Second Committee Meeting

Updated Progress Report

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Fall 2025

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Where Were We?

Introduction

- Our project:
  - **Drasil:** our software artifact generation framework
  - Generating test cases would improve Drasil's value and code quality
  - Started writing test cases manually

Where Were We?

Introduction

- Our project:
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  - Generating test cases would improve Drasil's value and code quality
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- Our next steps:
  - Understand the problem domain
  - Make use of all areas of the domain
  - Follow domain standards, including quality and terminology

Where Were We?

Introduction

- Our project:
  - **Drasil:** our software artifact generation framework
  - Generating test cases would improve Drasil's value and code quality
  - Started writing test cases manually
- Our next steps:
  - Understand the problem domain
  - Make use of all areas of the domain
  - Follow domain standards, including quality and terminology
- What happened?
  - The domain of software testing is *much* larger than we expected
  - Software testing terminology and standards are *not* standardized

The Problem

Introduction

- [ ] **Clarify relation between All-DU-Paths and All-Uses**
  #6 · by samm82 was closed on Nov 11, 2024
- [ ] **Categorize todos in thesis notes** documentation low priority
  #5 · samm82 opened on Oct 25, 2023
- [ ] **Add notes on black box testing from Peters**
  #4 · by samm82 was closed on Nov 7, 2023
- [ ] **How "exhaustive" is path testing *really*?** question
  #3 · by samm82 was closed on Oct 26, 2023
- [ ] **Ambiguity about meaning of "path" in testing literature** question
  #2 · by samm82 was closed on Nov 13, 2024
- [ ] **Explicitly define structural testing**
  #1 · by samm82 was closed on Jan 8

- The problem started subtly in textbooks

The Problem

Introduction

- Clarify scope of research
  #28 · by samm82 was closed on Apr 4, 2024
- Track implicit test types
  #27 · by samm82 was closed on Jan 22, 2024
- Improve current "Field of Testing" column
  #26 · by samm82 was closed on Feb 25, 2024
- Document and investigate confusion surrounding "functional testing"
  #25 · by samm82 was closed 2 weeks ago
- Sam's Thesis Meeting | Jan 22, 2023 - 10:30am - VIRTUAL discussion
  #24 · by samm82 was closed on Jan 22, 2024
- "Implied" Test Types discussion question
  #23 · by samm82 was closed on Jan 20, 2024
- Scope of Testing (vs. V&V) discussion question
  #22 · by samm82 was closed on Jan 20, 2024
- "Test approach" vs. "test practice" discussion to do later
  #21 · by samm82 was closed on Jan 20, 2024

- The problem started subtly in textbooks
- It then became more obvious with larger implications

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- The problem started subtly in textbooks
- It then became more obvious with larger implications
- We needed something standardized

Existing Taxonomies?

Introduction

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

Existing Taxonomies?

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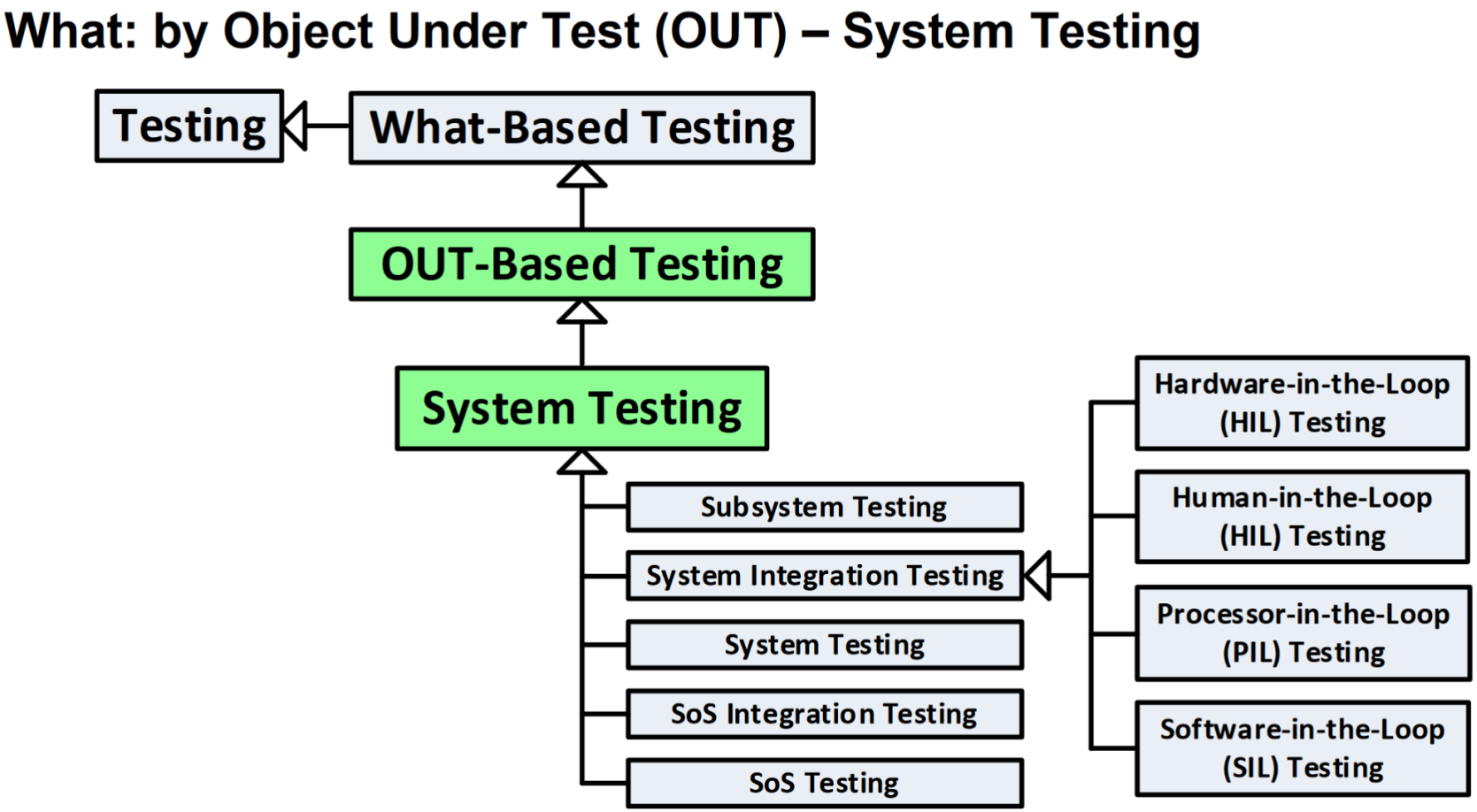
Focus on:

The Testing Process
Organizing Terminology
Relations between Approaches
Traceability between Stages

Relations from Firesmith (2015)?

Introduction



(Firesmith, 2015, p. 23)

Relations from Firesmith (2015)?

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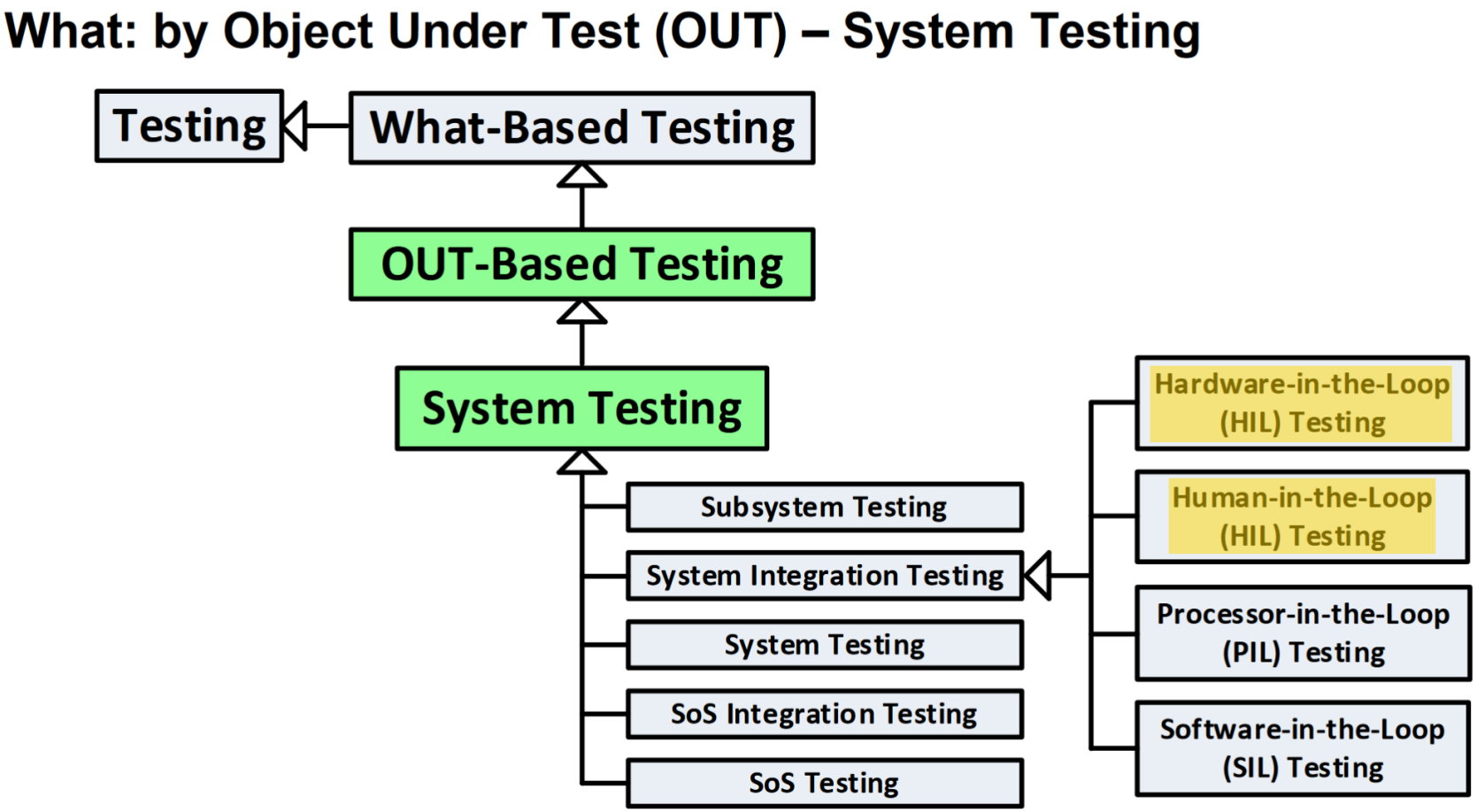

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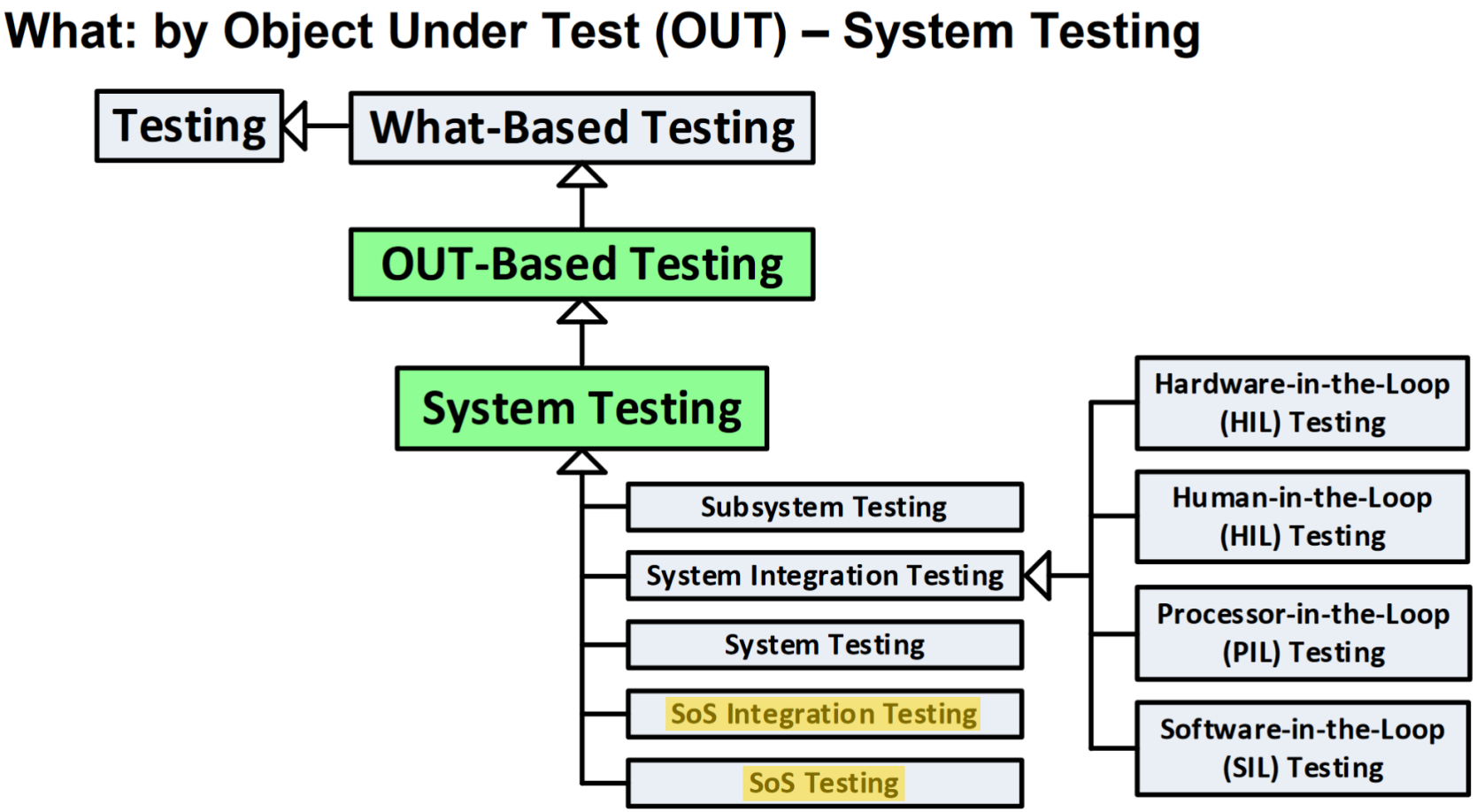

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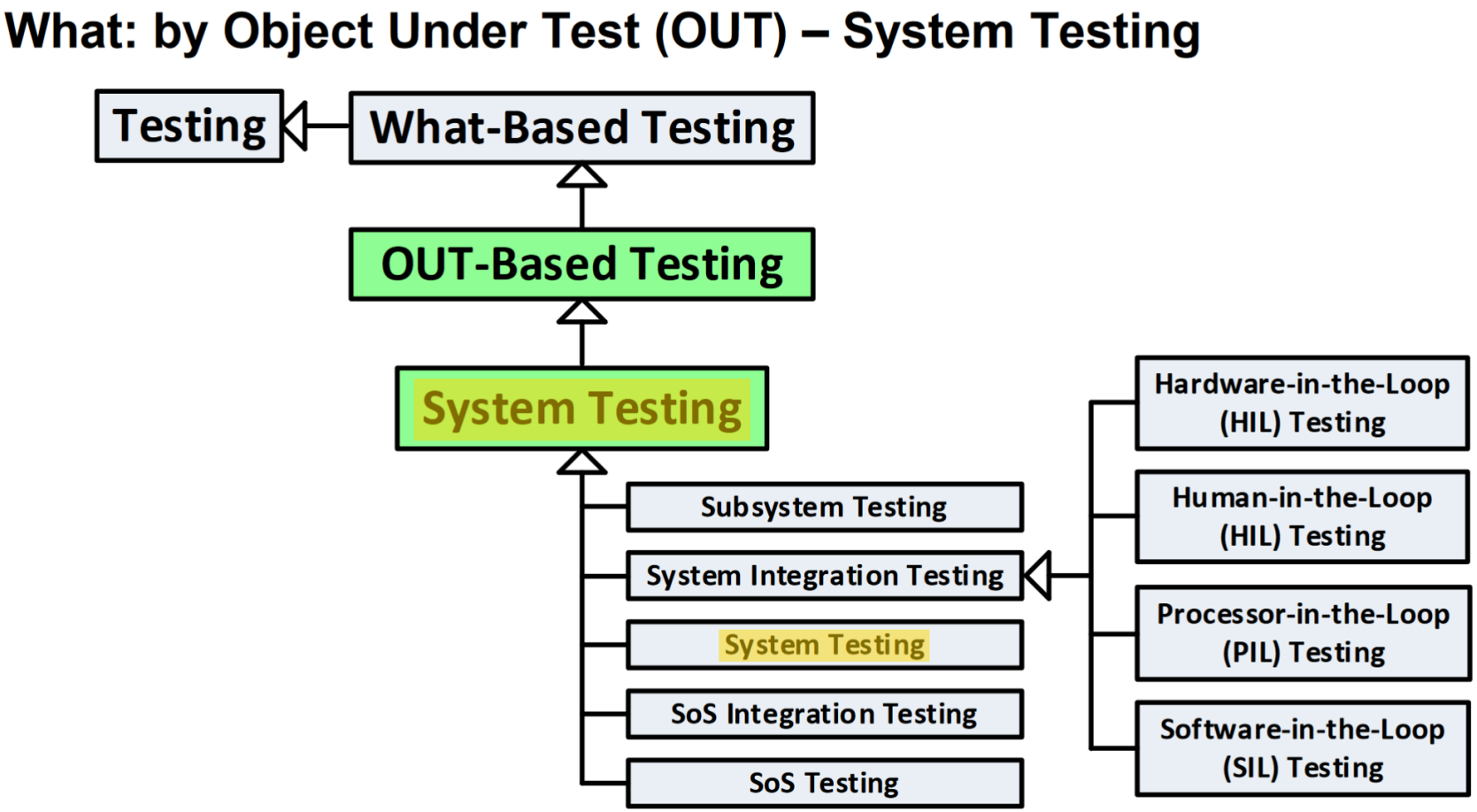

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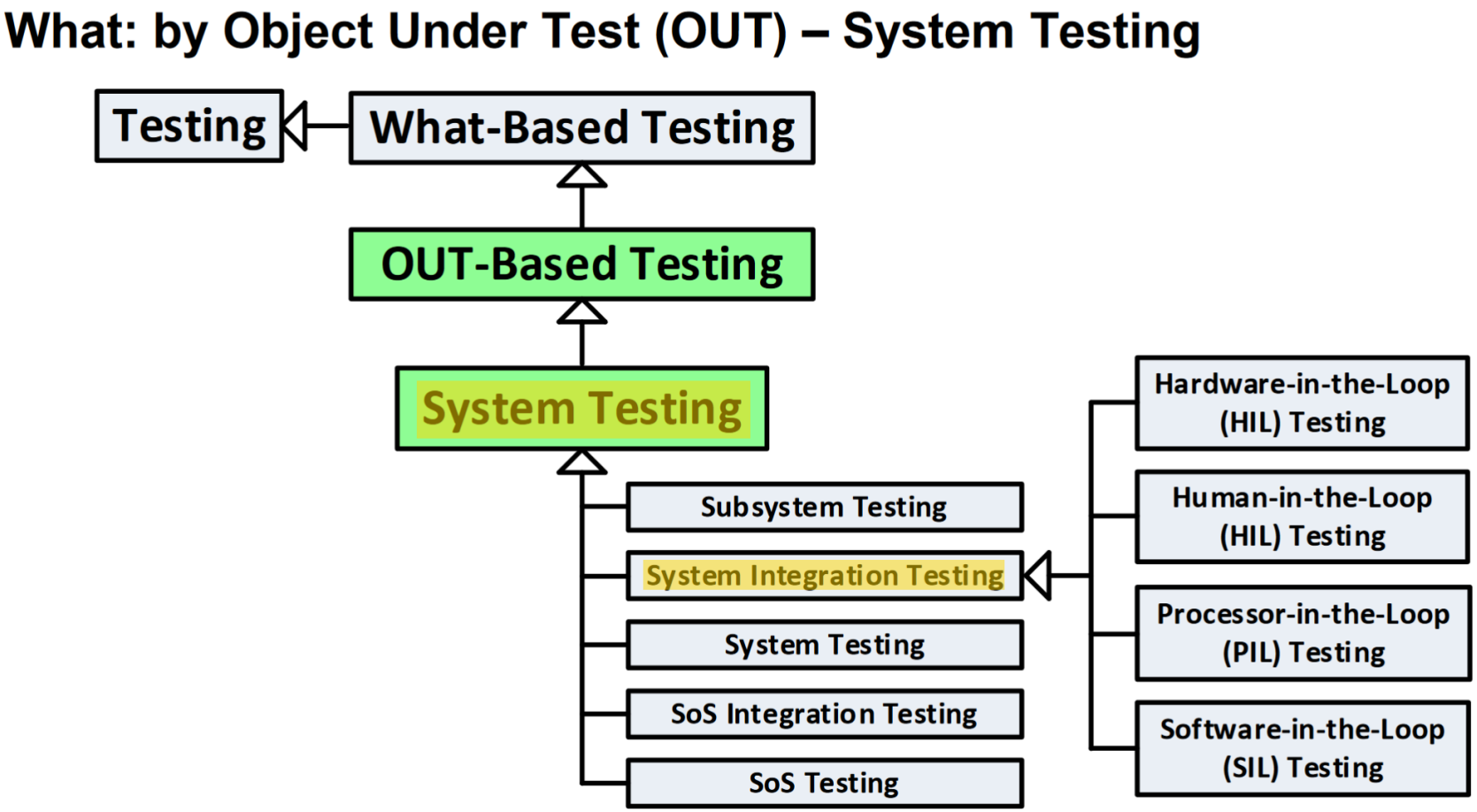

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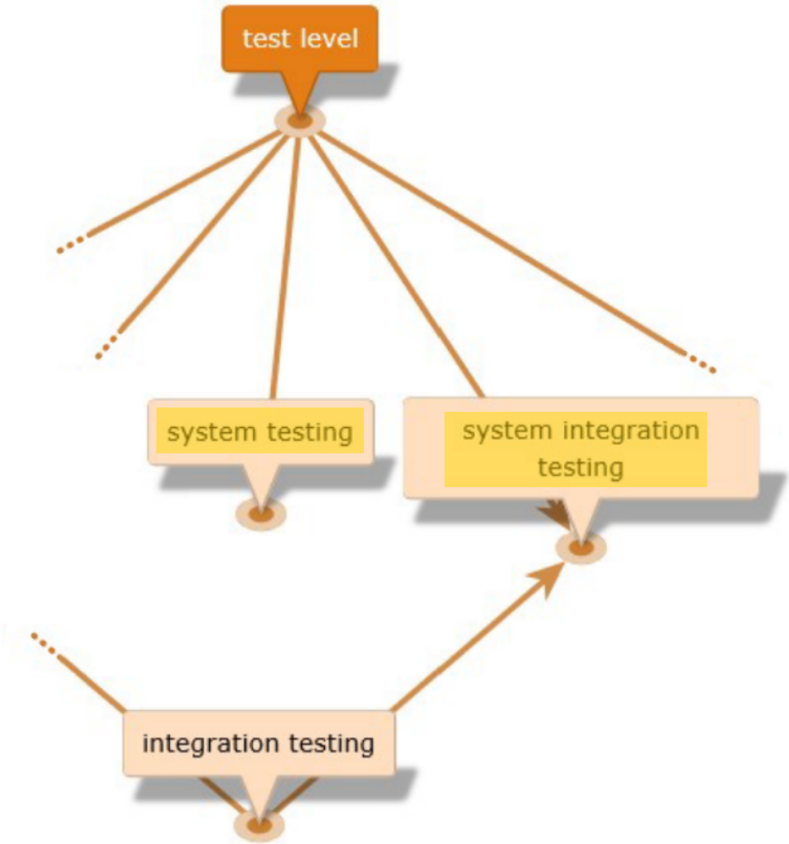
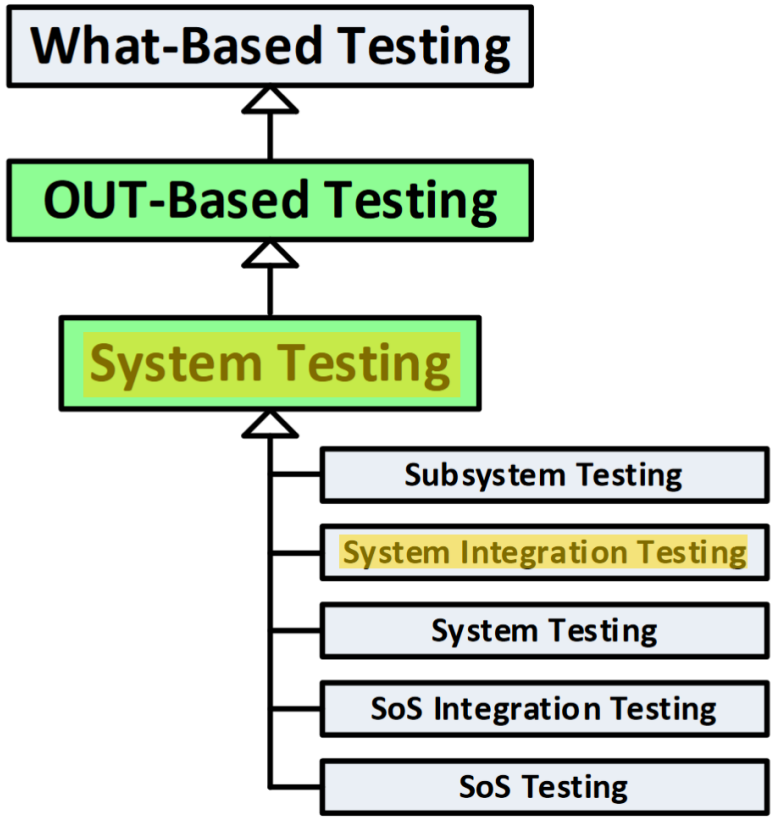


Adapted from (Hamburg and Mogyorodi, 2024)



Adapted from (Firesmith, 2015, p. 23)

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Research Questions

Research Question 1

What testing 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 testing approaches do the literature describe?

1. Identify authoritative sources on software testing and "snowball" from them
2. Identify all test approaches and testing-related terms described in these authoritative sources
3. Record all relevant data, including implicit data, for each term identified in step 2; 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 until the stopping criteria is reached

Research Question 2

Are these descriptions consistent?

5. Analyze recorded test approach data for additional flaws
    1. Generate relation graphs
    2. Automatically detect certain classes of flaws
    3. Automatically 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

- A row is created 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)

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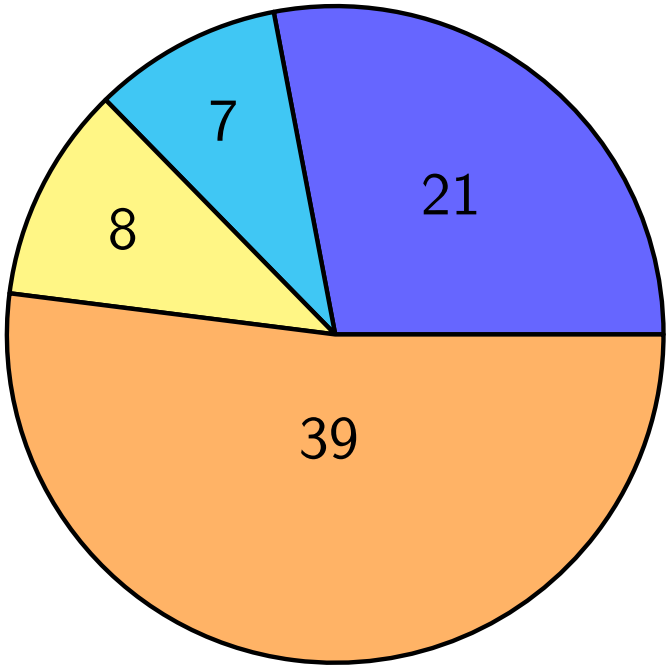
Information from (ISO/IEC and IEEE, 2022)

- This information is gathered from sources by looking for
  - Glossaries, taxonomies, hierarchies, etc.
  - Testing-related terms
  - Terms described *by* other approaches
  - Terms that *imply* other approaches

Methodology

Sources



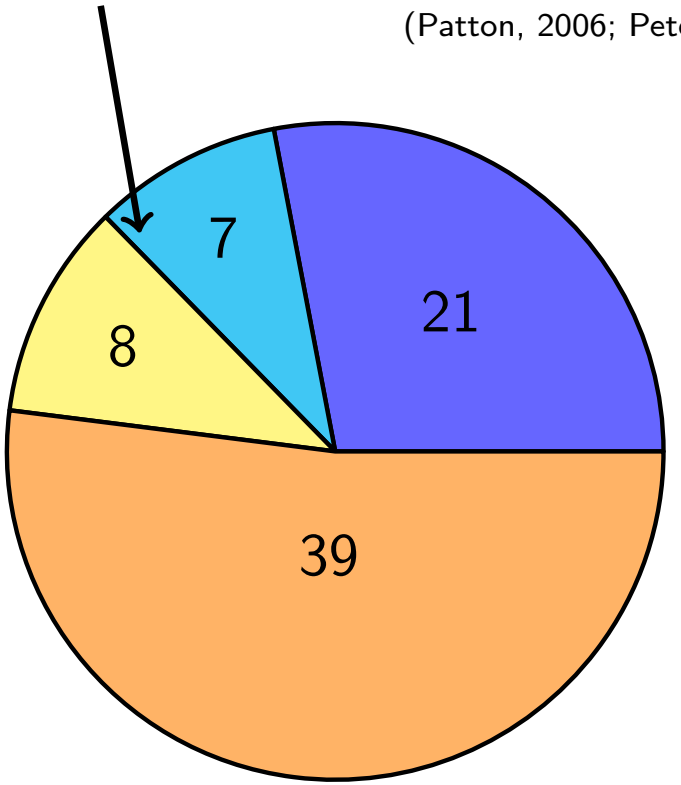
- Established Standards
- Terminology Collections
- Textbooks
- Papers and Other Documents

Methodology

Sources

Textbooks used at McMaster were our ad hoc starting points

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



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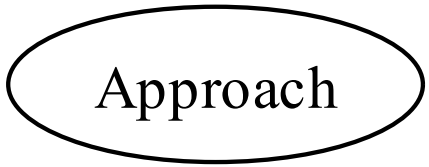
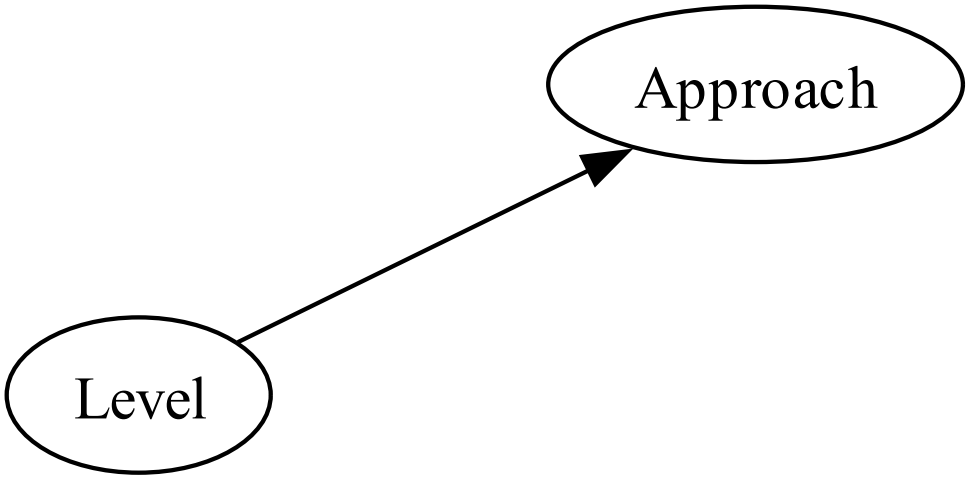


Approach: a "high-level test implementation choice" (ISO/IEC and IEEE, 2022, p. 10) used to "pick the particular test case values" (2017, p. 465)

Methodology

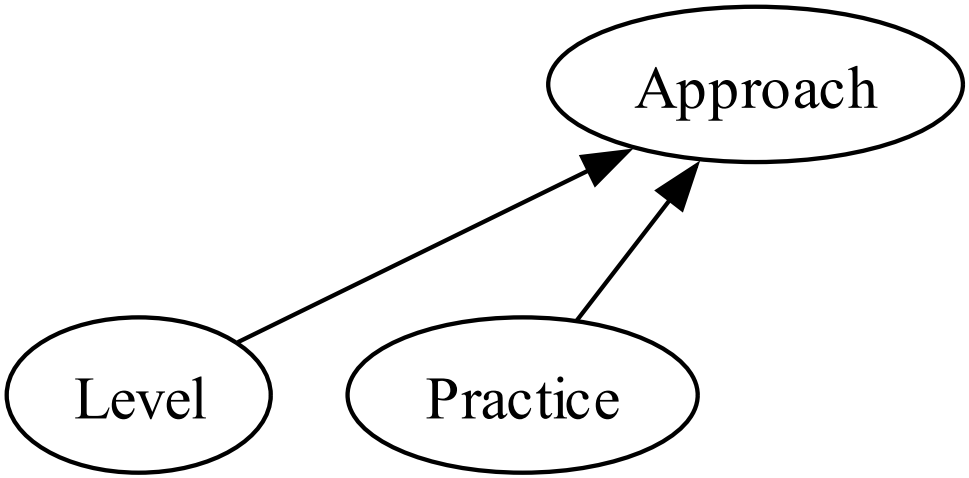
Categories



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

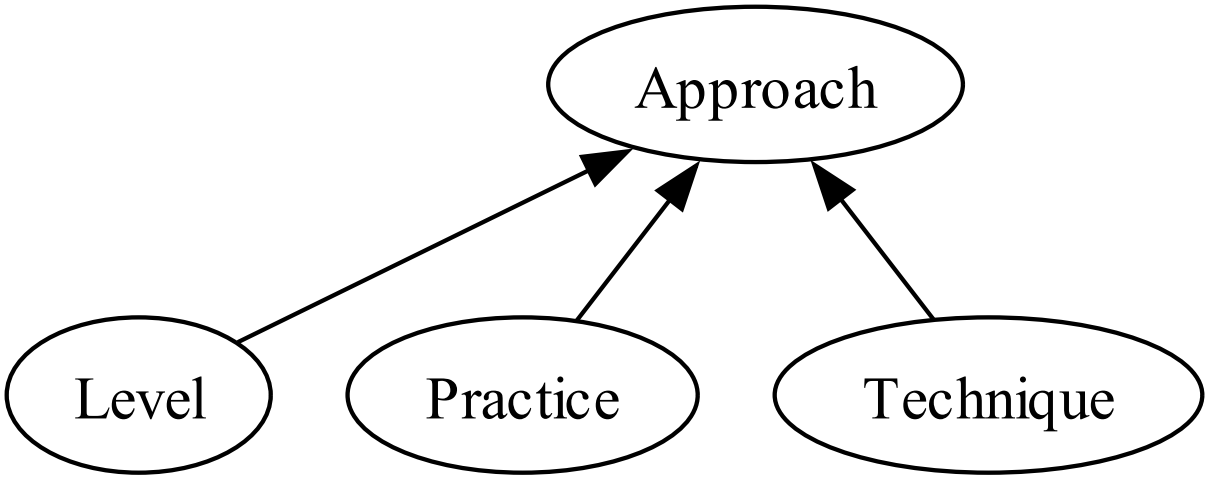
Categories



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

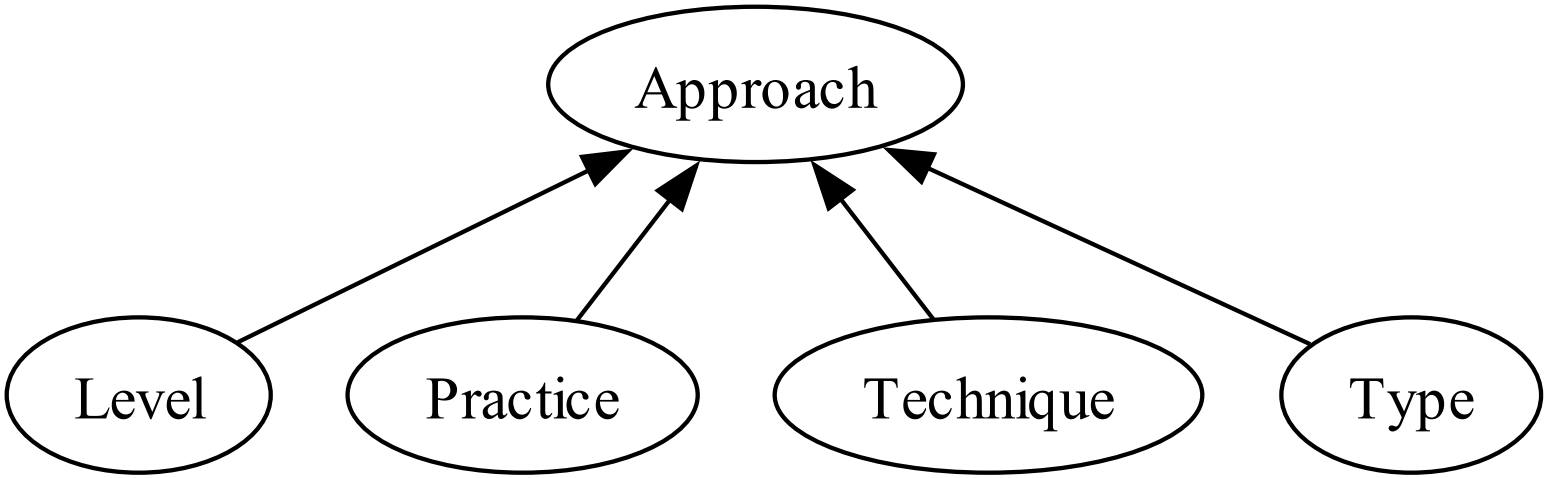
Categories



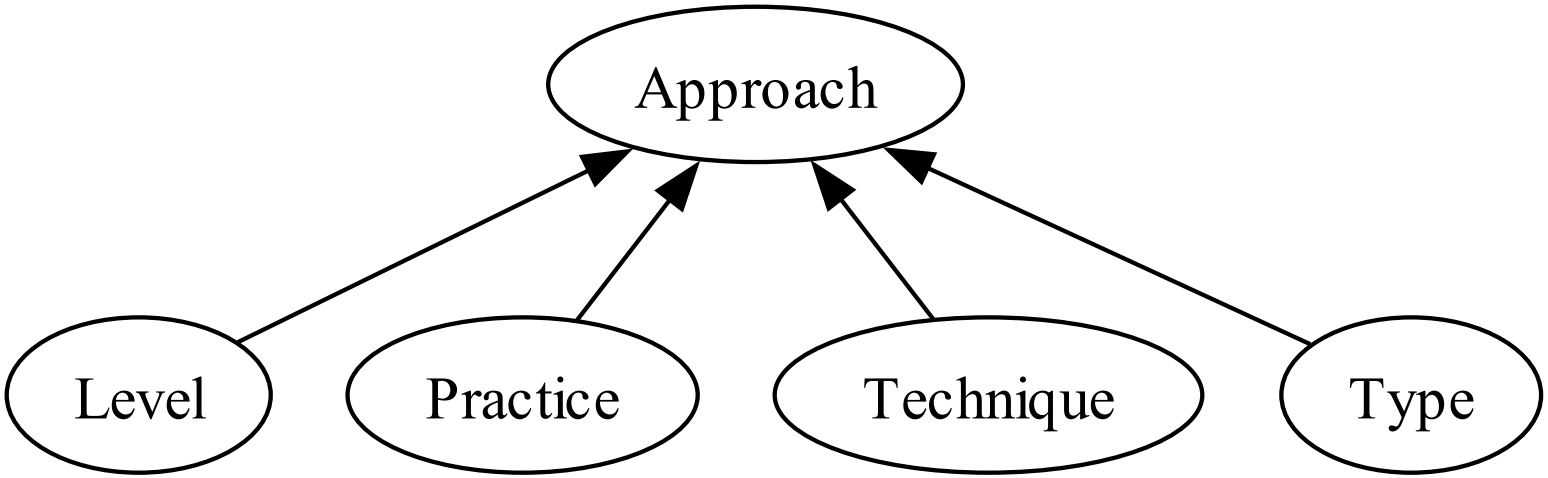
Technique: a "procedure used to create or select a test model, identify test coverage items, and derive corresponding test cases" (2022, p. 11; 2021a, p. 5; similar in 2017, p. 467)

Methodology

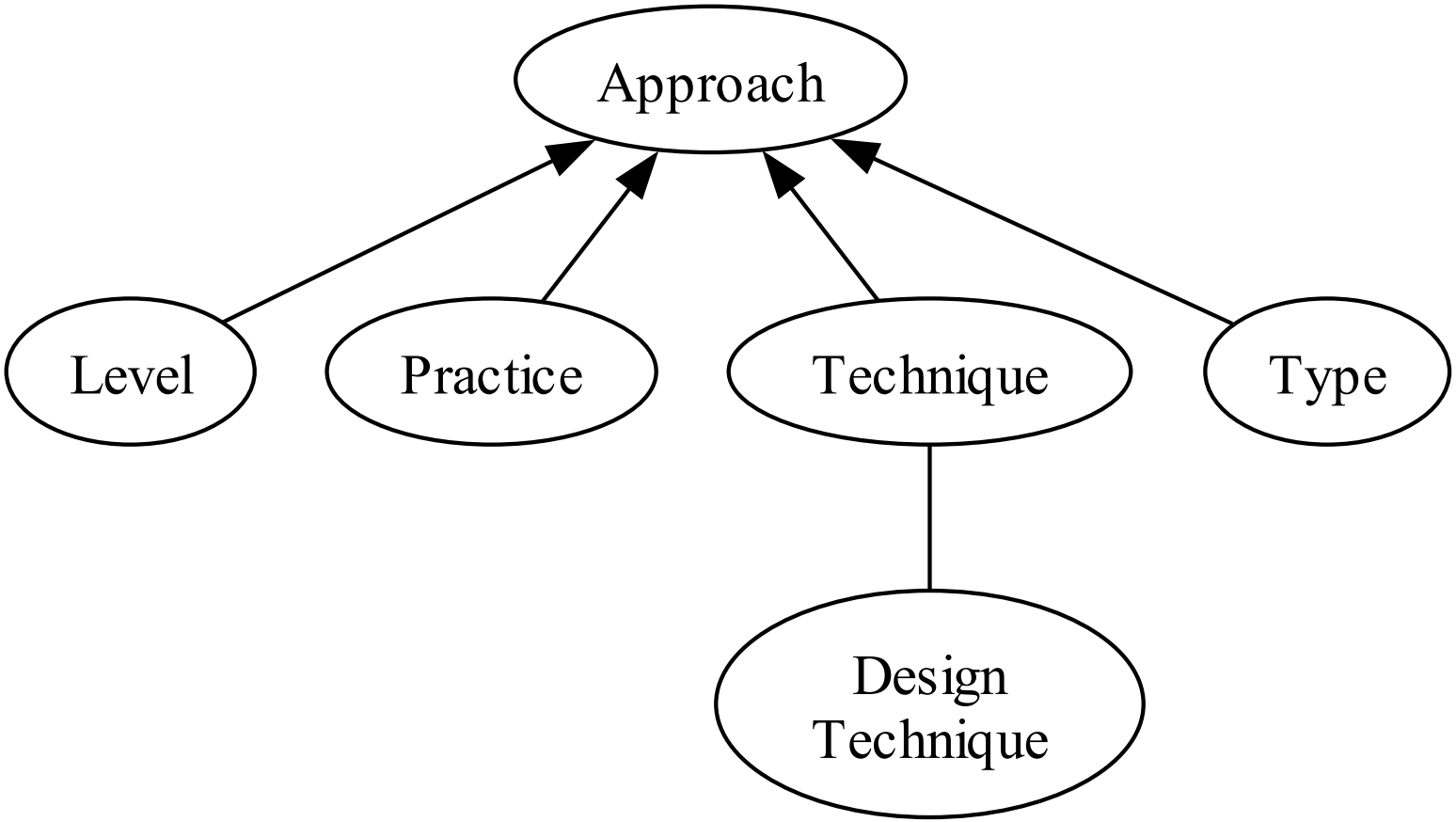
Categories



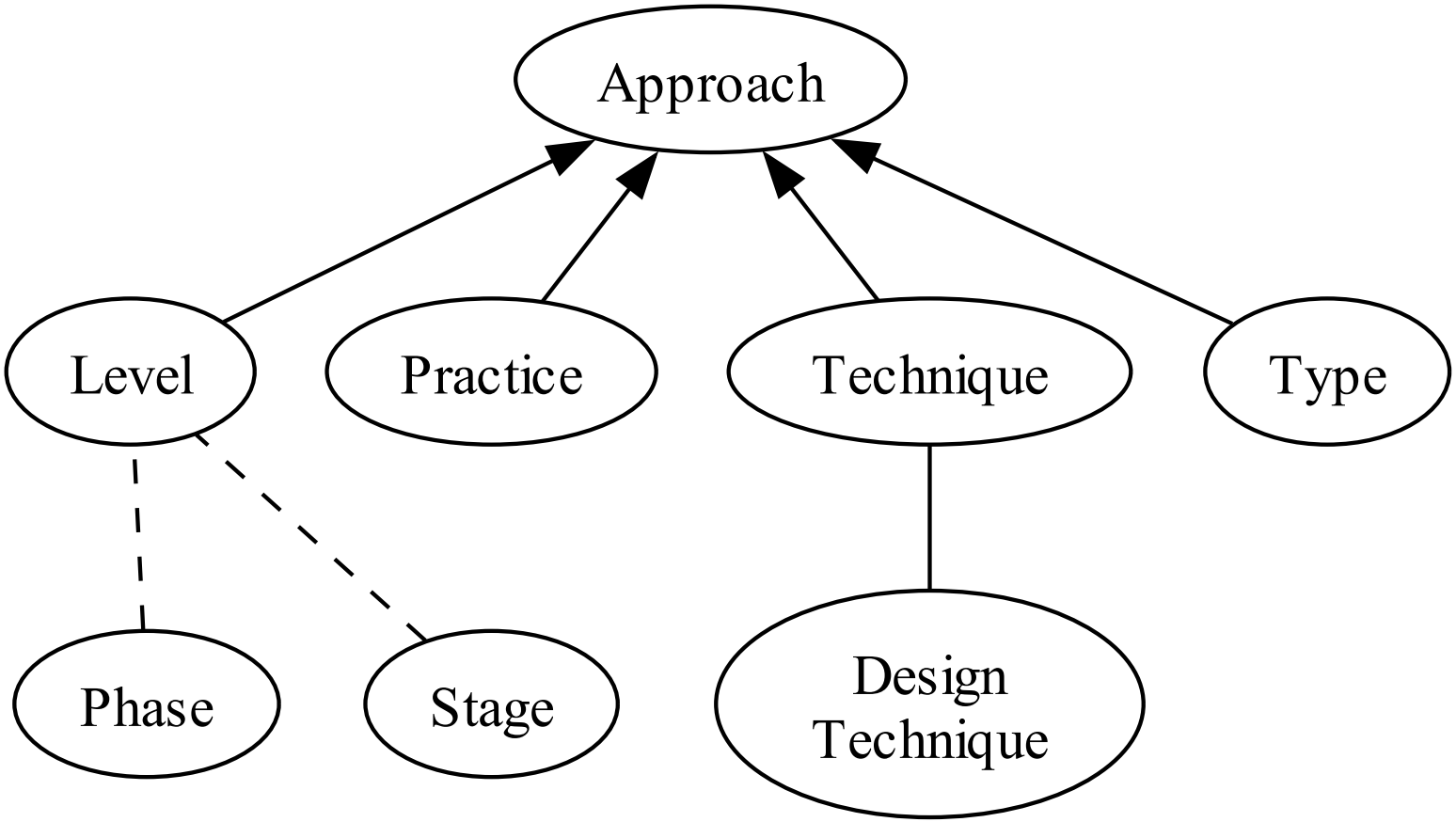
Type: "Testing that is focused on specific quality characteristics" (ISO/IEC and IEEE, 2022, p. 15; 2021c, p. 7; 2017, p. 473)



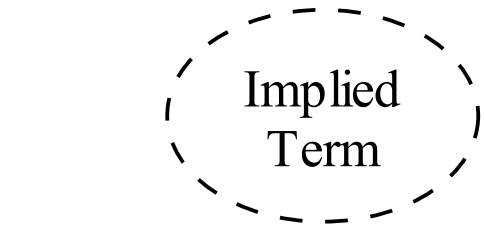
Arrows point from a *child* node to a *parent* node.



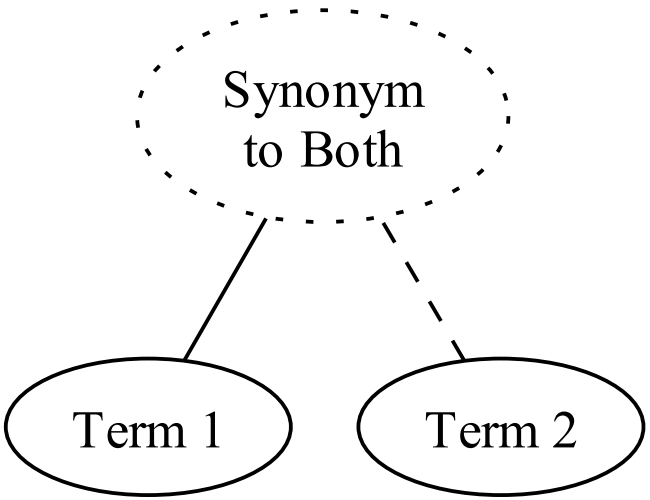
Lines without arrowheads connect *synonyms*.



Dashed lines indicate a relationship is *implicit*.



Dashed outlines indicate a term is *implicit*.



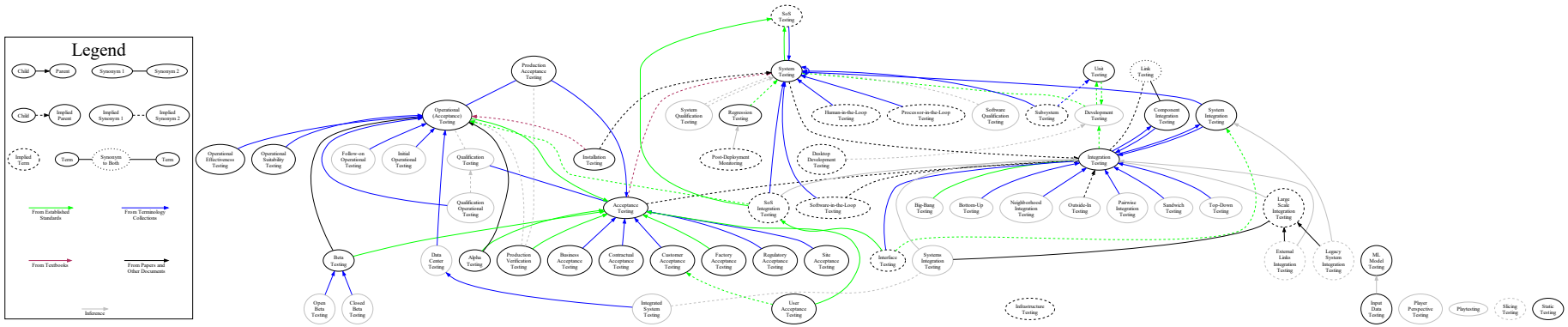
Dotted outlines indicate a term is a *synonym* to more than one term.

Graph of Test Approaches

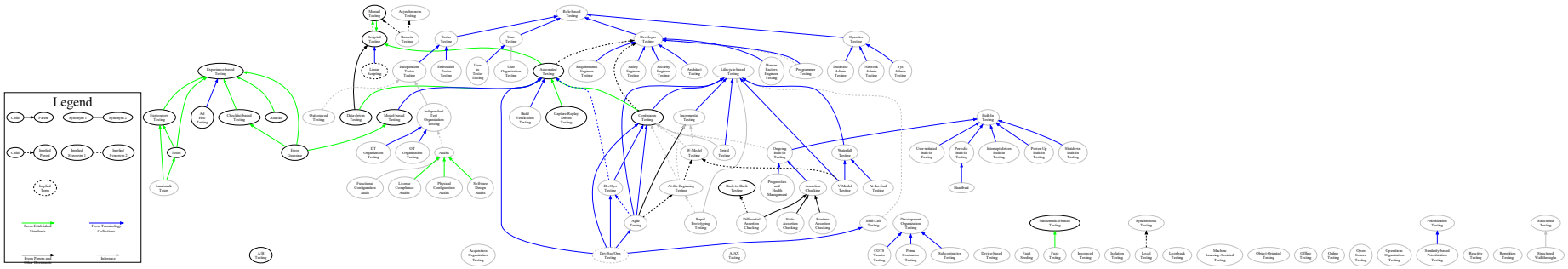
Graph of Test Approaches

```
! Dimension too large.
```

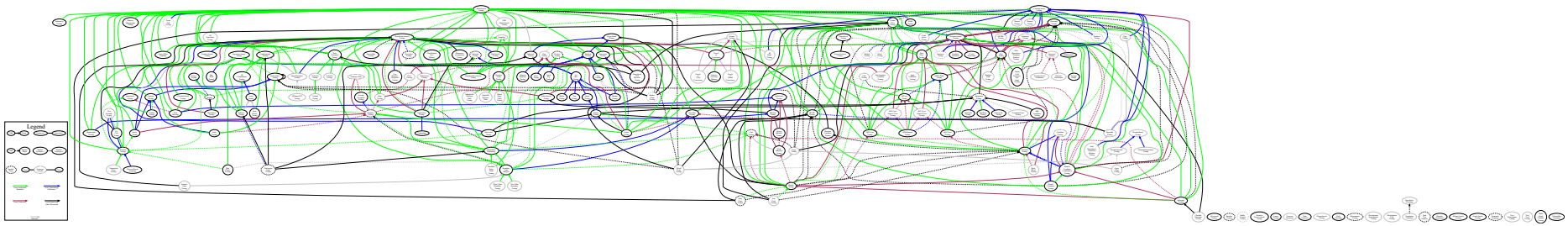
Graph of Test Levels



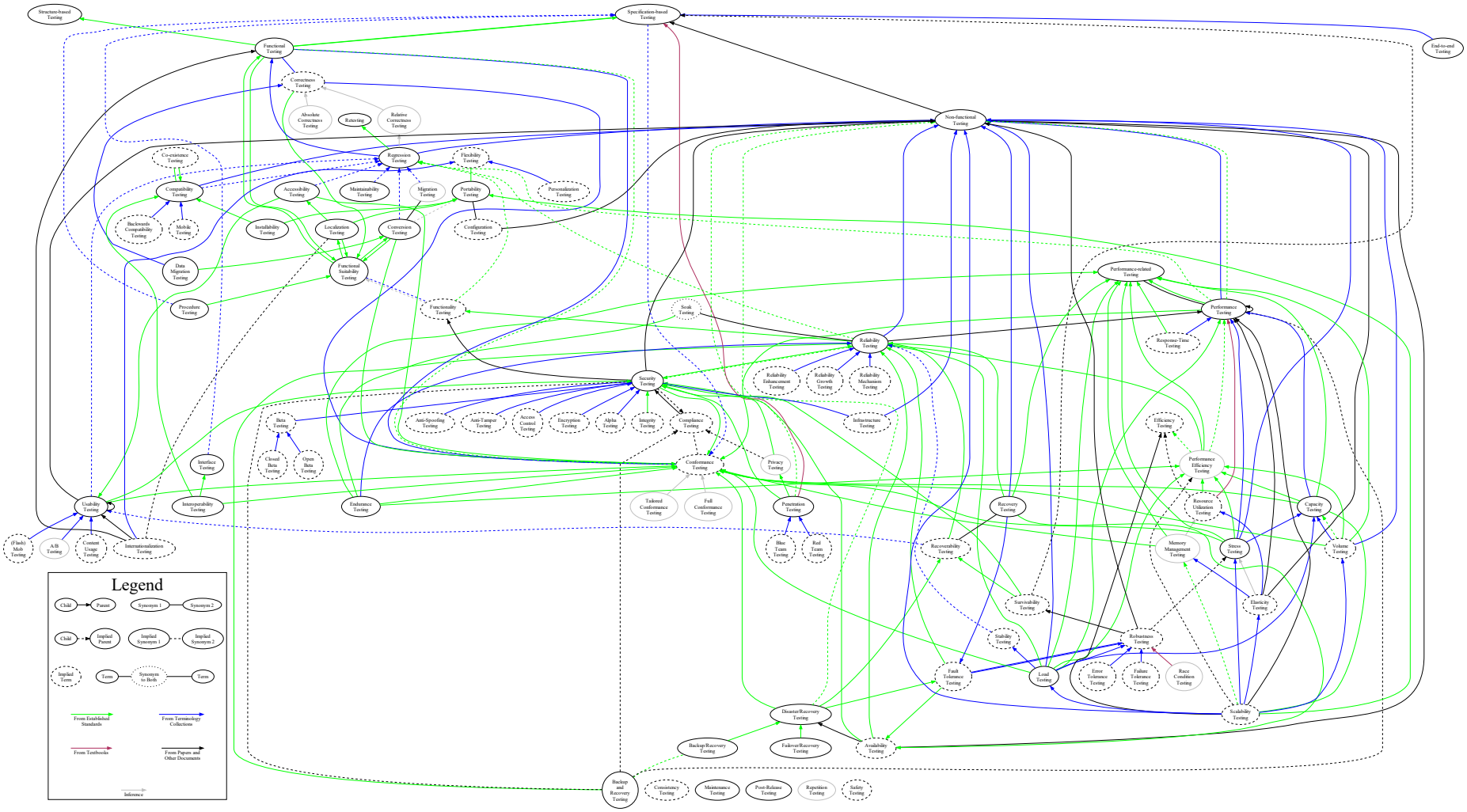
Graph of Test Practices



Graph of Test Techniques

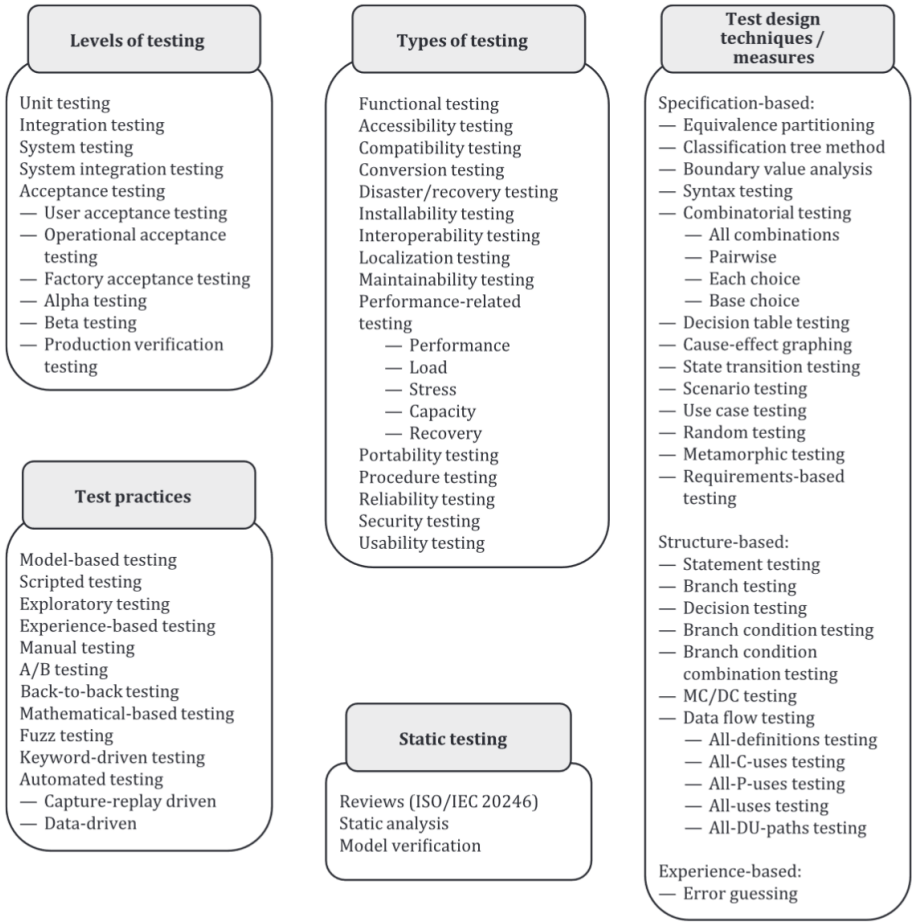


Graph of Test Types



Methodology

Visualization Notation



(ISO/IEC and IEEE, 2022, Fig. 2)

Methodology

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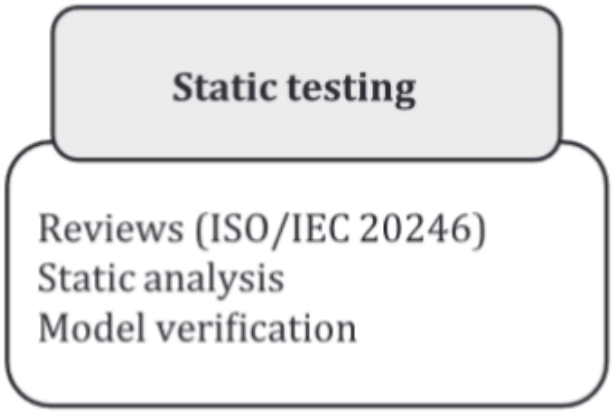

Adapted from (ISO/IEC and IEEE, 2022, Fig. 2)

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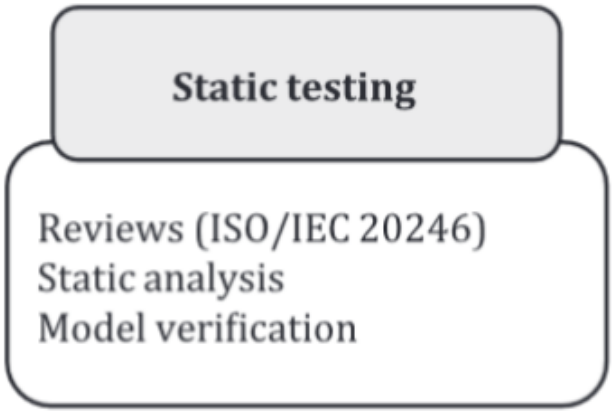

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- Quite distinct but not necessarily orthogonal

Methodology

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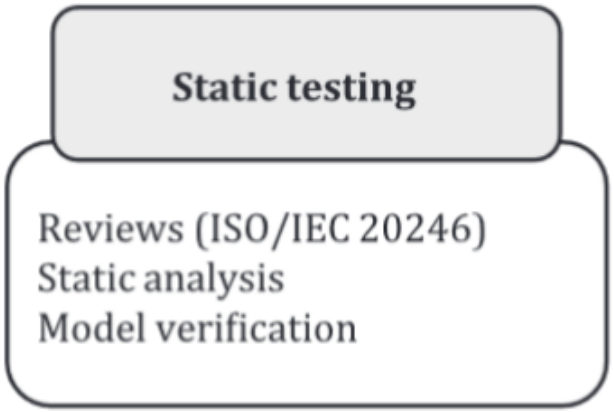
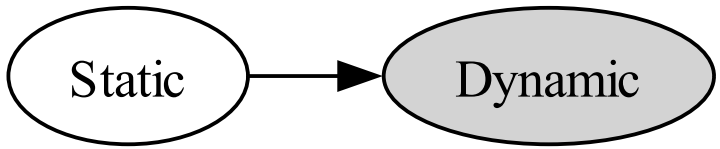
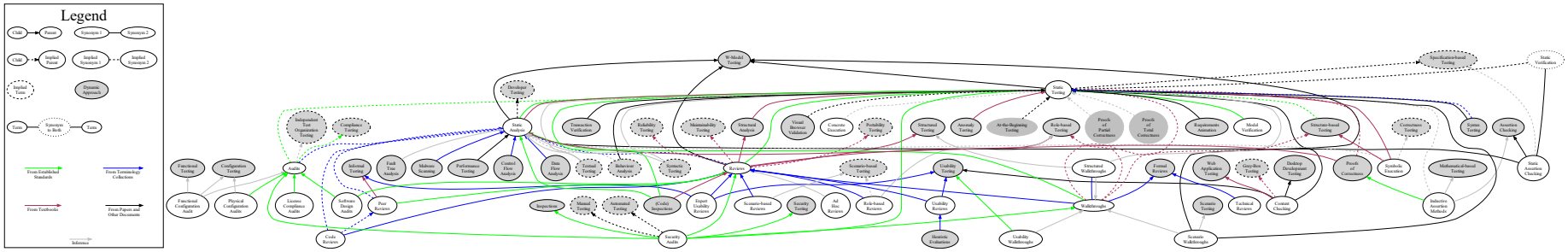


Adapted from (ISO/IEC and IEEE, 2022, Fig. 2)

- Quite distinct but not necessarily orthogonal
- When considering static testing in isolation, related *dynamic approaches* have grey backgrounds



Graph of *Static* Test Approaches



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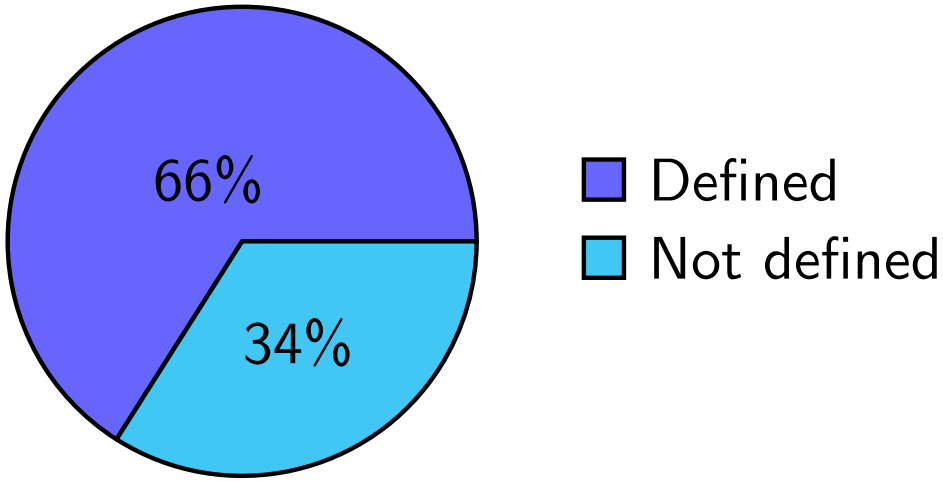
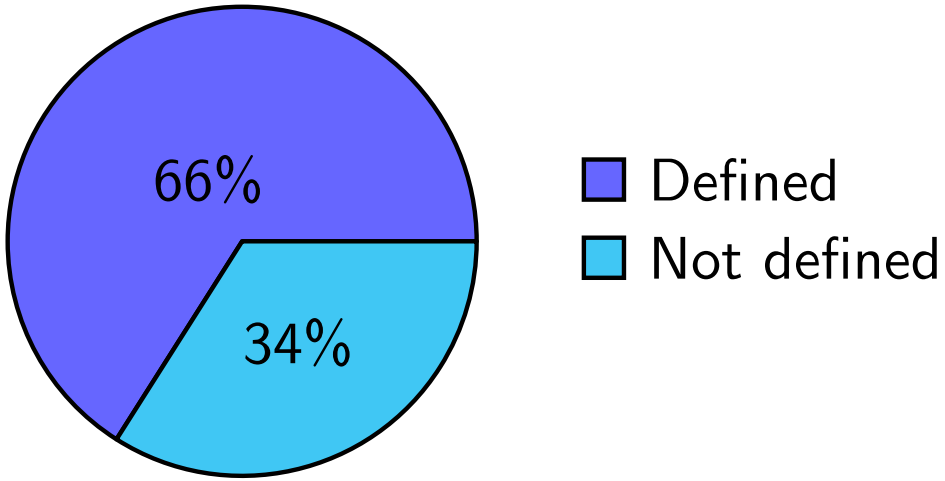
Overview

- 561 test approaches $\rightarrow$



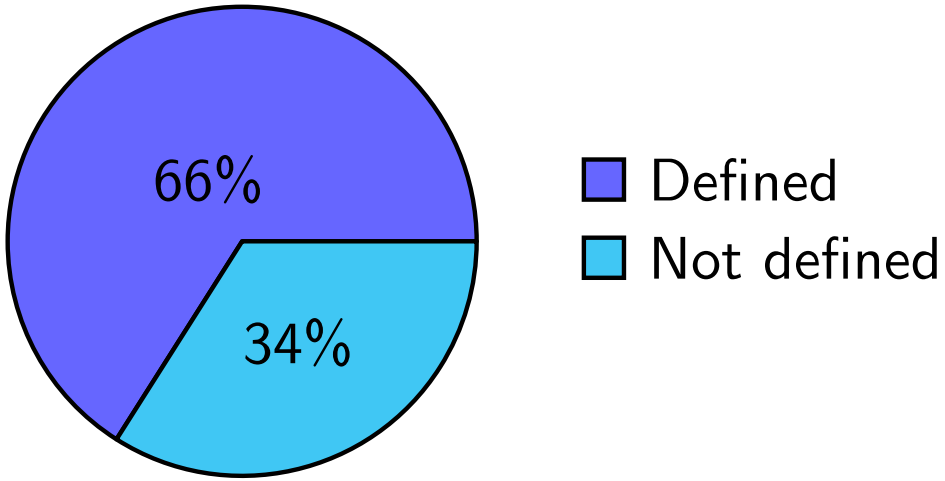
Overview

- 561 test approaches $\rightarrow$
- 77 software qualities
  (may imply test approaches)

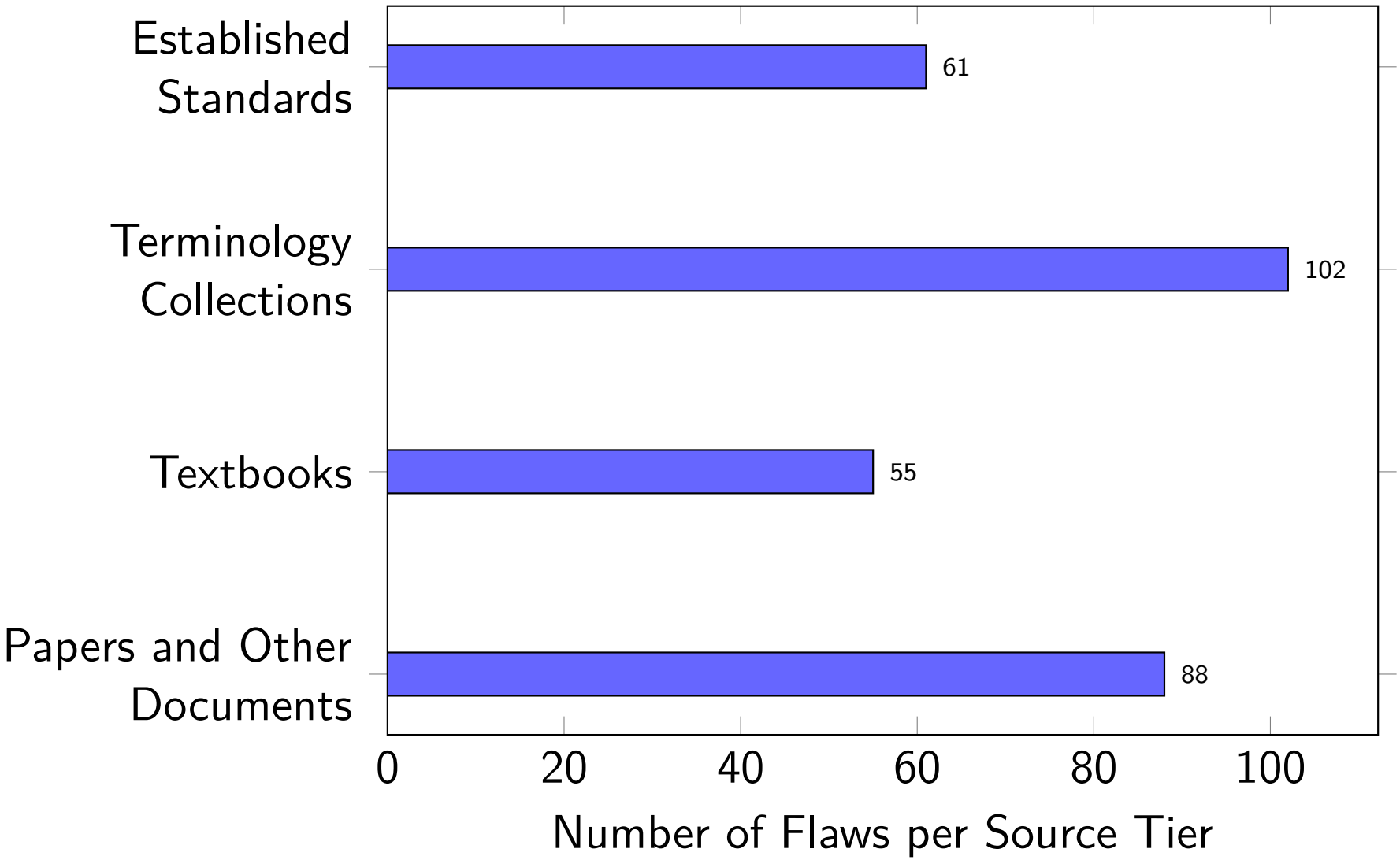


Overview

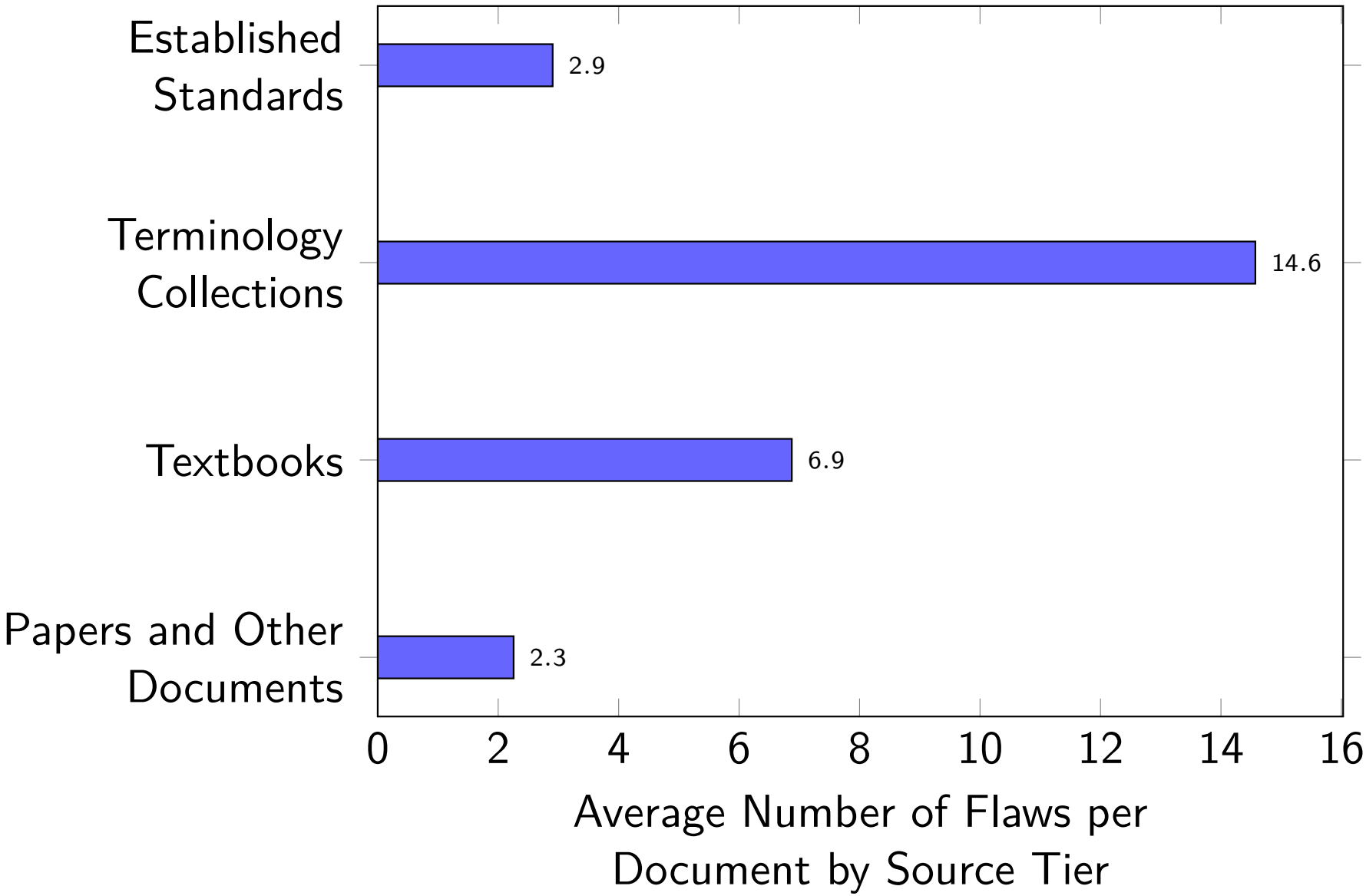
- 561 test approaches $\rightarrow$
- 77 software qualities (may imply test approaches)
- 306 flaws in the software testing literature



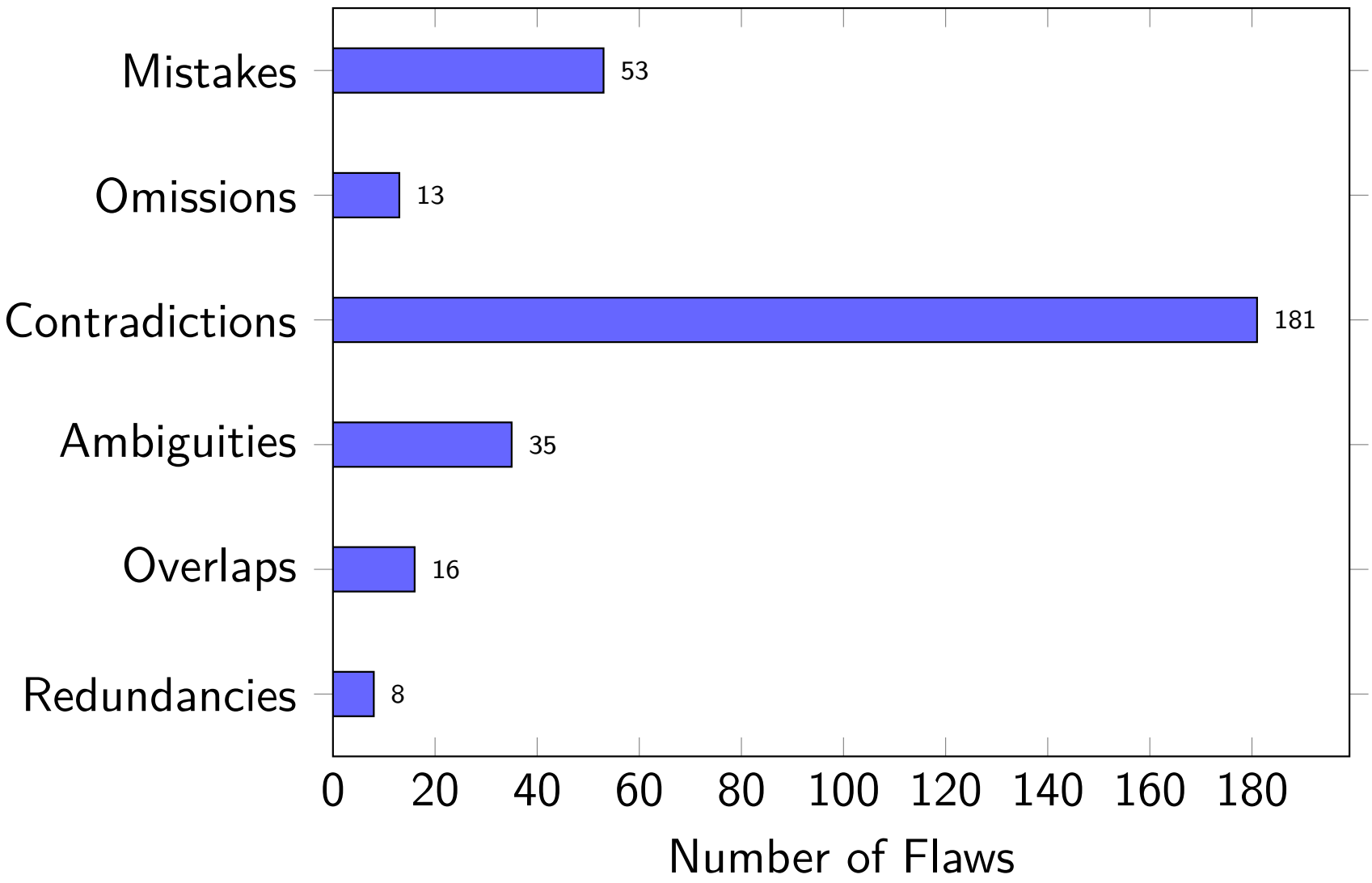
Flaw Summary by Source Tier



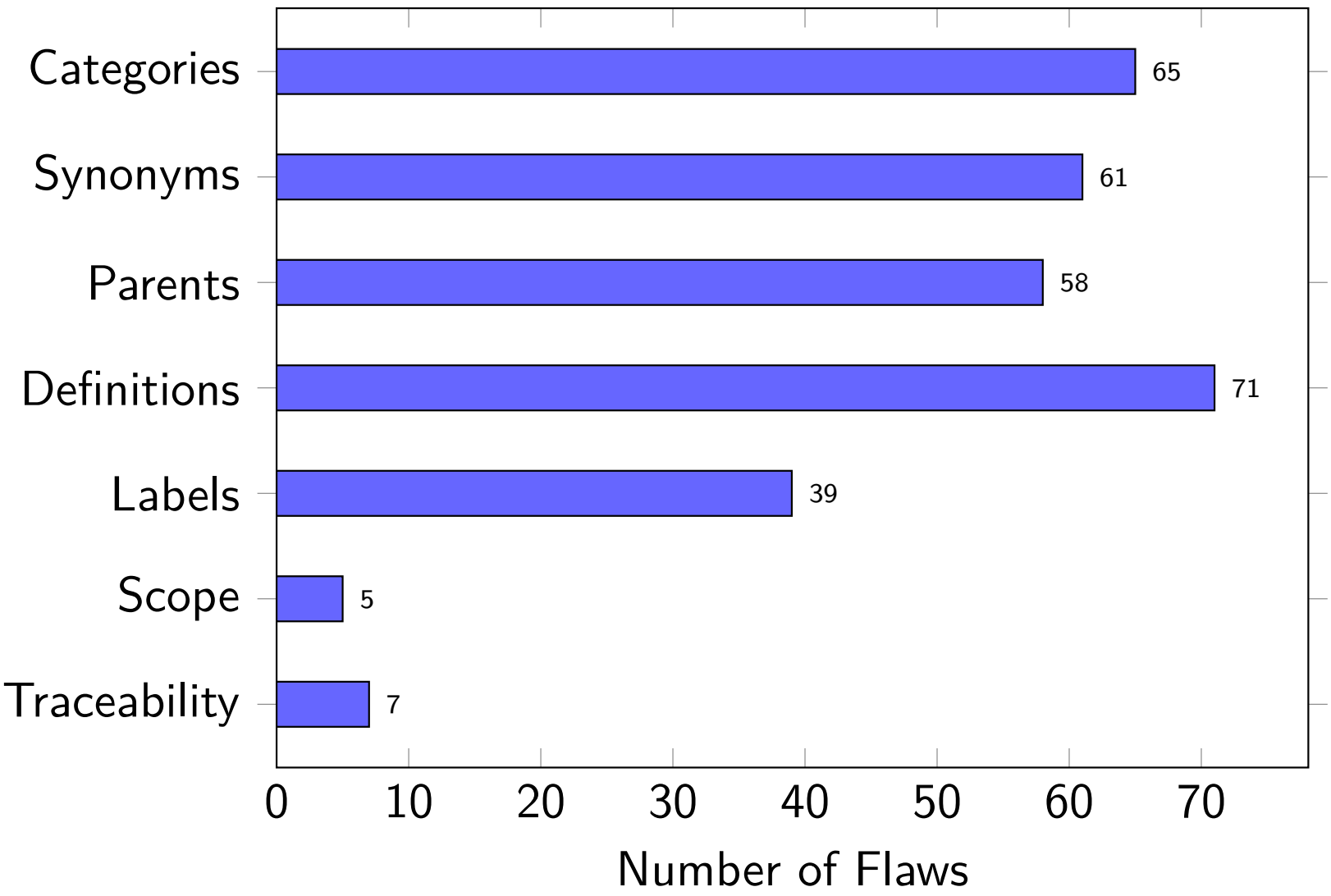
Normalized Flaw Summary



Flaw Summary by Manifestation



Flaw Summary by Domain



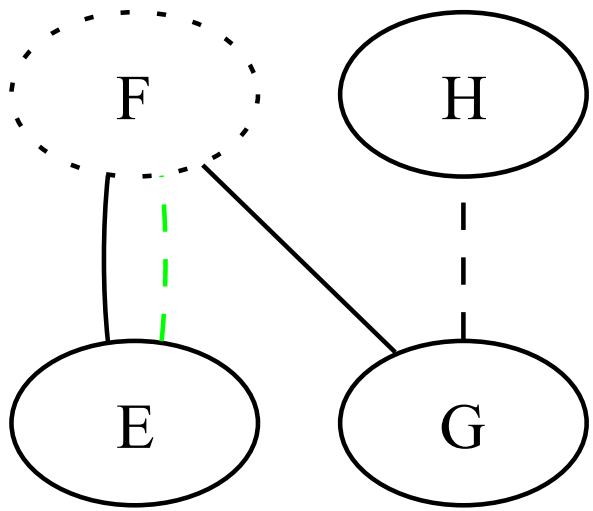
Automated Flaws

- Some terms are given as a synonym to two (or more) disjoint, unrelated terms, making the relation between the given synonyms ambiguous

Automated Flaws

- Some terms are given as a synonym to two (or more) disjoint, unrelated terms, making the relation between the given synonyms ambiguous
- These are included in generated visualizations automatically

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

Prominent examples of these “multi-synonyms”:

1. **Soak Testing:**
   - Endurance Testing
   - Reliability Testing

Source(s)

(ISO/IEC and IEEE, 2021c, p. 39)

(Gerrard, 2000a, Tab. 2; 2000b, Tab. 1, p. 26)

Automated Flaws

Prominent examples of these "multi-synonyms":

	Source(s)
1. **Soak Testing:**	
• Endurance Testing	(ISO/IEC and IEEE, 2021c, p. 39)
• Reliability Testing	(Gerrard, 2000a, Tab. 2; 2000b, Tab. 1, p. 26)
2. **Functional Testing:**	
• Behavioural Testing	(Kam, 2008, p. 45)
• Correctness Testing	(Washizaki, 2024, p. 5-7)
• Specification-based Testing	(ISO/IEC and IEEE, 2017, p. 196; . . .)

Automated Flaws

Prominent examples of these "multi-synonyms":

	Source(s)
1 Soak Testing:	
• Endurance Testing	(ISO/IEC and IEEE, 2021c, p. 39)
• Reliability Testing	(Gerrard, 2000a, Tab. 2; 2000b, Tab. 1, p. 26)
2 Functional Testing:	
• Behavioural Testing	(Kam, 2008, p. 45)
• Correctness Testing	(Washizaki, 2024, p. 5-7)
• Specification-based Testing	(ISO/IEC and IEEE, 2017, p. 196; . . .)
3 Link Testing:	
• Branch Testing	(implied by ISO/IEC and IEEE, 2021c, p. 24)
• Component Integration Testing	(Kam, 2008, p. 45)
• Integration Testing	(implied by Gerrard, 2000a, p. 13)

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- The past and current Drasil team have created a truly amazing framework!

Thank you!

Questions?

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