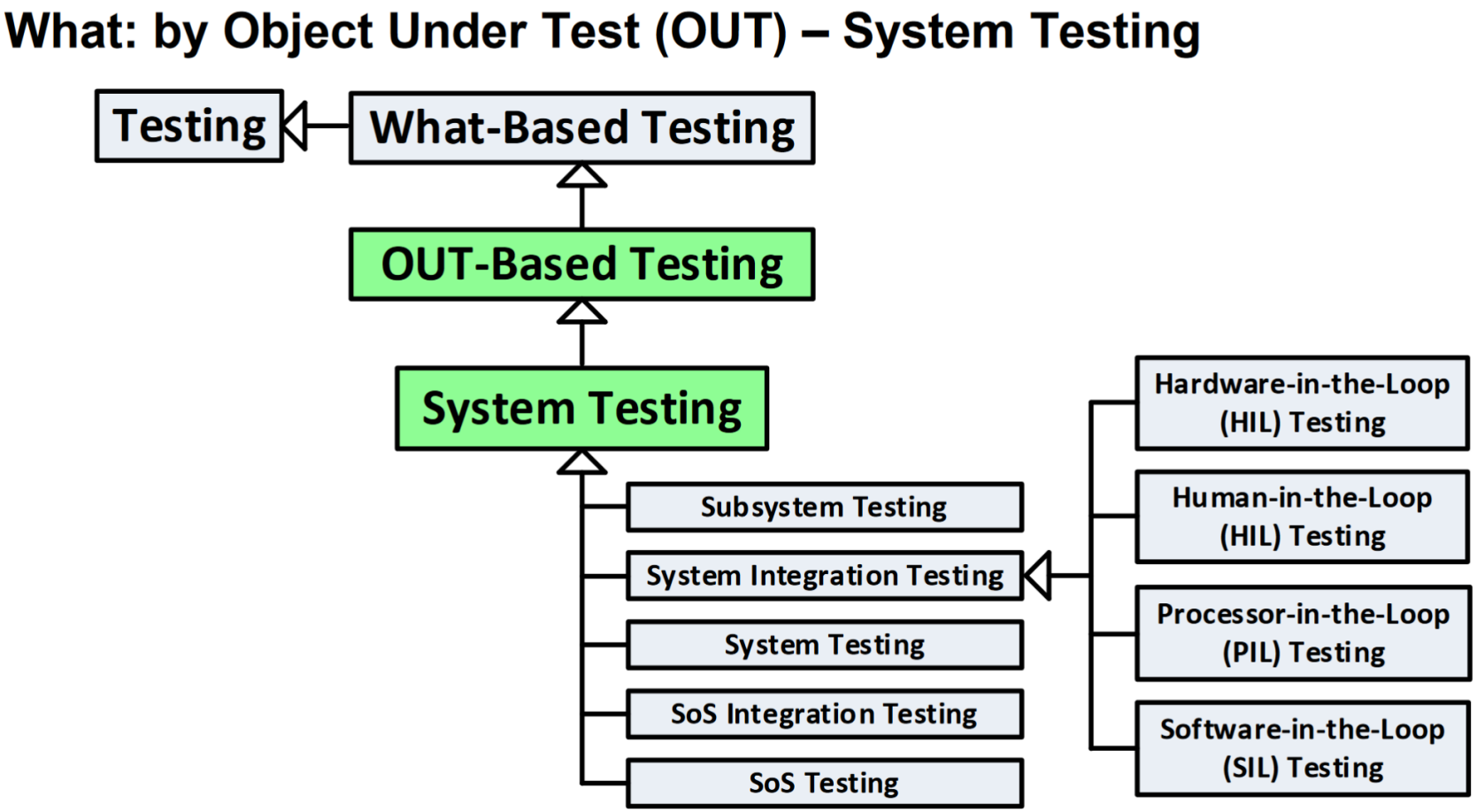
Introduction

Existing Taxonomies?

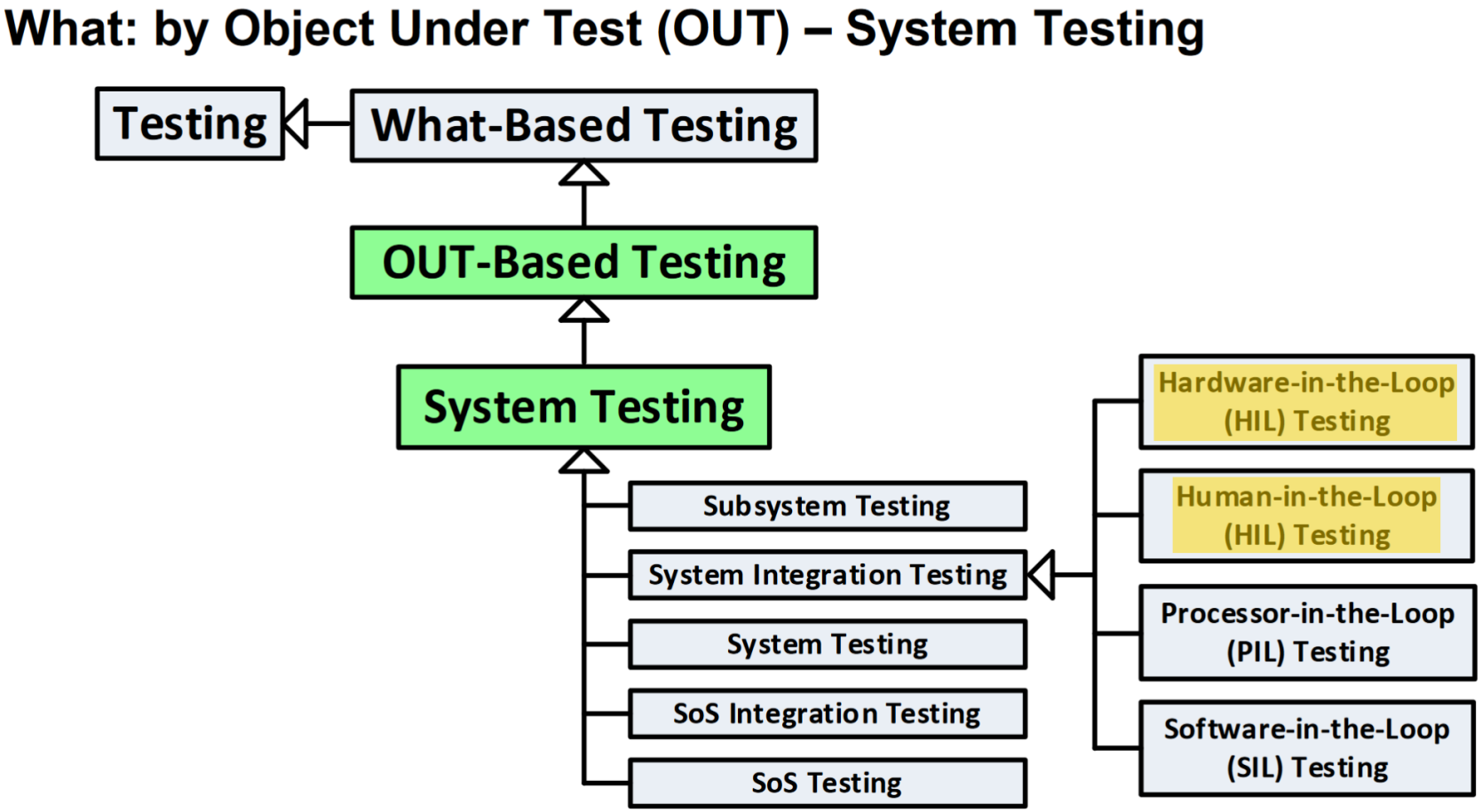
- Existing software testing taxonomies:
  - Tebes et al. (2020)
  - Souza et al. (2017)
  - Firesmith (2015)
  - Unterkalmsteiner et al. (2014)

Focus on:

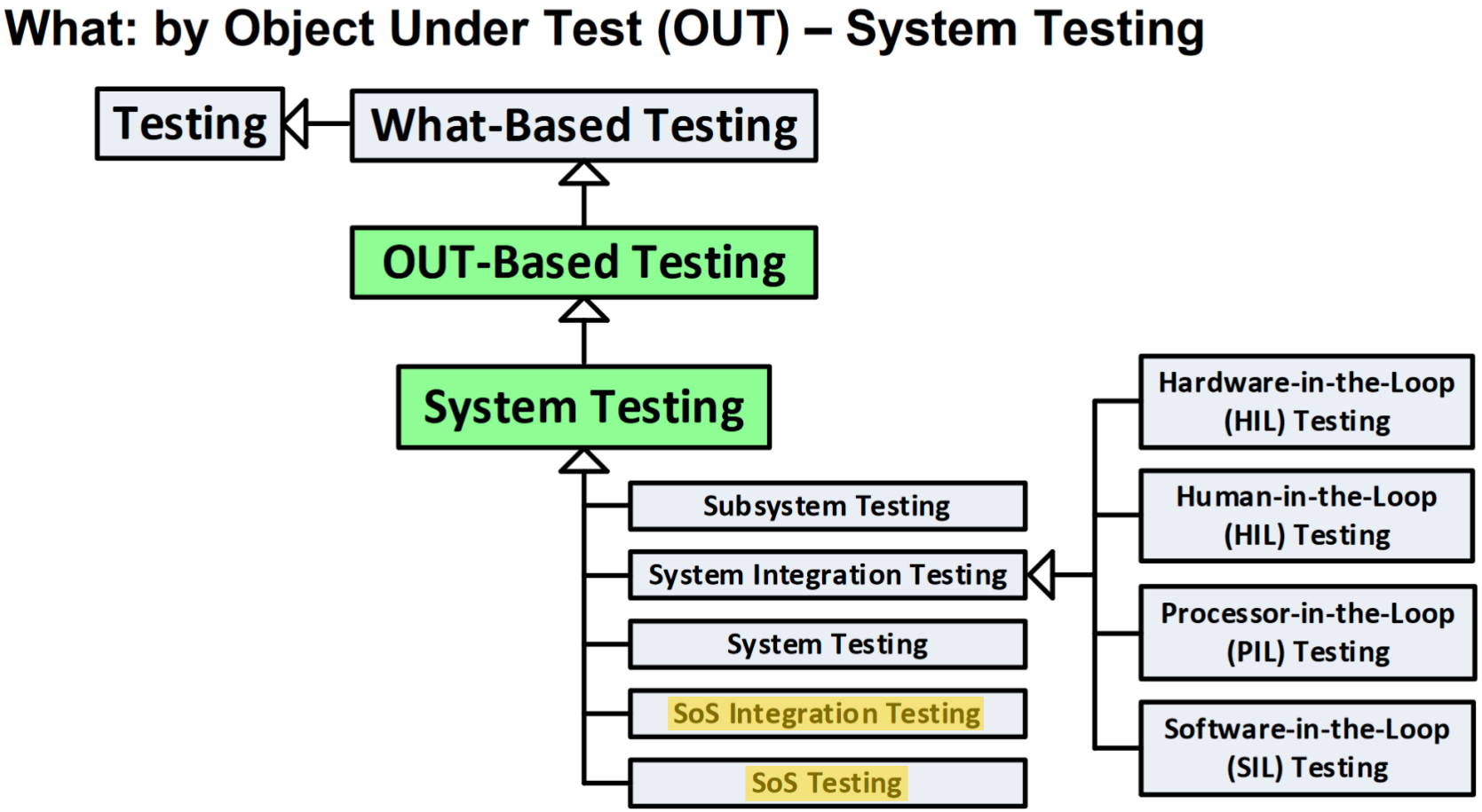
The Testing Process
Organizing Terminology
Relations between Approaches
Traceability between Stages



(Firesmith, 2015, p. 23)



Adapted from (Firesmith, 2015, p. 23)



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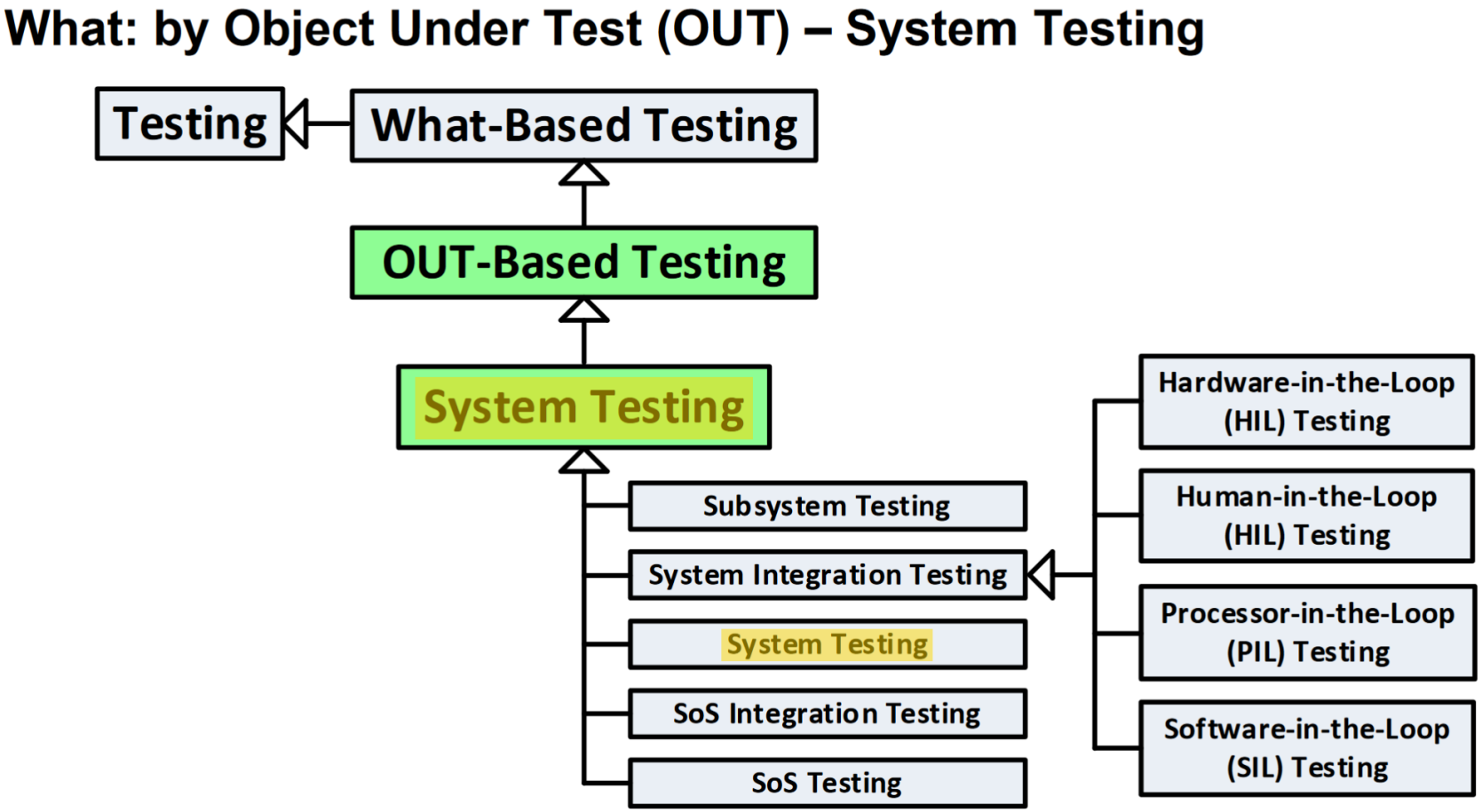
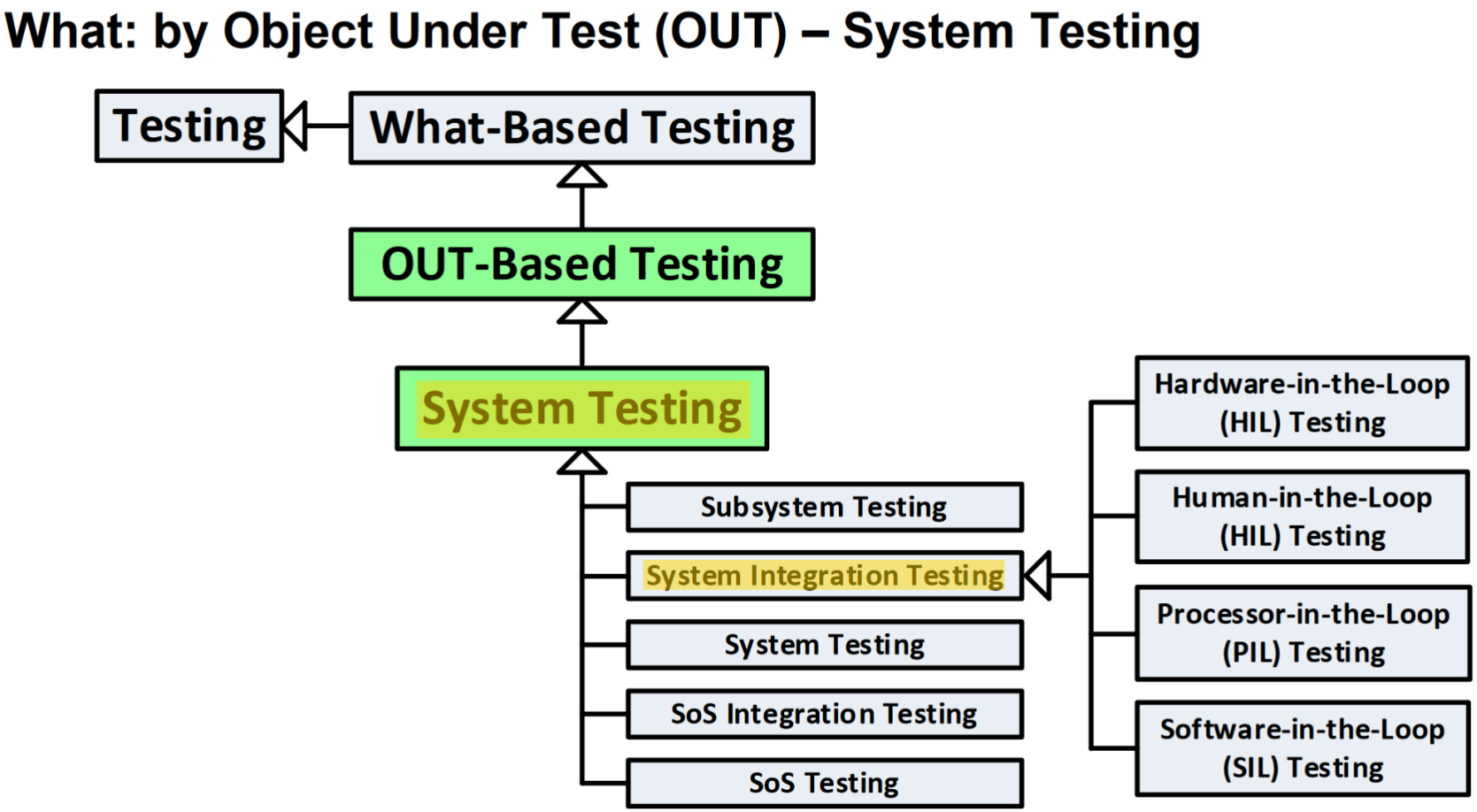


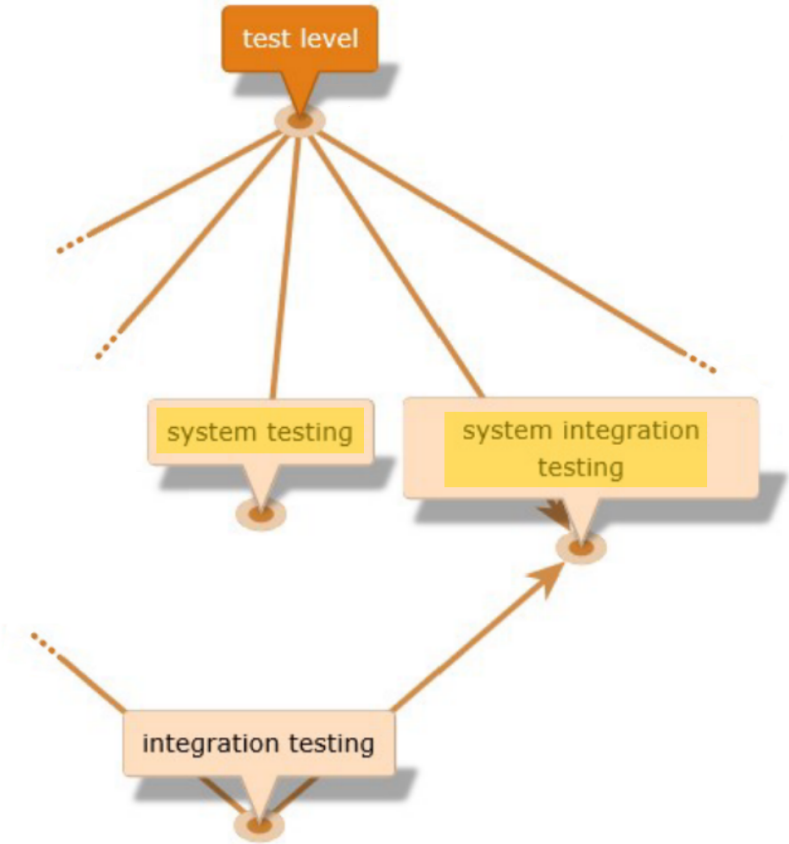
Adapted from (Firesmith, 2015, p. 23)



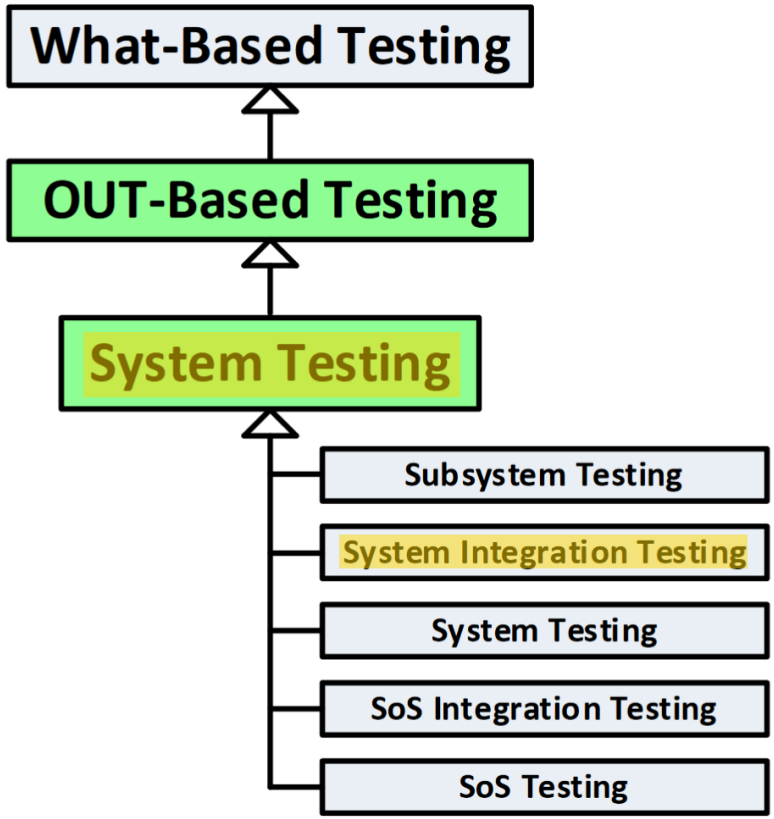
Adapted from (Firesmith, 2015, p. 23)

Introduction

Existing Taxonomies?



Adapted from (Hamburg and Mogyorodi, 2024)



Adapted from (Firesmith, 2015, p. 23)

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Research Questions

Research Question 1

What test approaches do the literature describe?

Research Question 2

Are these descriptions consistent?

Research Question 3

Can we systematically resolve any of these inconsistencies?

Research Question 1

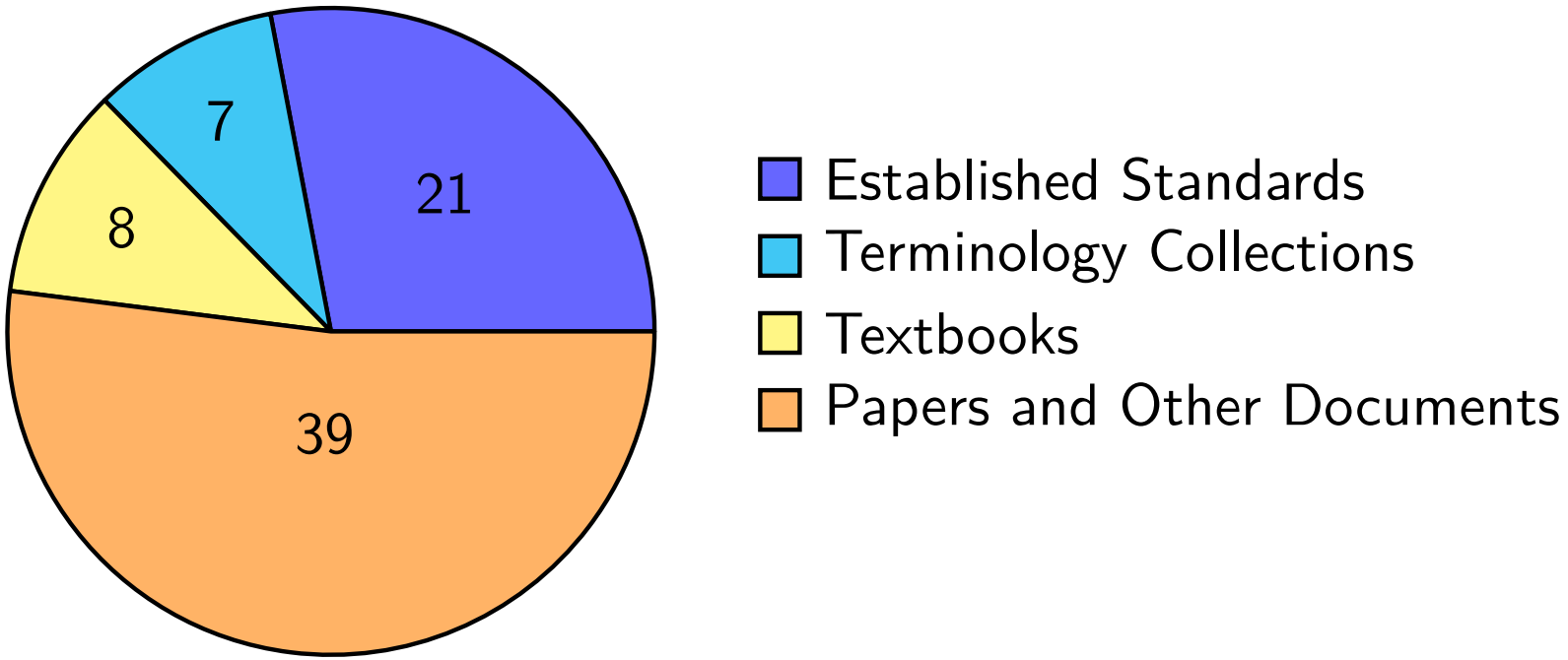
What test approaches do the literature describe?

1. Identify authoritative sources on software testing
2. Identify all test approaches and testing-related terms
3. Record data for these terms; test approach data are comprised of:
   1. Names
   2. Categories
   3. Definitions
   4. Synonyms
   5. Parents
   6. Flaws
4. Repeat steps 1 to 3 for any missing or unclear terms

Methodology

Sources

In total, we investigate 75 sources

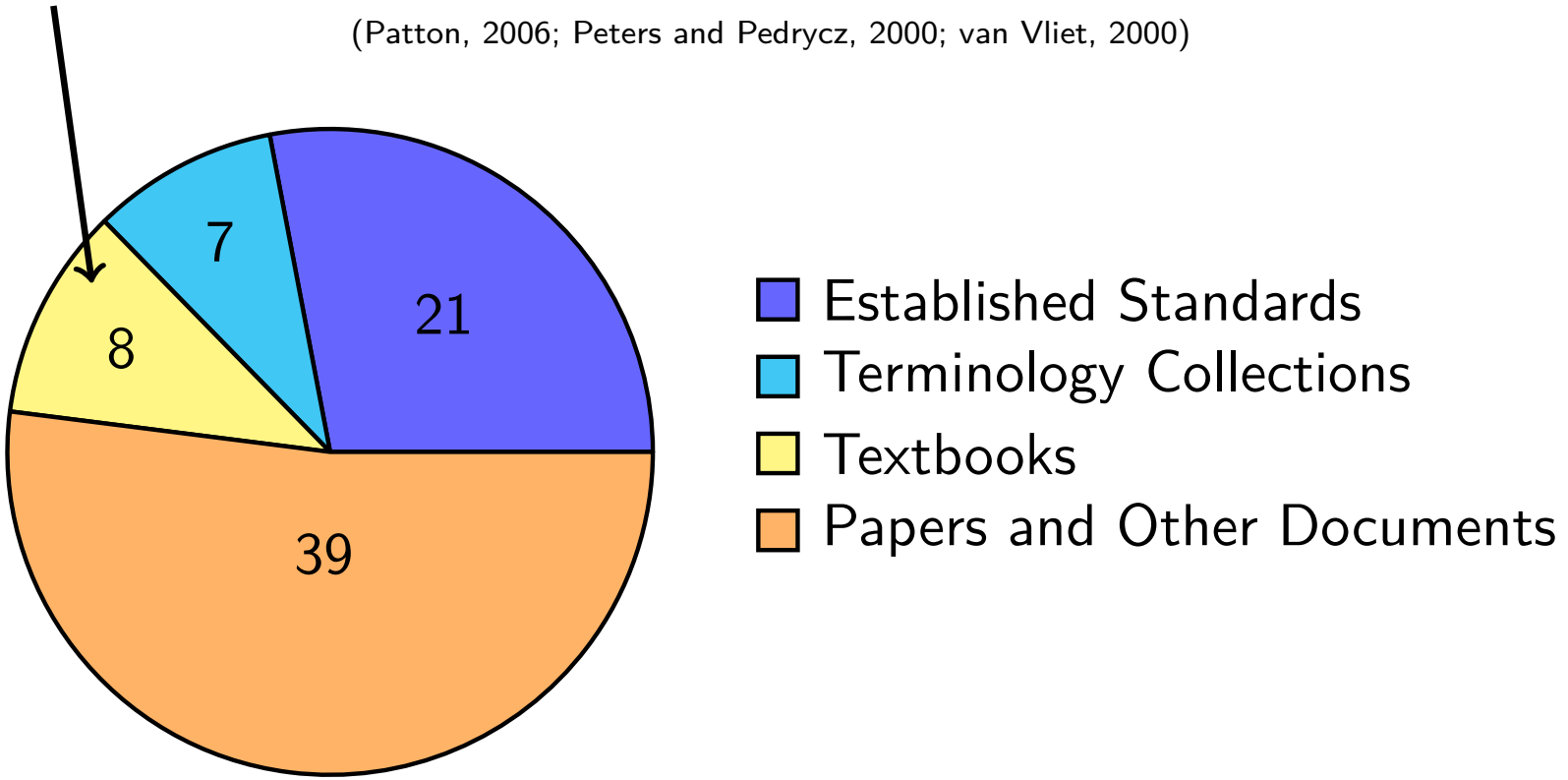


Methodology

Sources

Textbooks used at McMaster were our ad hoc starting points

(Patton, 2006; Peters and Pedrycz, 2000; van Vliet, 2000)



- We build a glossary with a row for each test approach

Name	Category	Definition	Parent(s)	Synonym(s)
A/B Testing	Practice (Fig. 2)	Testing "that allows testers to determine which of two systems or components performs better" (pp. 1, 36)	Statistical Testing (pp. 1, 36), ...	Split-Run Testing (pp. 1, 36)

Information from (ISO/IEC and IEEE, 2022)

- We gather this information from sources by looking for:
  - Glossaries, taxonomies, hierarchies, etc.
  - Testing-related terms
  - Terms described *by* other approaches
  - Terms that *imply* other approaches

Research Question 2

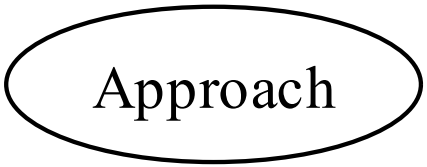
Are these descriptions consistent?

5. Automatically analyze recorded test approach data
    1. Visualize approach relations
    2. Detect certain classes of flaws
    3. Analyze manually recorded flaws from step 3.6
6. Report results of flaw analysis

Research Question 3

Can we systematically resolve any of these inconsistencies?

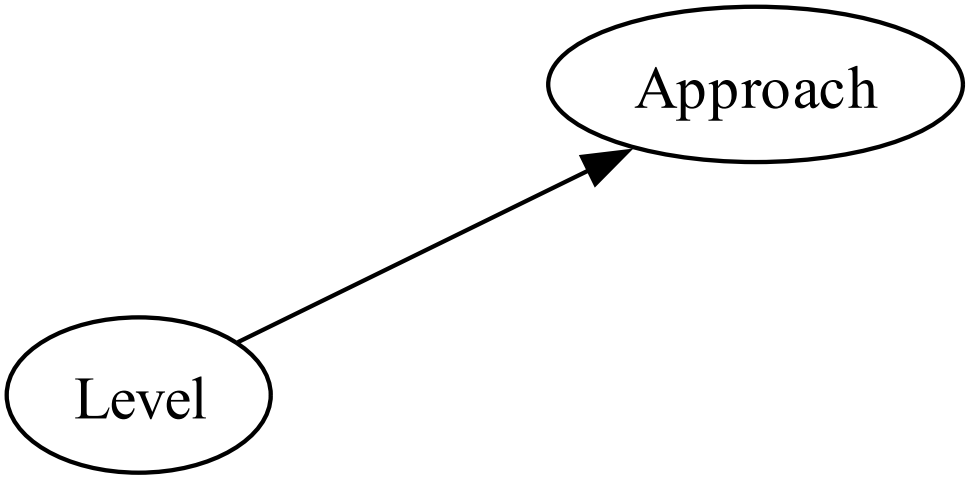
7. Provide examples of how to resolve these flaws



Approach: a "high-level test implementation choice" (ISO/IEC and IEEE, 2022, p. 10) used to "pick the particular test case values" (2017, p. 465)

Methodology

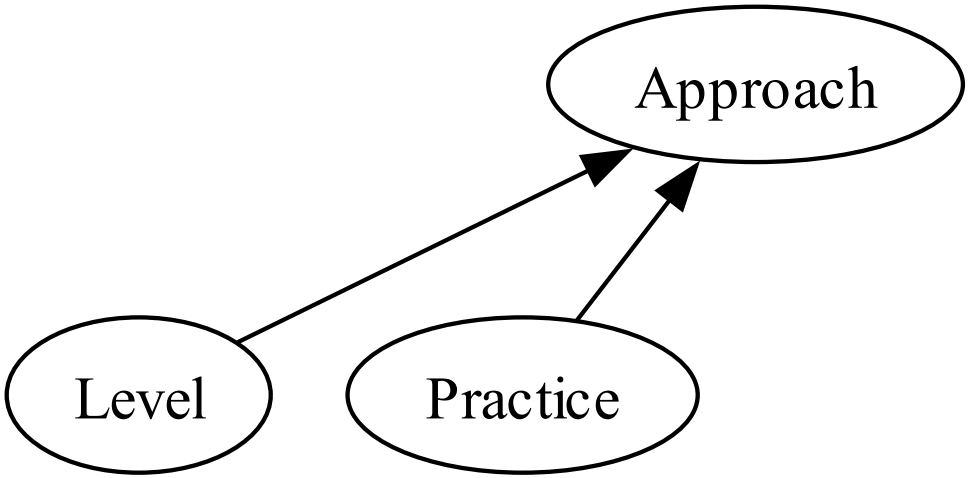
Categories



Level: a stage of testing with "particular objectives and . . . risks", each performed in sequence (ISO/IEC and IEEE, 2022, p. 12; 2021a, p. 6; 2021c, p. 6)

Methodology

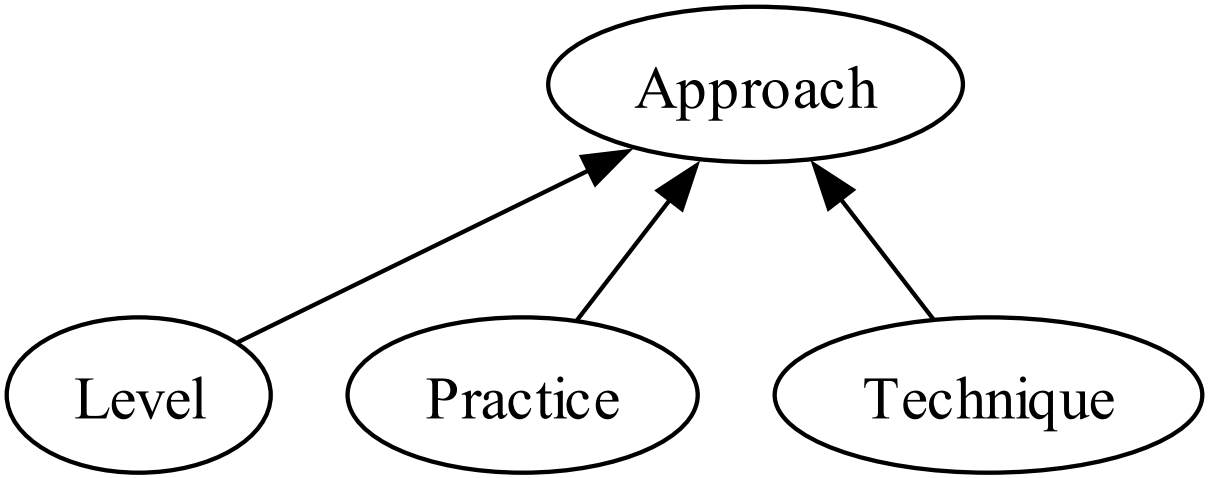
Categories



Practice: a "conceptual framework that can be applied to . . . [a] test process to facilitate testing" (ISO/IEC and IEEE, 2022, p. 14; 2017, p. 471)

Methodology

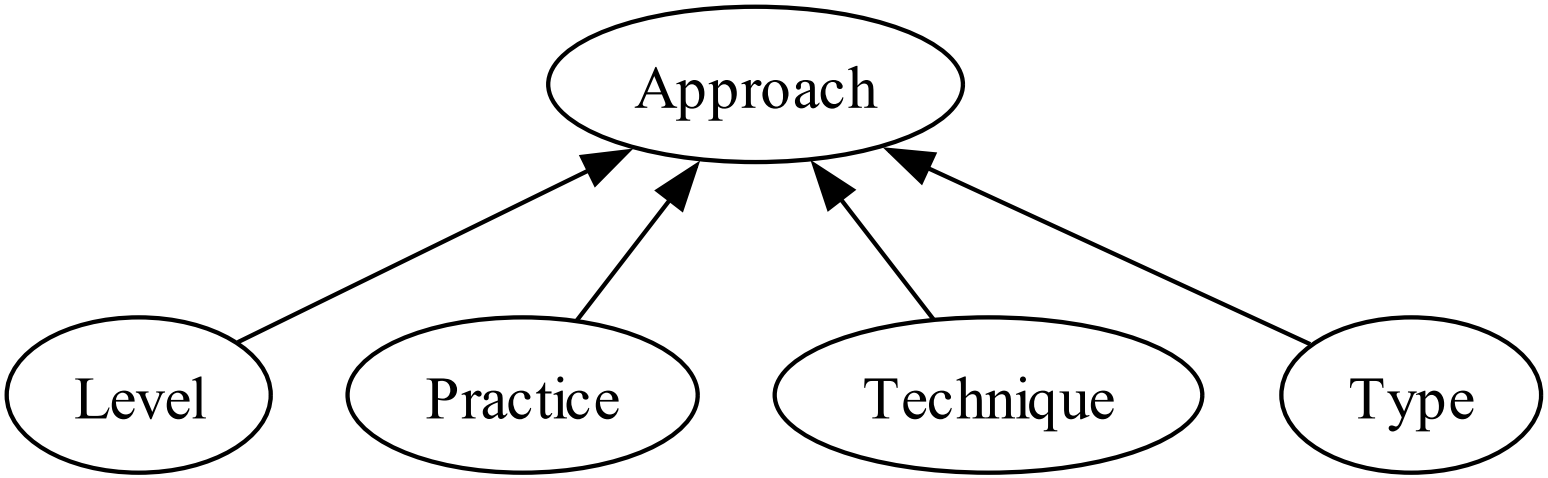
Categories



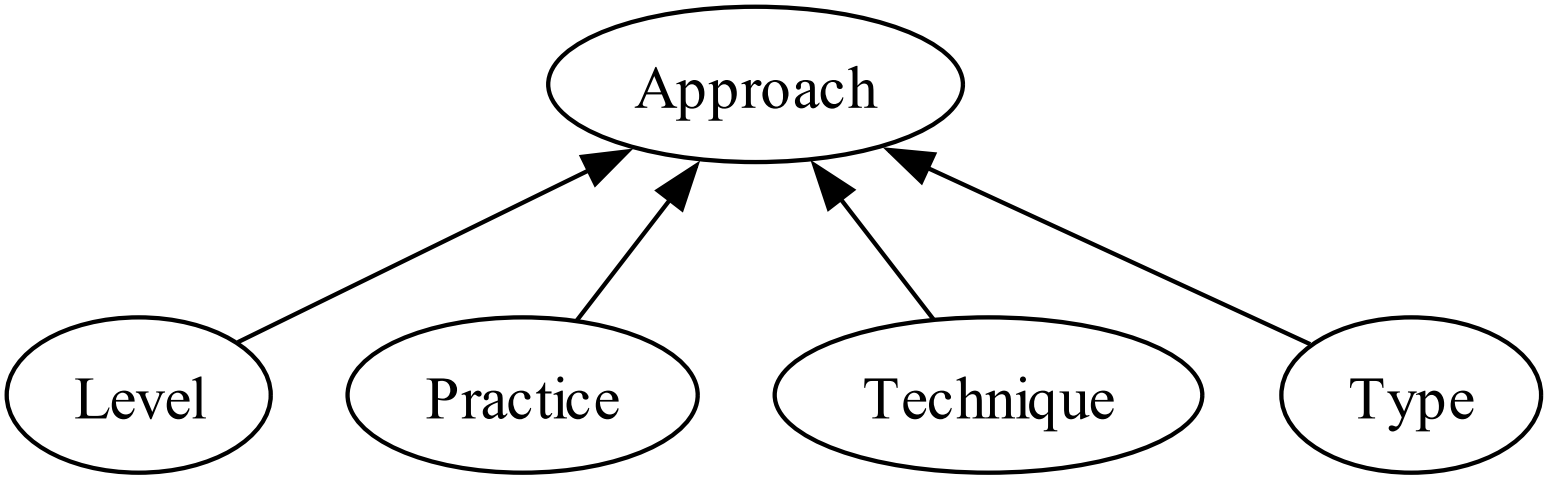
Technique: a "procedure used to create or select a test model, identify test coverage items, and derive corresponding test cases" (2022, p. 11; 2021a, p. 5; similar in 2017, p. 467)

Methodology

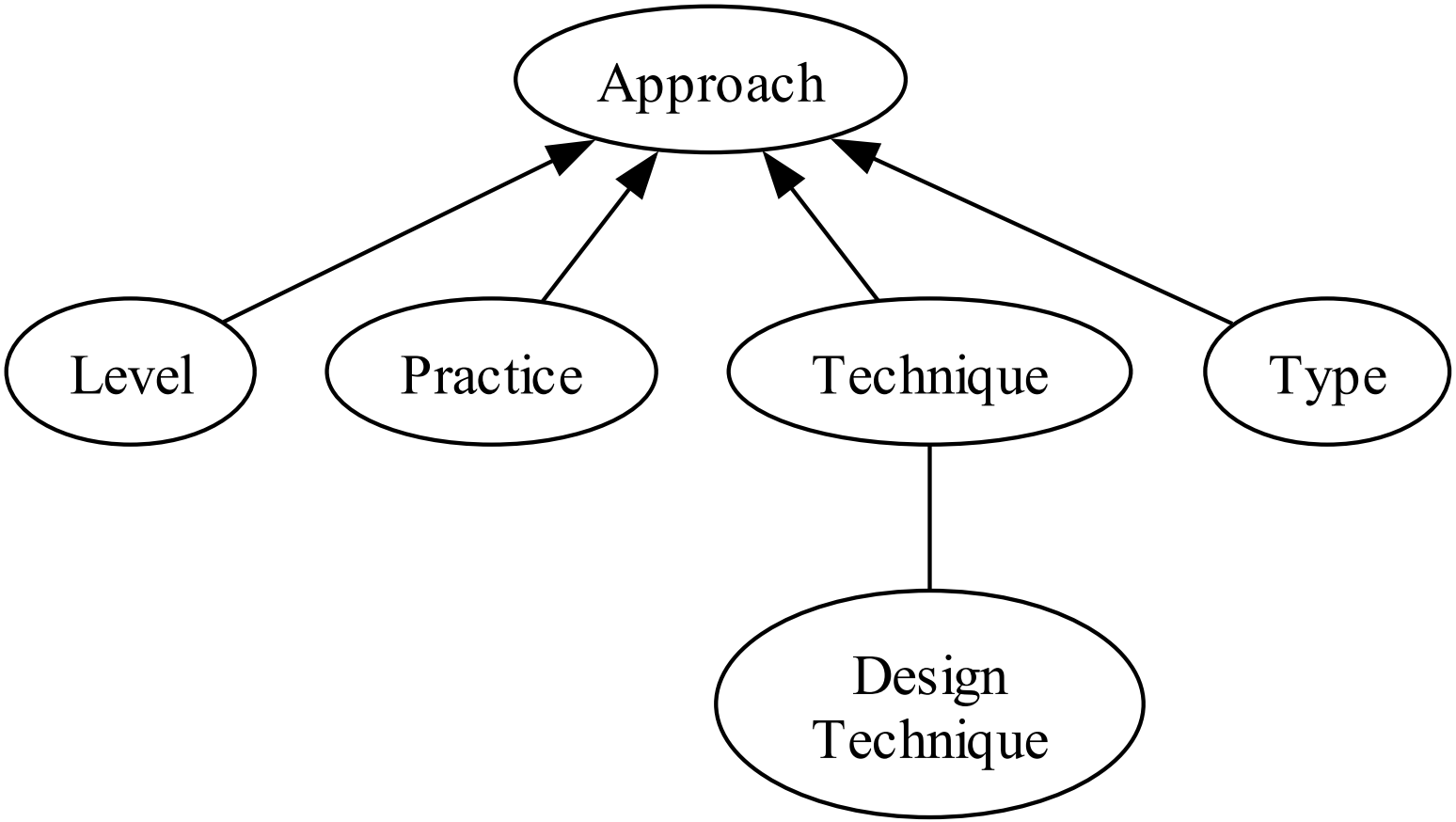
Categories



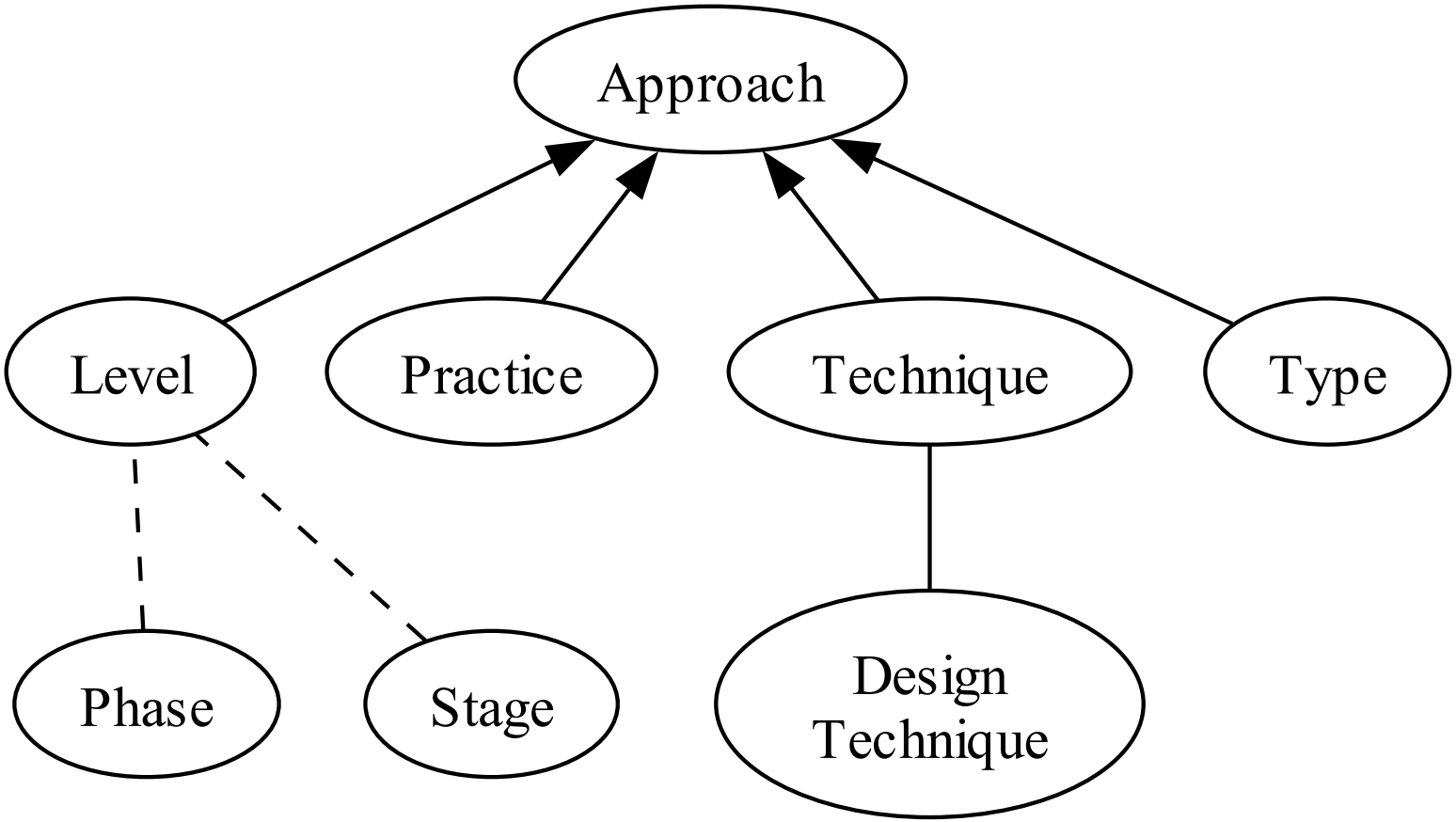
Type: "testing that is focused on specific quality characteristics" (ISO/IEC and IEEE, 2022, p. 15; 2021c, p. 7; 2017, p. 473)



Arrows point from a *child* node to a *parent* node.



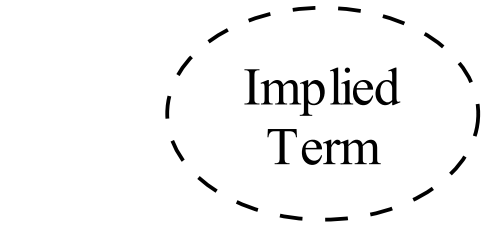
Lines without arrowheads connect *synonyms*.



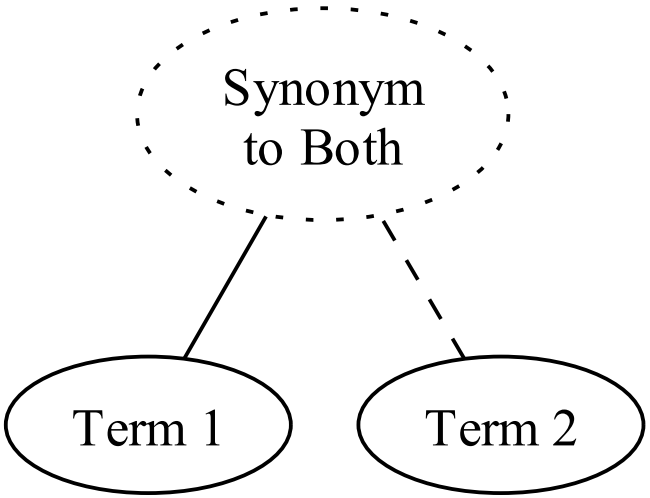
Dashed lines indicate a relationship is *implicit*.

Methodology

Visualization Notation



Dashed outlines indicate a term is *implicit*.



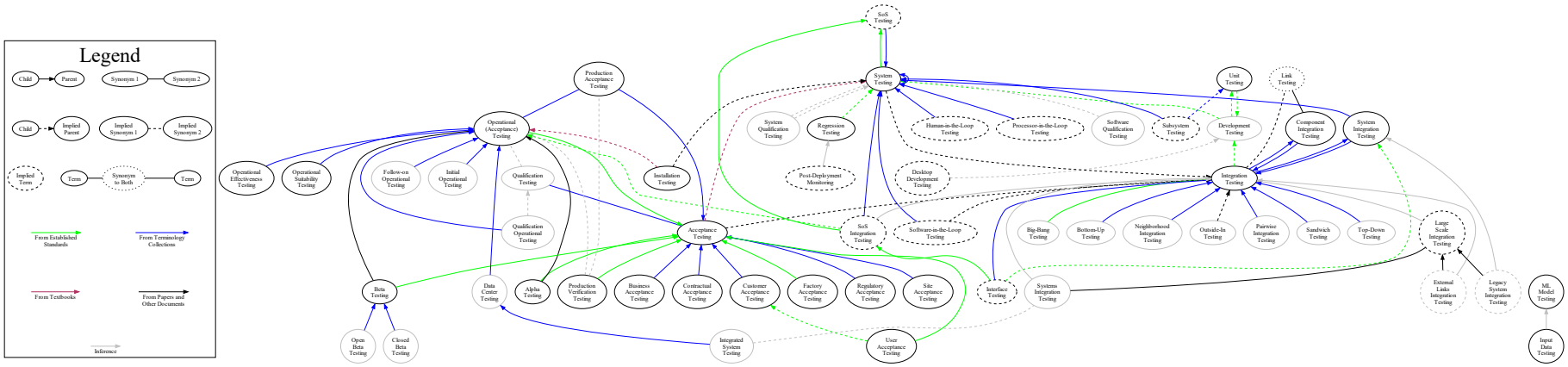
Dotted outlines indicate a term is a *synonym* to more than one term.

Visualization of Test Approaches

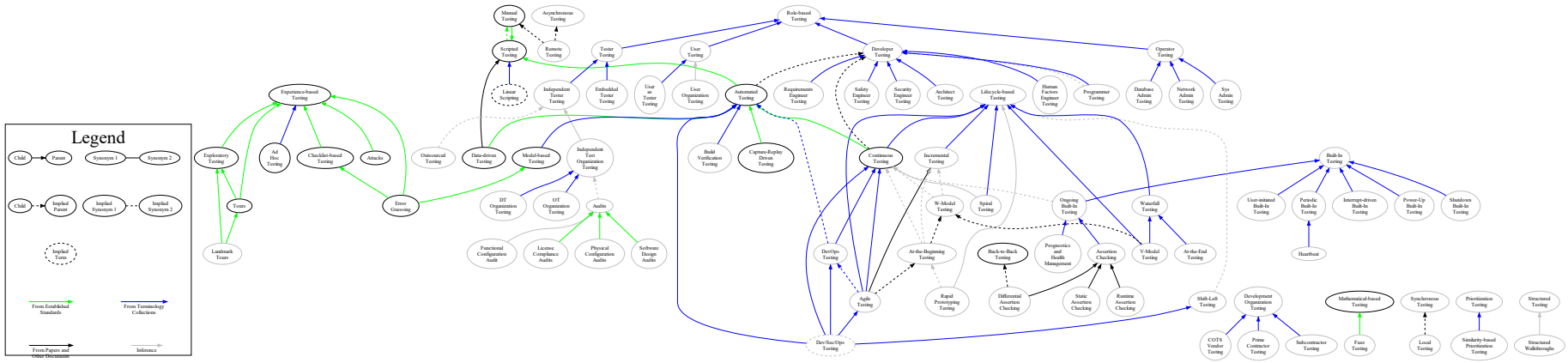
Visualization of Test Approaches

```
!  Dimension too large.
```

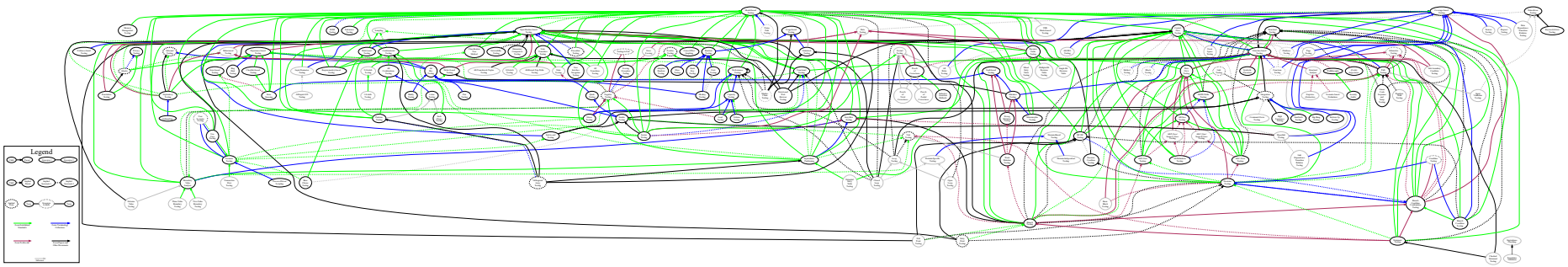
Visualization of Test Levels



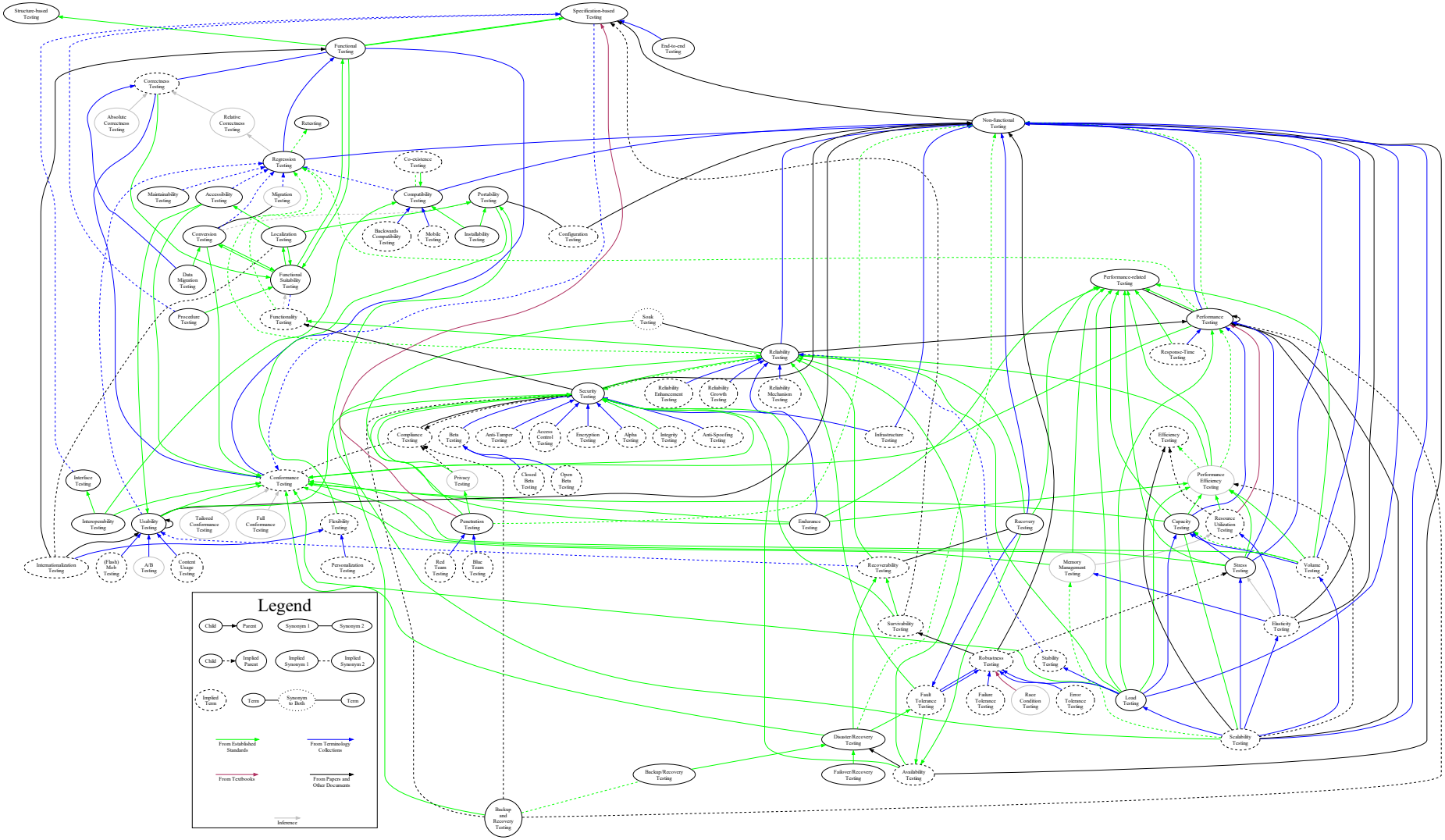
Visualization of Test Practices



Visualization of Test Techniques



Visualization of Test Types



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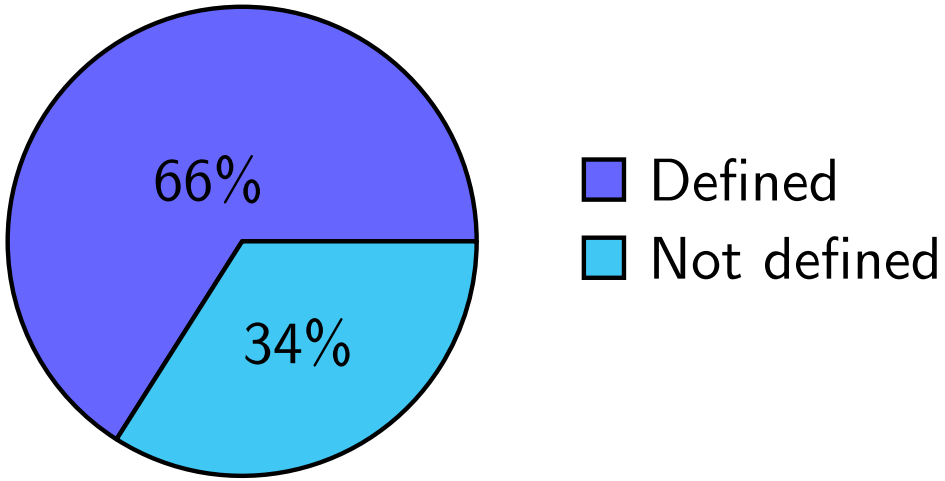
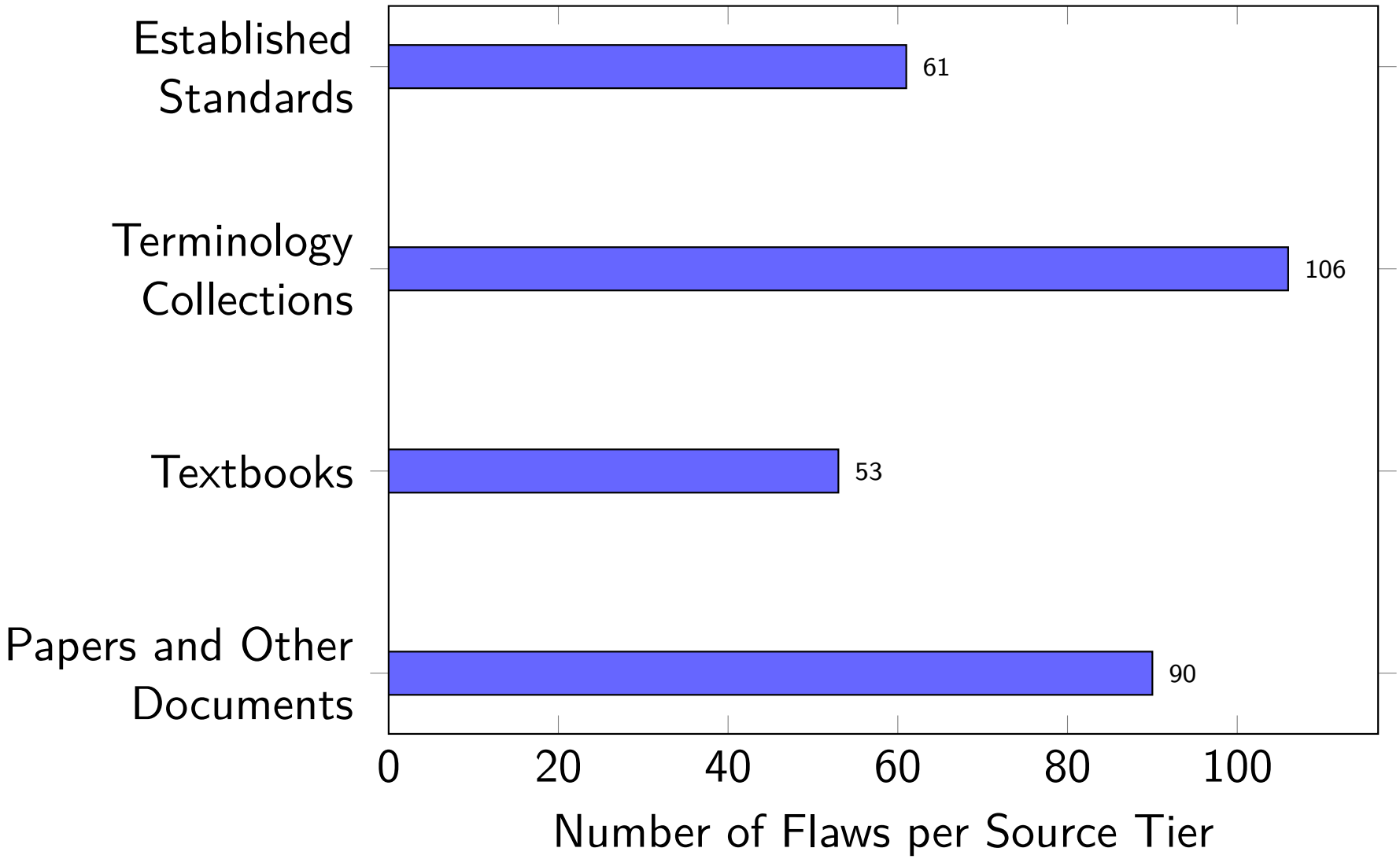
Overview

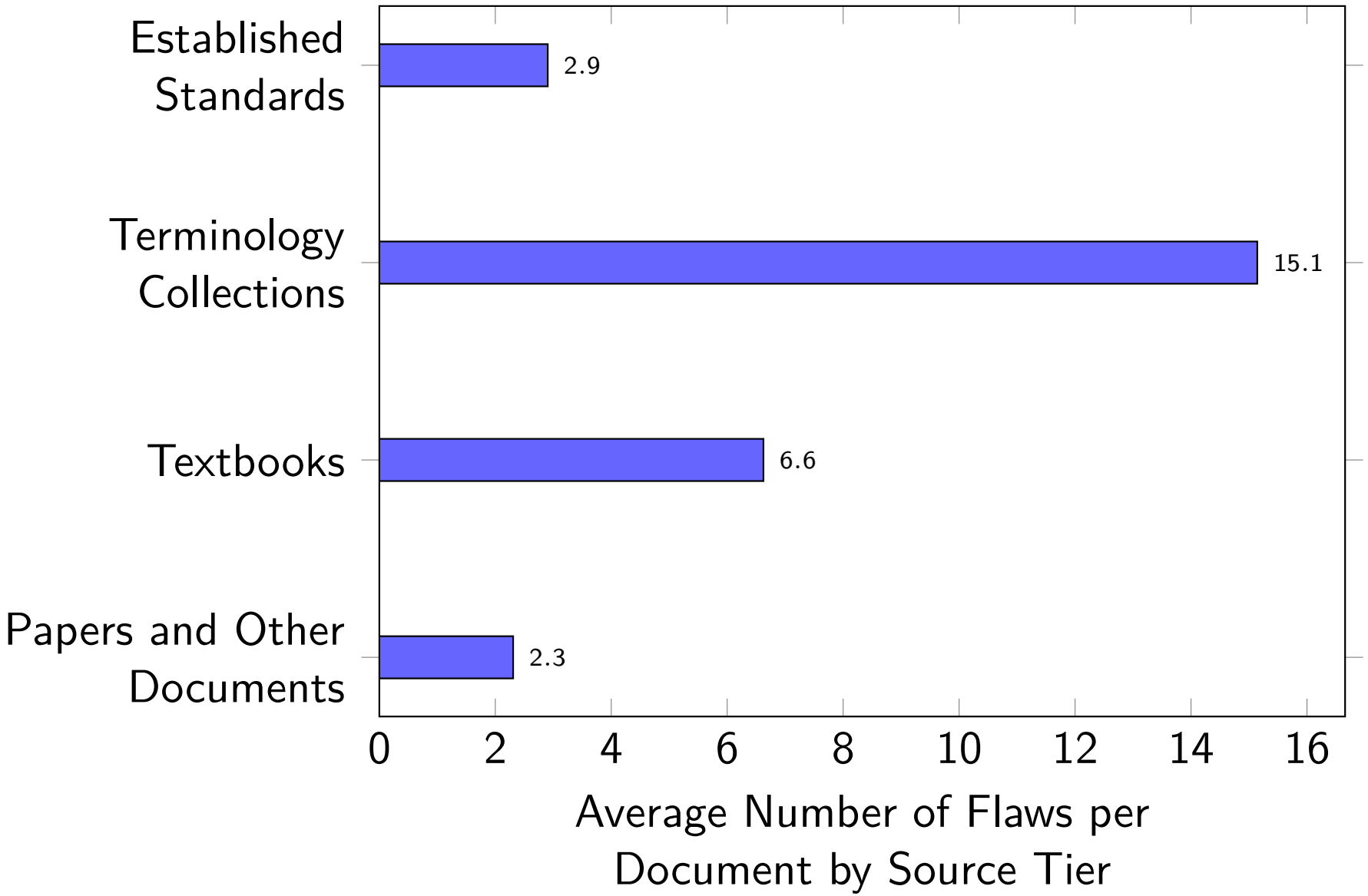
- 563 test approaches $\rightarrow$
- 77 software qualities (may imply test approaches)
- 310 flaws in the software testing literature



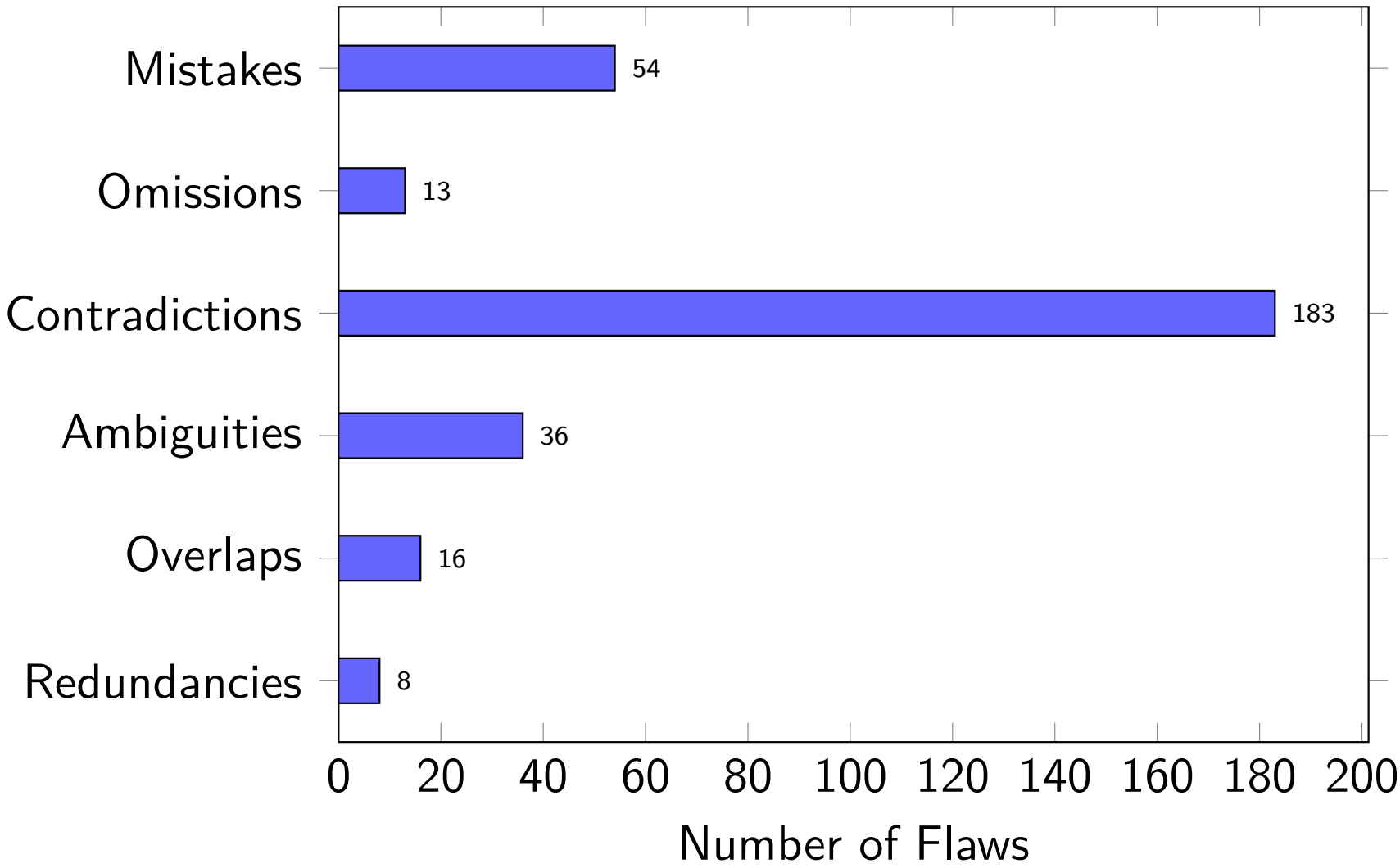
Flaw Summary by Source Tier



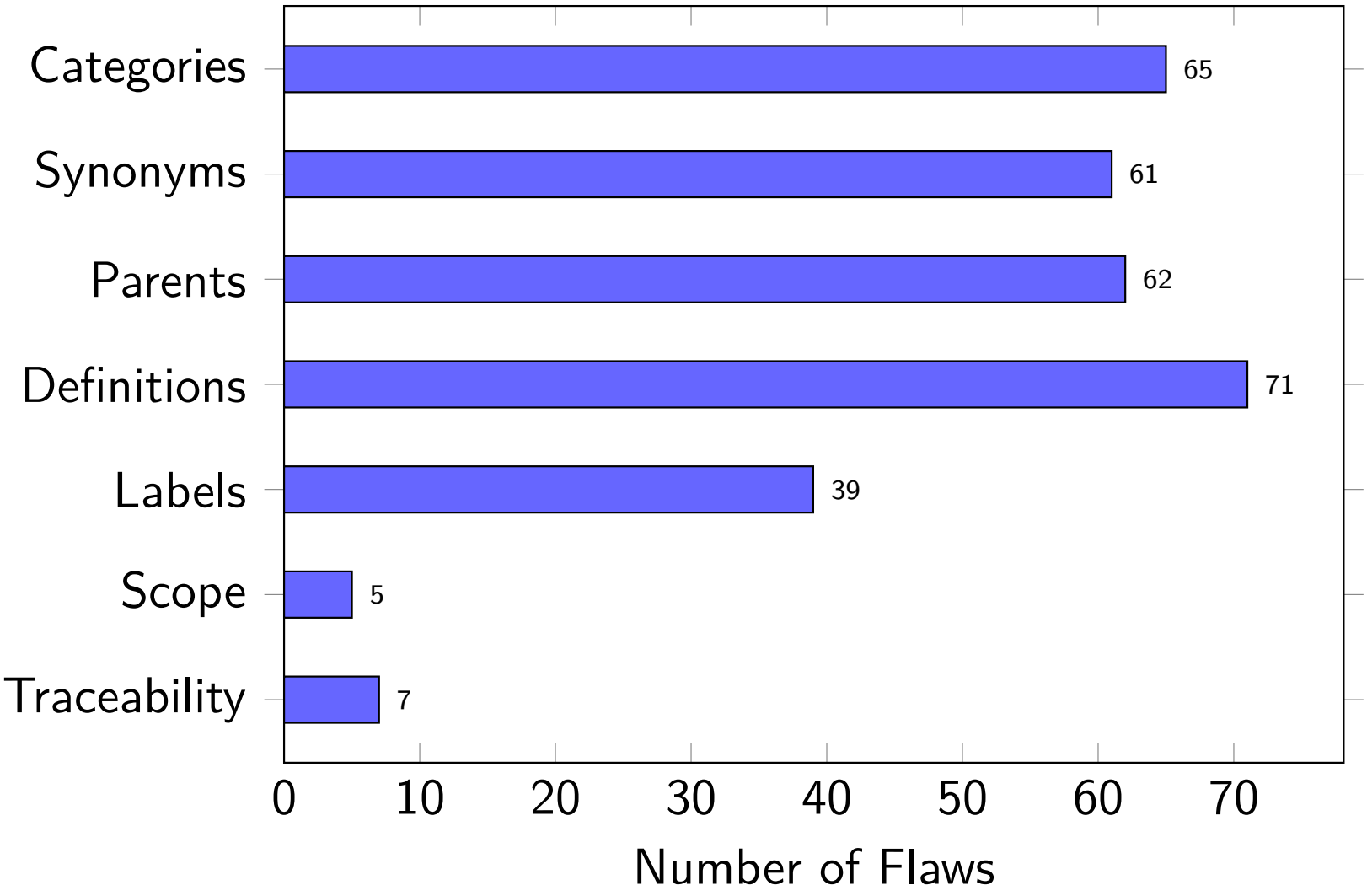
Normalized Flaw Summary



Flaw Summary by Manifestation



Flaw Summary by Domain

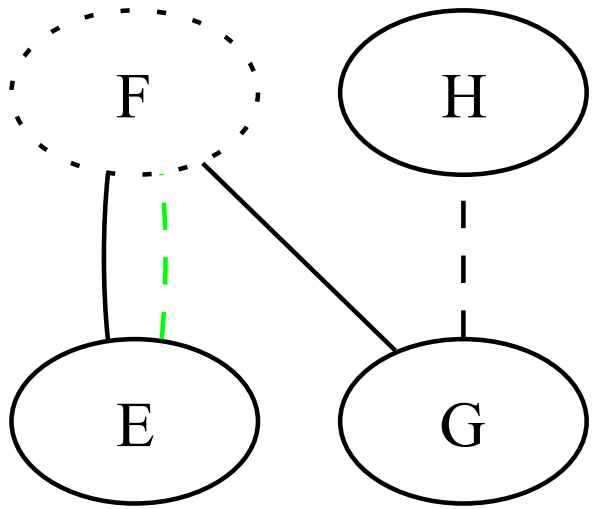


Automated Flaws

Intransitive Synonyms

Some terms are given as a synonym to two (or more) disjoint terms, making their relations ambiguous

Name	Synonym(s)
E	F (Author, 2022; implied by StdAuthor, 2021)
G	F (Author, 2017), H (implied by 2022)
H	X (StdAuthor, 2021)



Automated Flaws

Intransitive Synonyms

Some prominent examples:

	Source(s)
1. **Functional Testing:**	
• *Conformance Testing*	(Washizaki, 2025a, p. 5-7)
• *Correctness Testing*	(Washizaki, 2025a, p. 5-7)
• Specification-based Testing	(ISO/IEC and IEEE, 2017, p. 196; . . .)

Automated Flaws

Intransitive Synonyms

Some prominent examples:

	Source(s)
1 Functional Testing:	
• *Conformance Testing*	(Washizaki, 2025a, p. 5-7)
• *Correctness Testing*	(Washizaki, 2025a, p. 5-7)
• Specification-based Testing	(ISO/IEC and IEEE, 2017, p. 196; . . .)
2 Portability Testing:	
• Configuration Testing	(Kam, 2008, p. 43)
• Flexibility Testing	(ISO/IEC, 2023)
3 Soak Testing:	
• Endurance Testing	(ISO/IEC and IEEE, 2021c, p. 39)
• Reliability Testing	(Gerrard, 2000a, Tab. 2; 2000b, Tab. 1, p. 26)

Automated Flaws

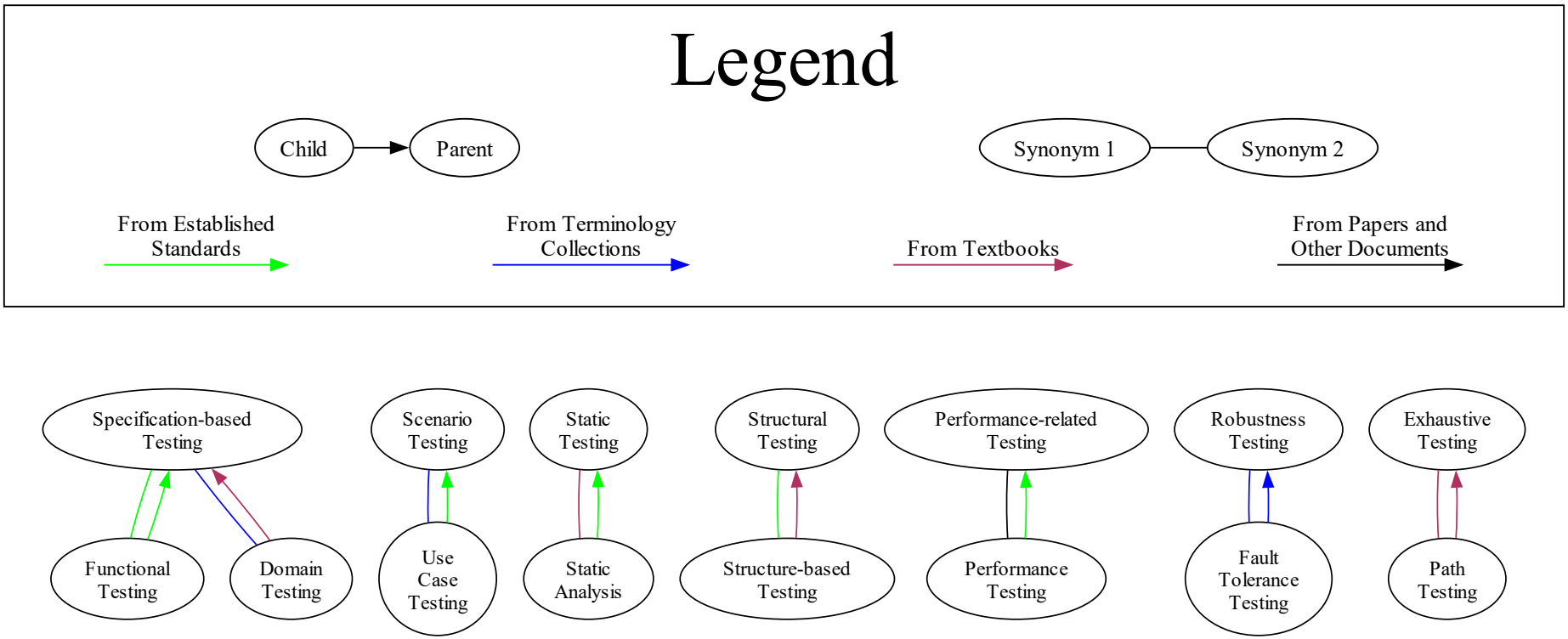
Irreflexive Parents

We also find some test approaches that are given as parents of themselves:

1. Performance Testing (Gerrard, 2000a, Tab. 2; 2000b, Tab. 1)
2. System Testing (Firesmith, 2015, p. 23)
3. Usability Testing (Gerrard, 2000a, Tab. 2; 2000b, Tab. 1)

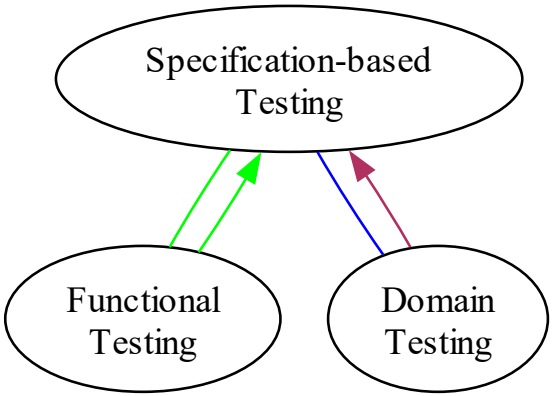
Automated Flaws

Synonym and Parent-Child Overlaps



Automated Flaws

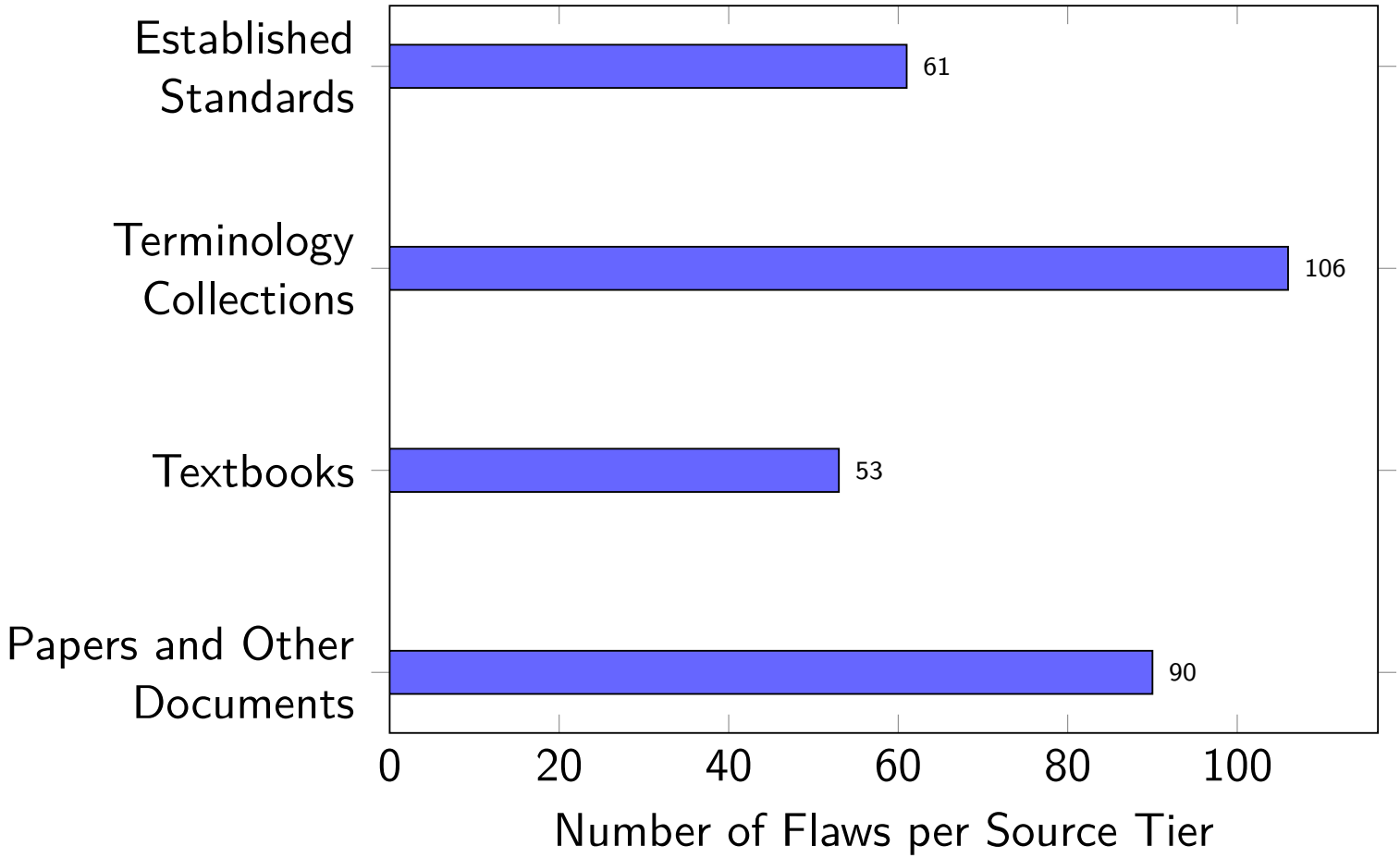
Synonym and Parent-Child Overlaps



- Functional testing is a:
  - Synonym (ISO/IEC and IEEE, 2017, p. 196; van Vliet, 2000, p. 399; Kam, 2008, pp. 44–45, 48; . . .)
  - Child (ISO/IEC and IEEE, 2021c, p. 38; Kam, 2008, p. 42)
- Domain testing is a:
  - Synonym (Washizaki, 2024, p. 5-10)
  - Child (Peters and Pedrycz, 2000, Tab. 12.1)

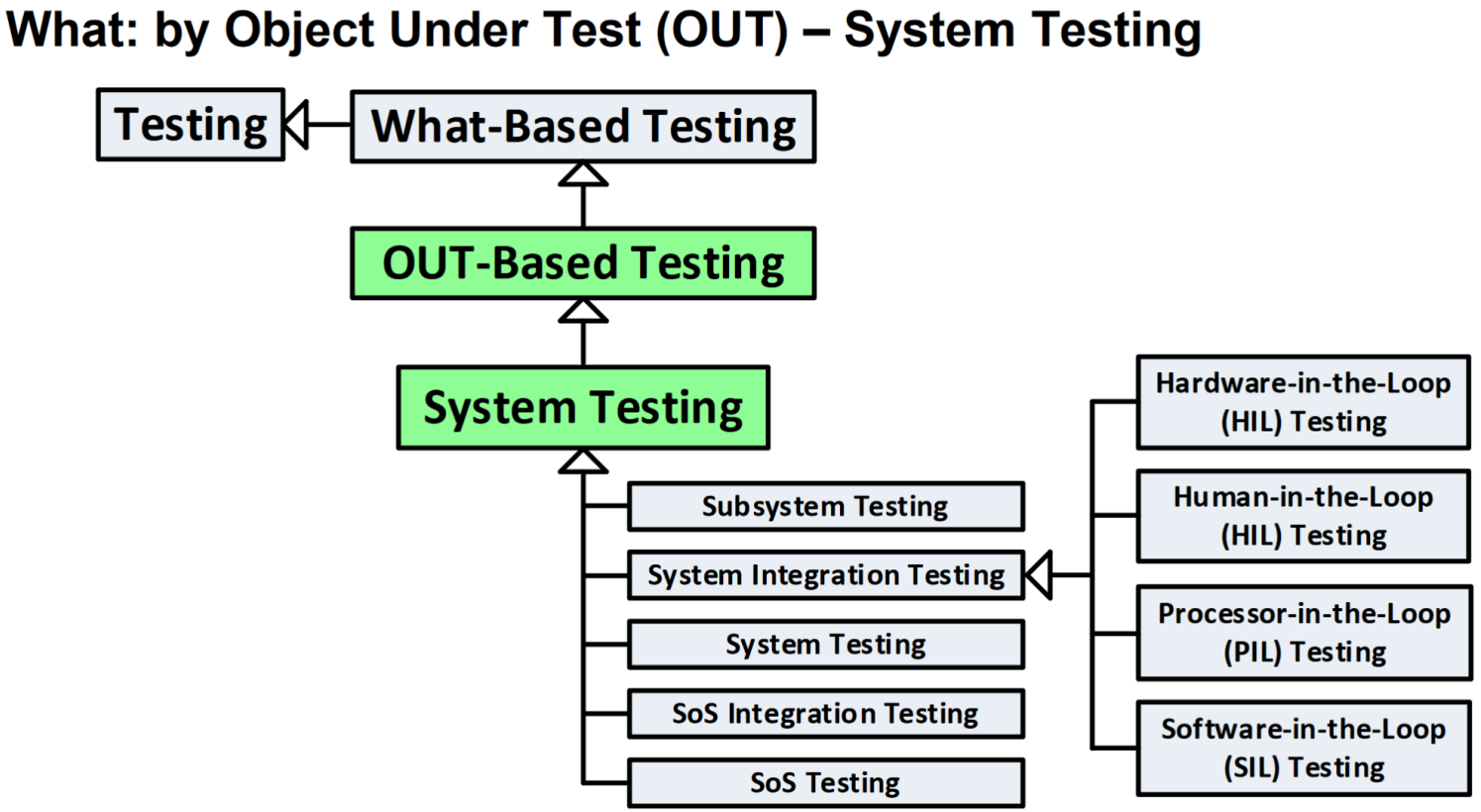
Conclusion

- The software testing literature is flawed, so don't assume everyone is on the same page



Conclusion

- The software testing literature is flawed, so don't assume everyone is on the same page
- Even if they are, there can still be issues!



(Firesmith, 2015, p. 23)

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Thesis Chapters

Complete

0. Abstract
1. Introduction
2. Terminology (including relevant appendices)
3. Methodology

Under Review

4. Tools
5. Observed Flaws (including relevant appendix)

In Progress

6. Recommendations
7. Threats to Validity
8. Future Work

To Do Later

9. Conclusion

Scheduling Next Presentations

Seminar		Defense	
Oct. 27	2:00–3:00	Nov. 10	2:00–5:00
Oct. 28	2:30–3:30	Nov. 11	10:00–1:00 or 2:30–4:00
Oct. 29	1:30–3:30	Nov. 17	2:00–5:00
Nov. 3	2:00–5:00	Nov. 18	11:00–1:00 or 2:30–4:00
Nov. 4	11:00–1:00 or 2:30–4:00	Nov. 19	9:30–10:30 or 1:00–3:30
Nov. 5	9:30–11:30 or 1:00–3:30		

Acknowledgment

- Dr. Spencer Smith and Dr. Jacques Carette have been great supervisors and valuable sources of guidance and feedback
- The format of this presentation was *heavily* based on a previous presentation by Jason Balaci, who also provided a great thesis template
- ChatGPT was used to help generate supplementary Python code for constructing visualizations and generating LaTeX code, including regex
- ChatGPT and GitHub Copilot were both used for assistance with LaTeX formatting

References I

Donald G. Firesmith. A Taxonomy of Testing Types, 2015. URL https://apps.dtic.mil/sti/pdfs/AD1147163.pdf.

Paul Gerrard. Risk-based E-business Testing - Part 1: Risks and Test Strategy. Technical report, Systeme Evolutif, London, UK, 2000a. URL https://www.agileconnection.com/sites/default/files/article/file/2013/XUS129342file1_0.pdf.

Paul Gerrard. Risk-based E-business Testing - Part 2: Test Techniques and Tools. Technical report, Systeme Evolutif, London, UK, 2000b. URL wenku.uml.com.cn/document/test/EBTestingPart2.pdf.

Matthias Hamburg and Gary Mogyorodi, editors. ISTQB Glossary, v4.3, 2024. URL https://glossary.istqb.org/en_US/search.

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