Putting Software Testing Terminology to the Test

M.A.Sc. Seminar

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Fall 2024

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1. Introduction
   - The Need for Standardized Terminology
   - The Lack of Standardized Terminology
2. Project
   - Research Questions
   - Methodology
3. Discrepancies

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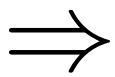
The Need for Standardized Terminology

- Engineering is applied science
- Scientific fields use precise terminology

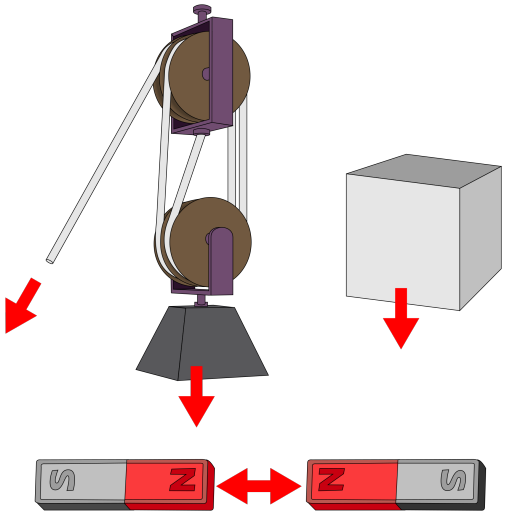


SOFTWARE ENGINEERING

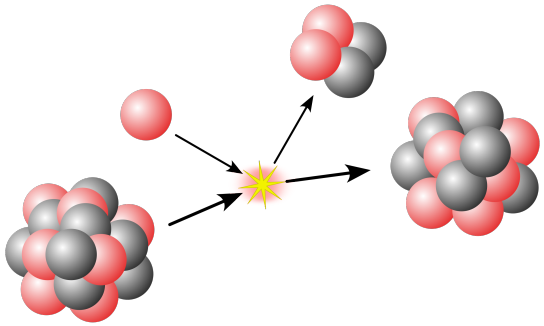
The Need for Standardized Terminology

- Engineering is applied science
- Scientific fields use precise terminology

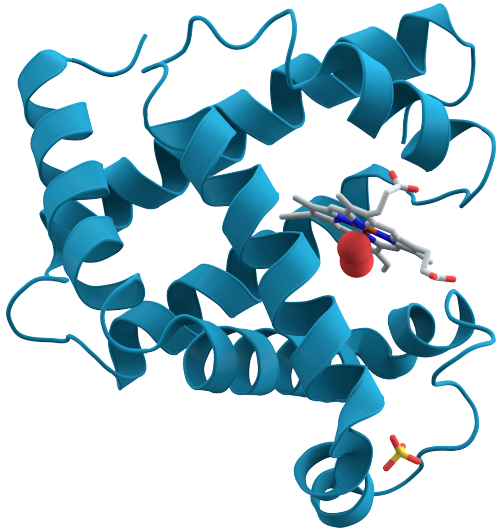
$\Rightarrow$ SOFTWARE ENGINEERING



Penubag and Ramey (2010)



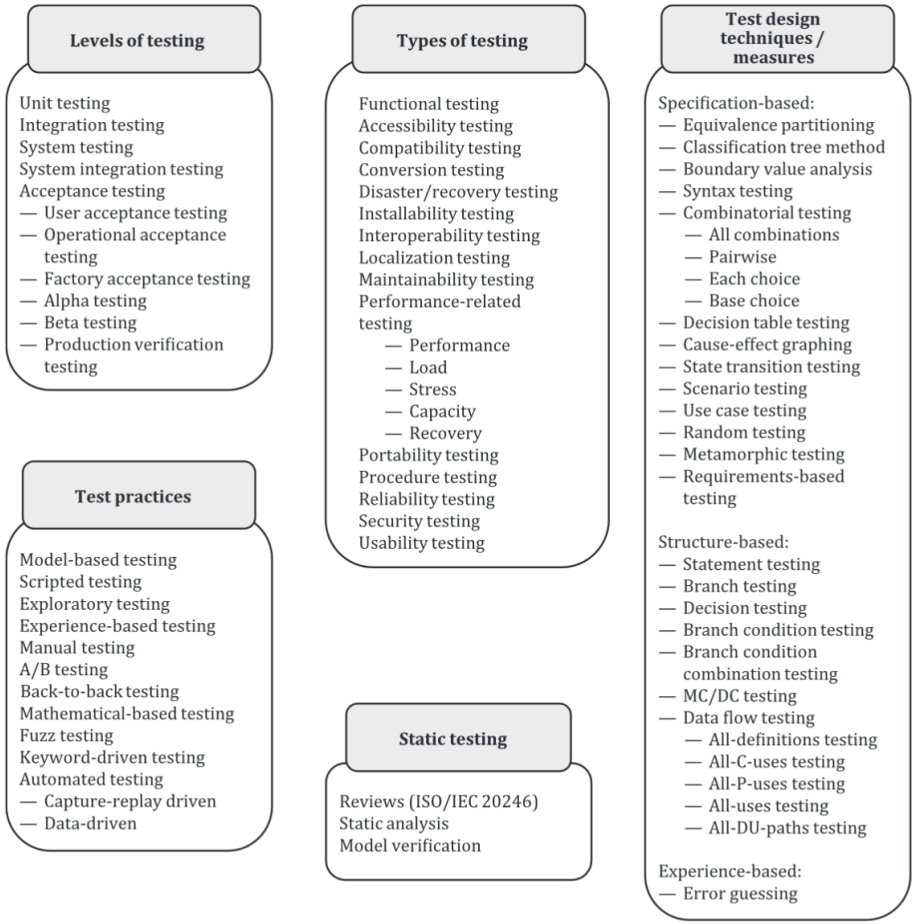
Kjerish (2016)



AzaToth (2008)

The Lack of Standardized Terminology

"The Problem"



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

The Lack of Standardized Terminology

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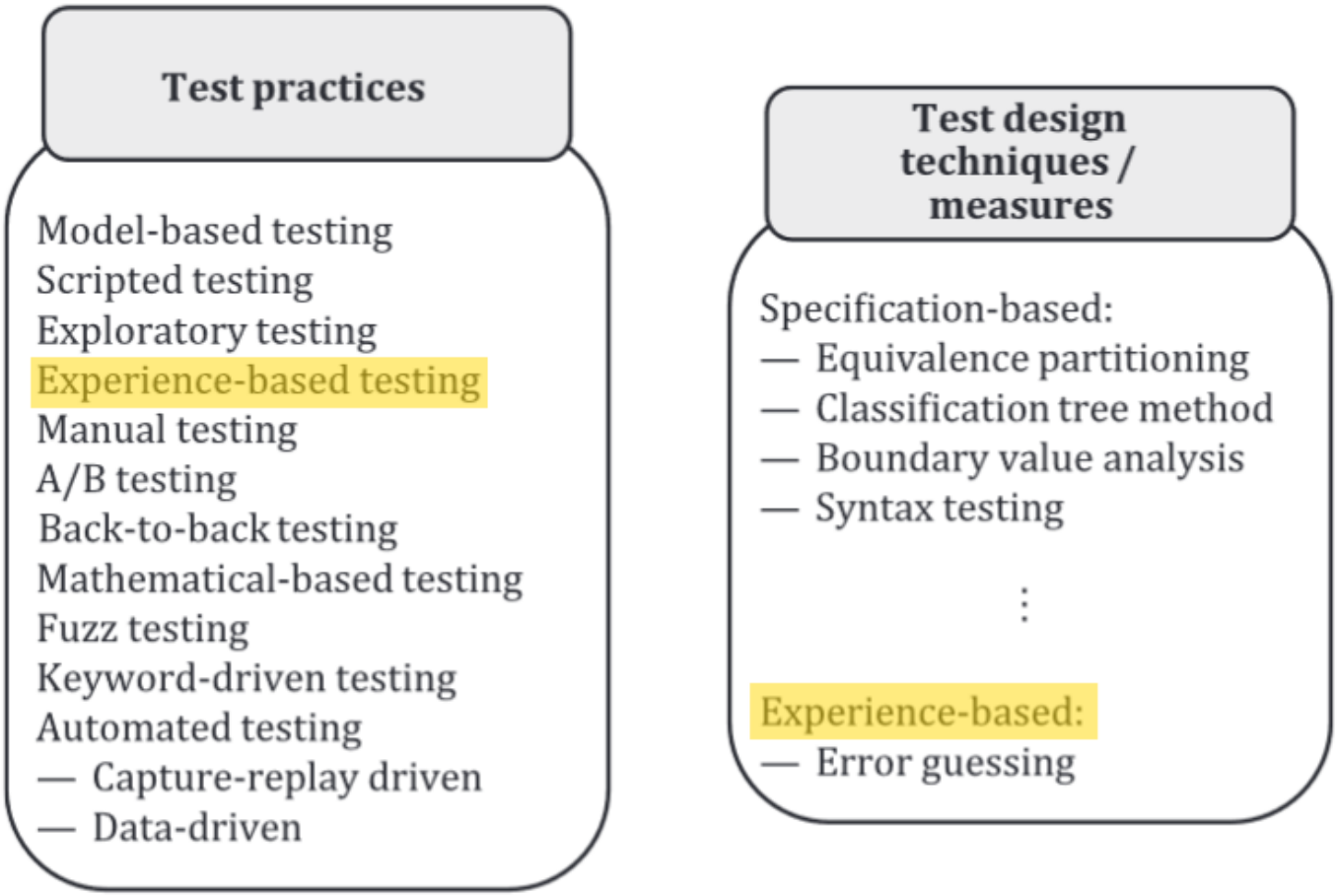


Adapted from (ISO/IEC and IEEE, 2022, Fig. 2)

The Lack of Standardized Terminology

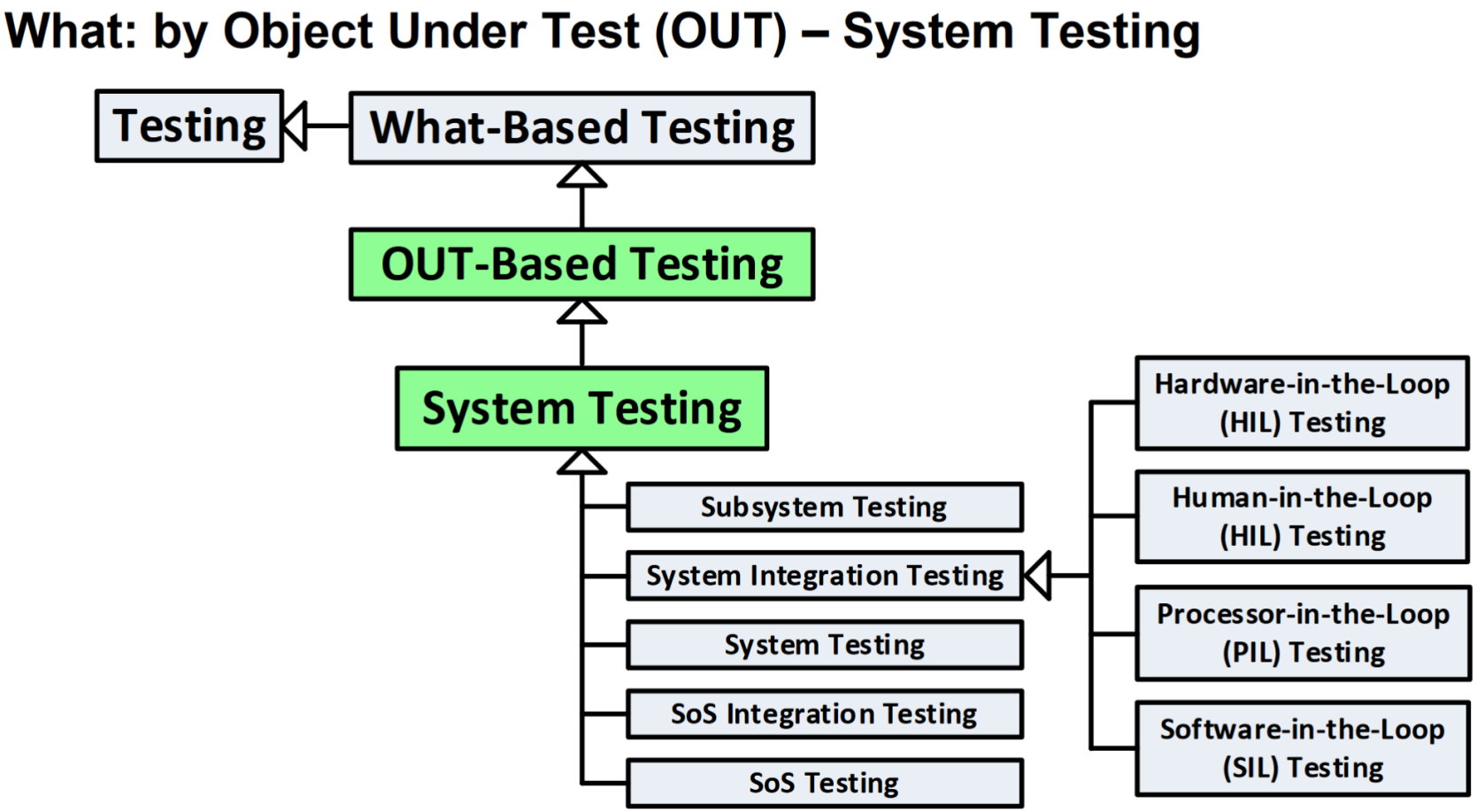
"The Problem"

ISO/IEC/IEEE 29119-4 describes the experience-based test design technique of error guessing. Other experience-based test practices include (but are not limited to) exploratory testing (see 4.4.3.3), tours, attacks, and checklist-based testing.

Adapted from (ISO/IEC and IEEE, 2022, p. 34)

The Lack of Standardized Terminology

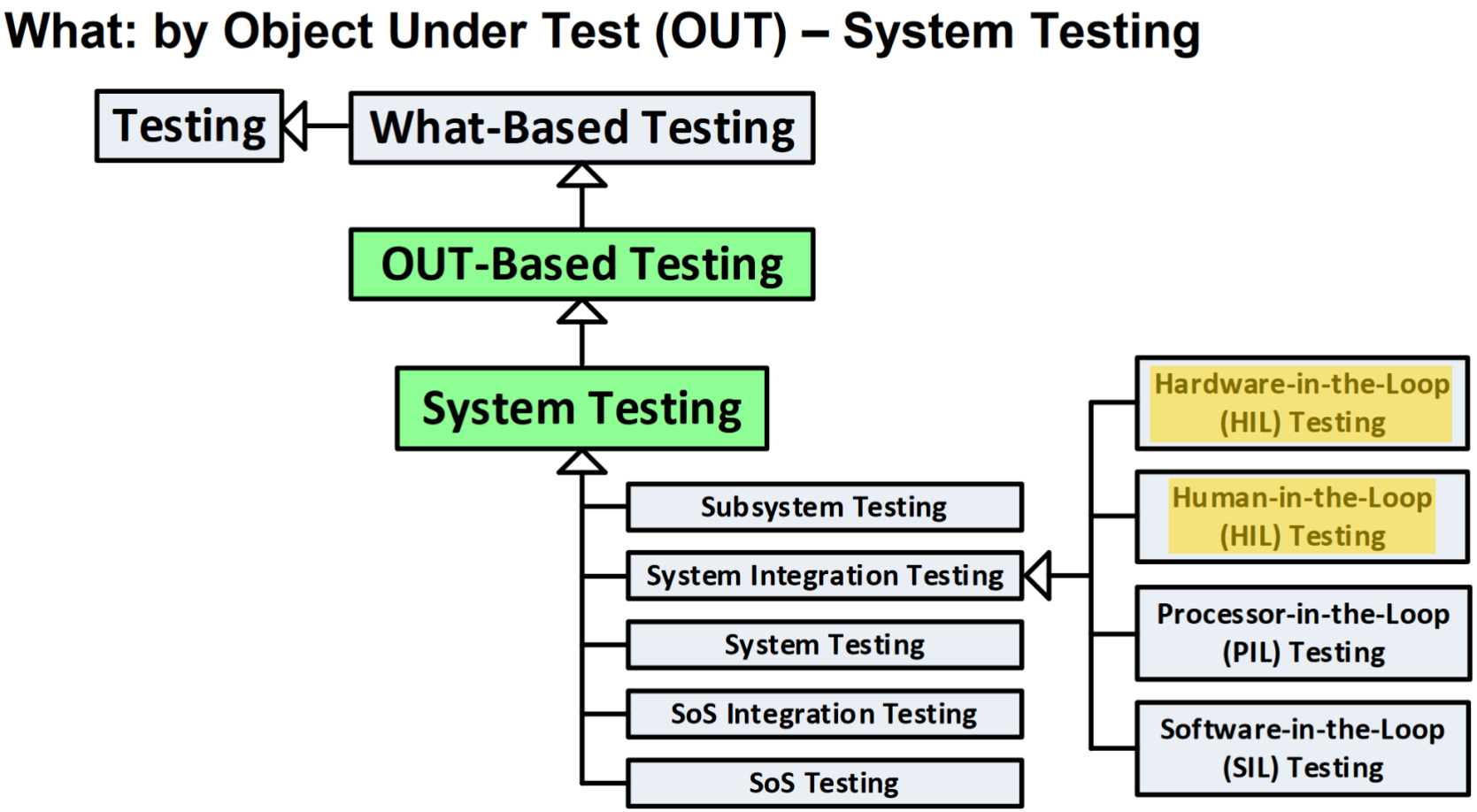
"The Problem" (cont.)



(Firesmith, 2015, p. 23)

The Lack of Standardized Terminology

"The Problem" (cont.)



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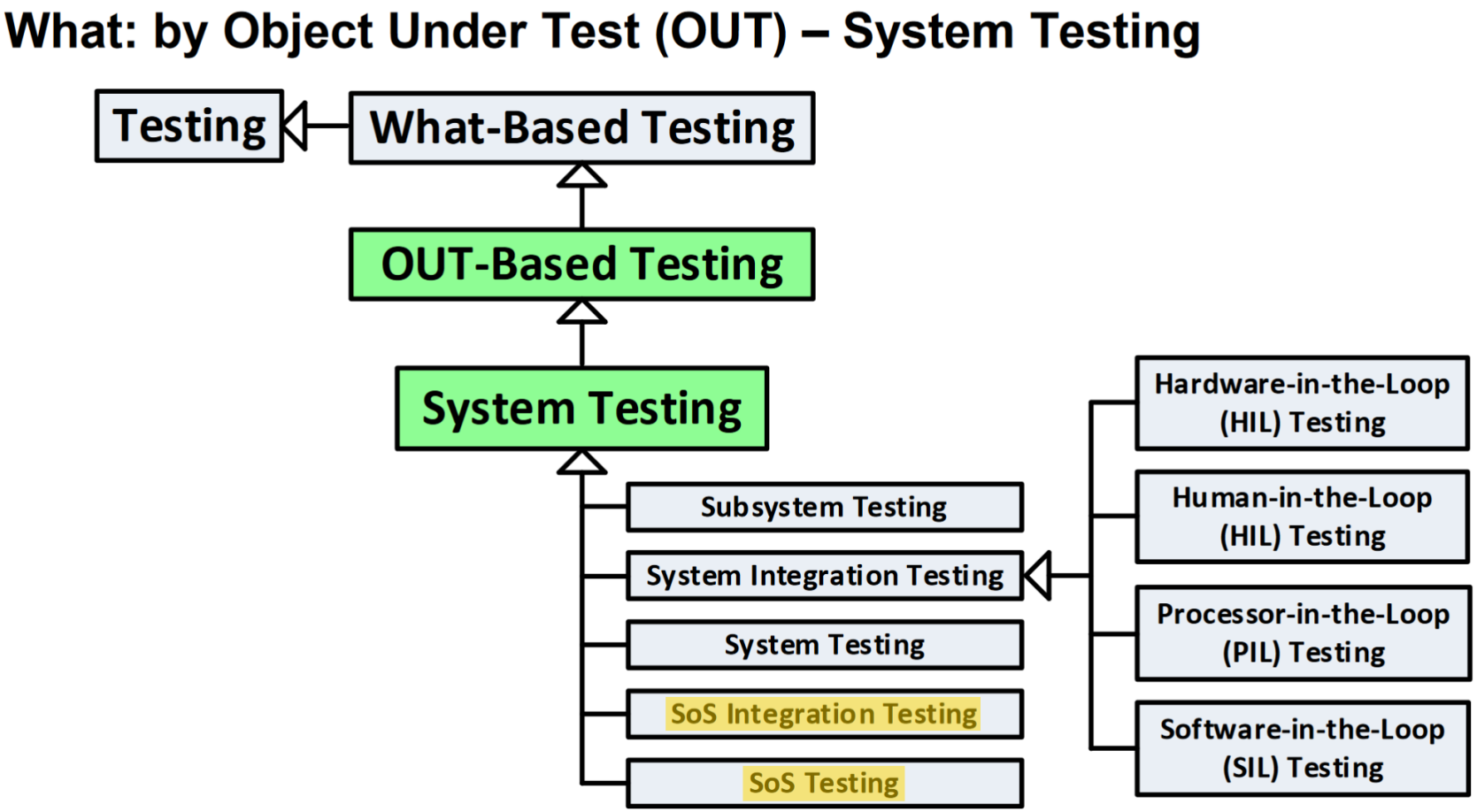

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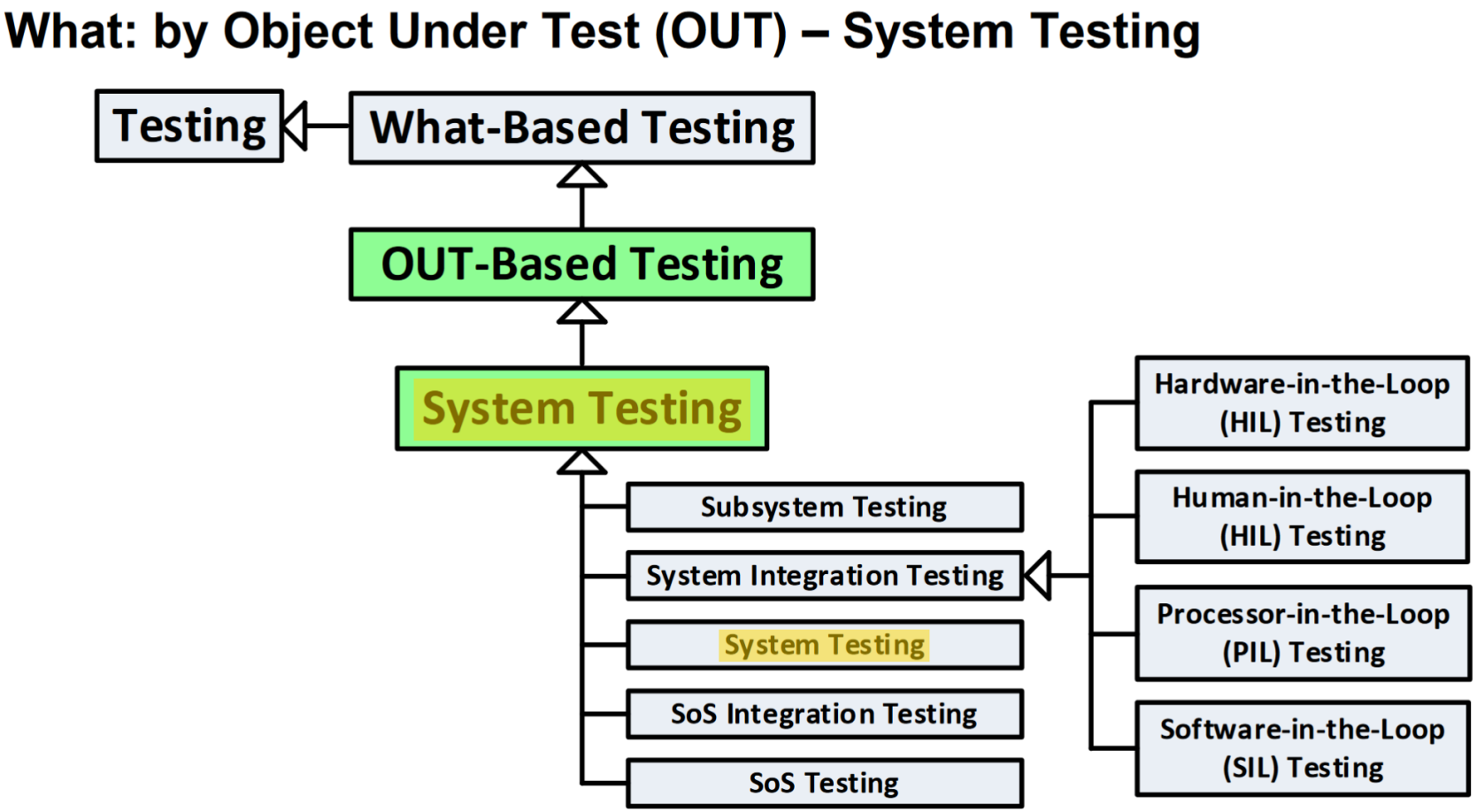

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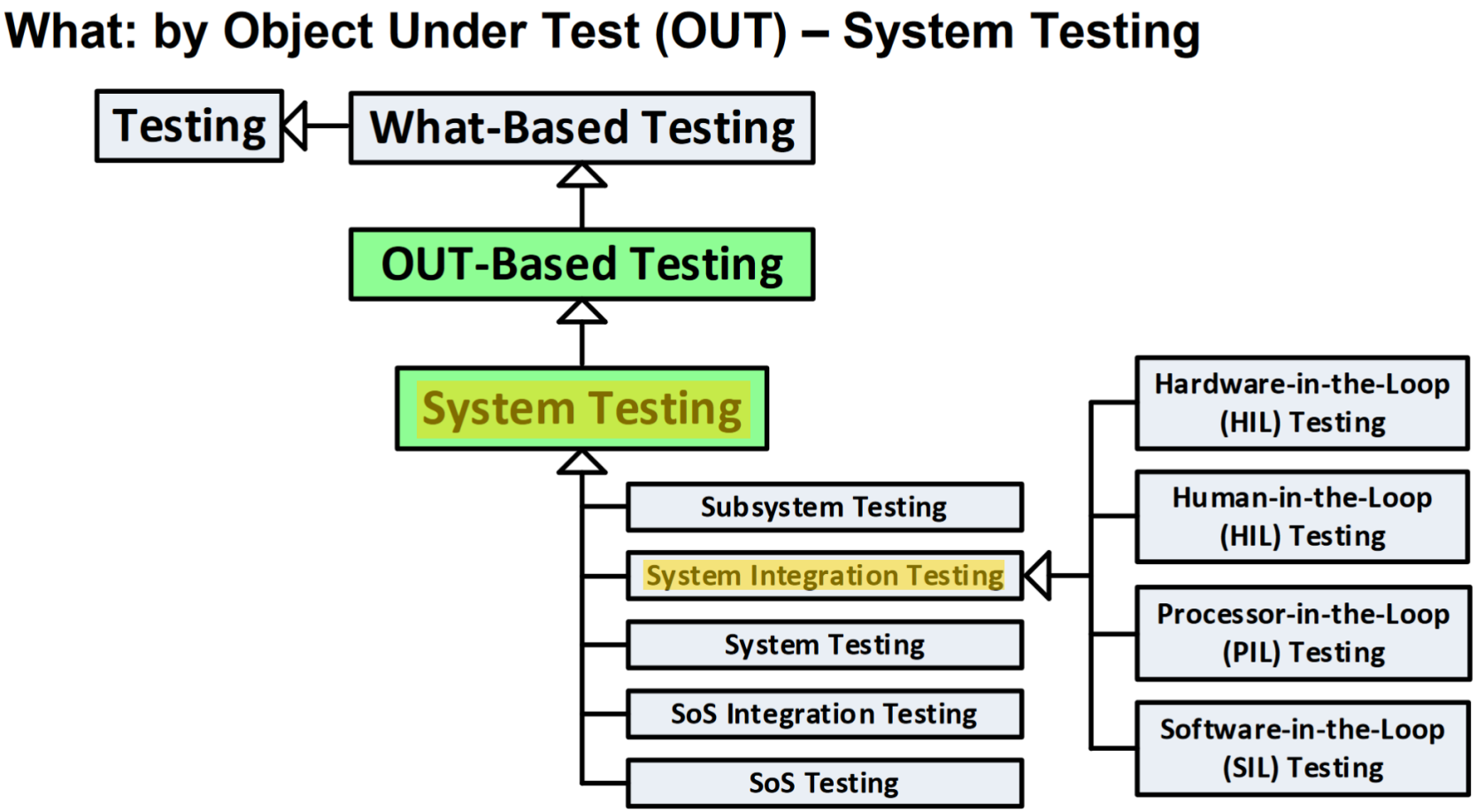

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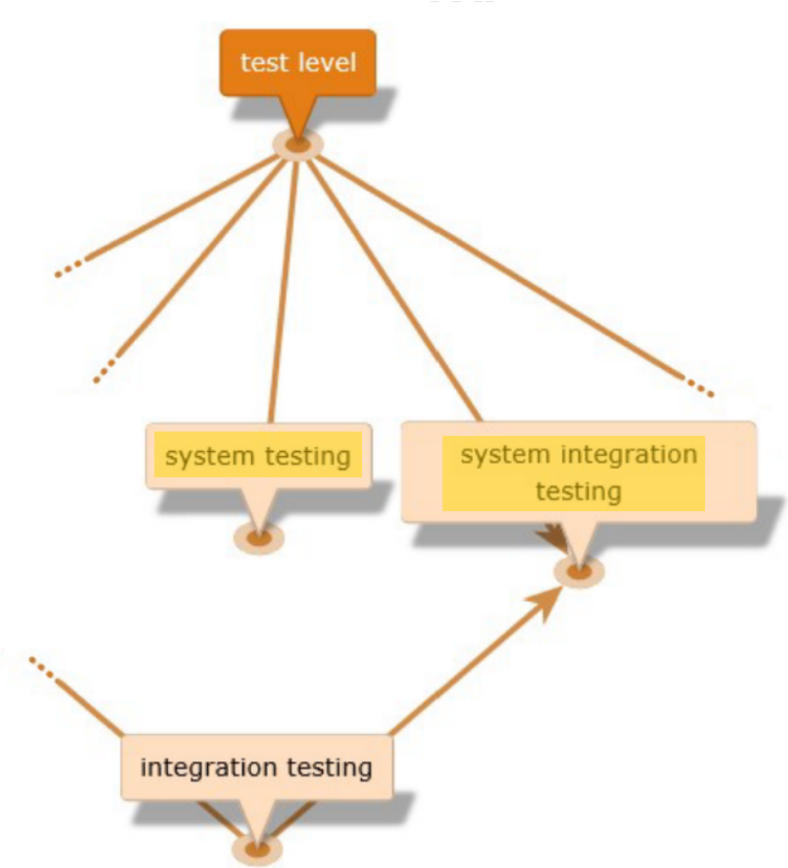
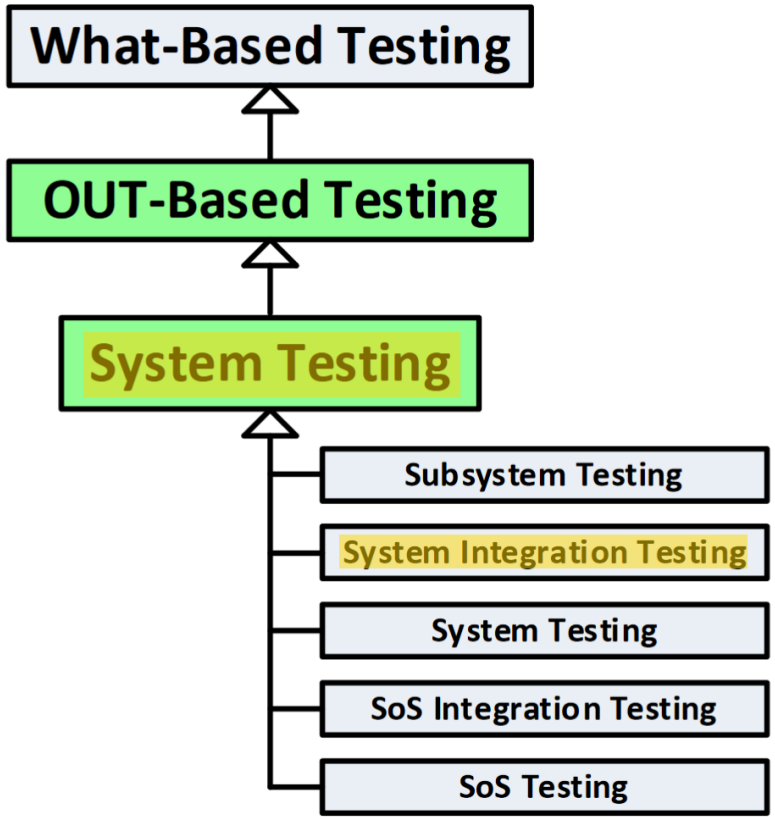


Adapted from (Hamburg and Mogyorodi, 2024)



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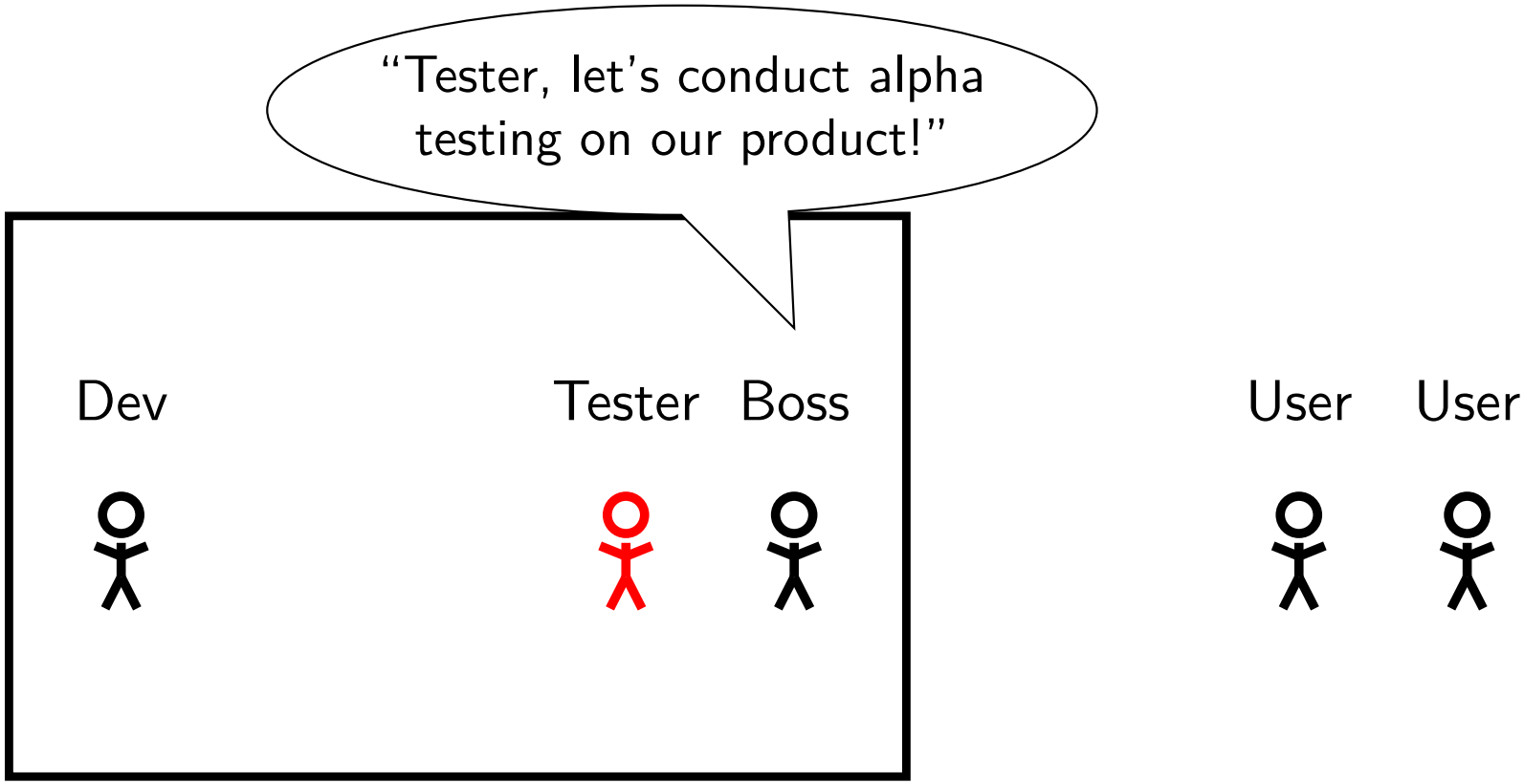

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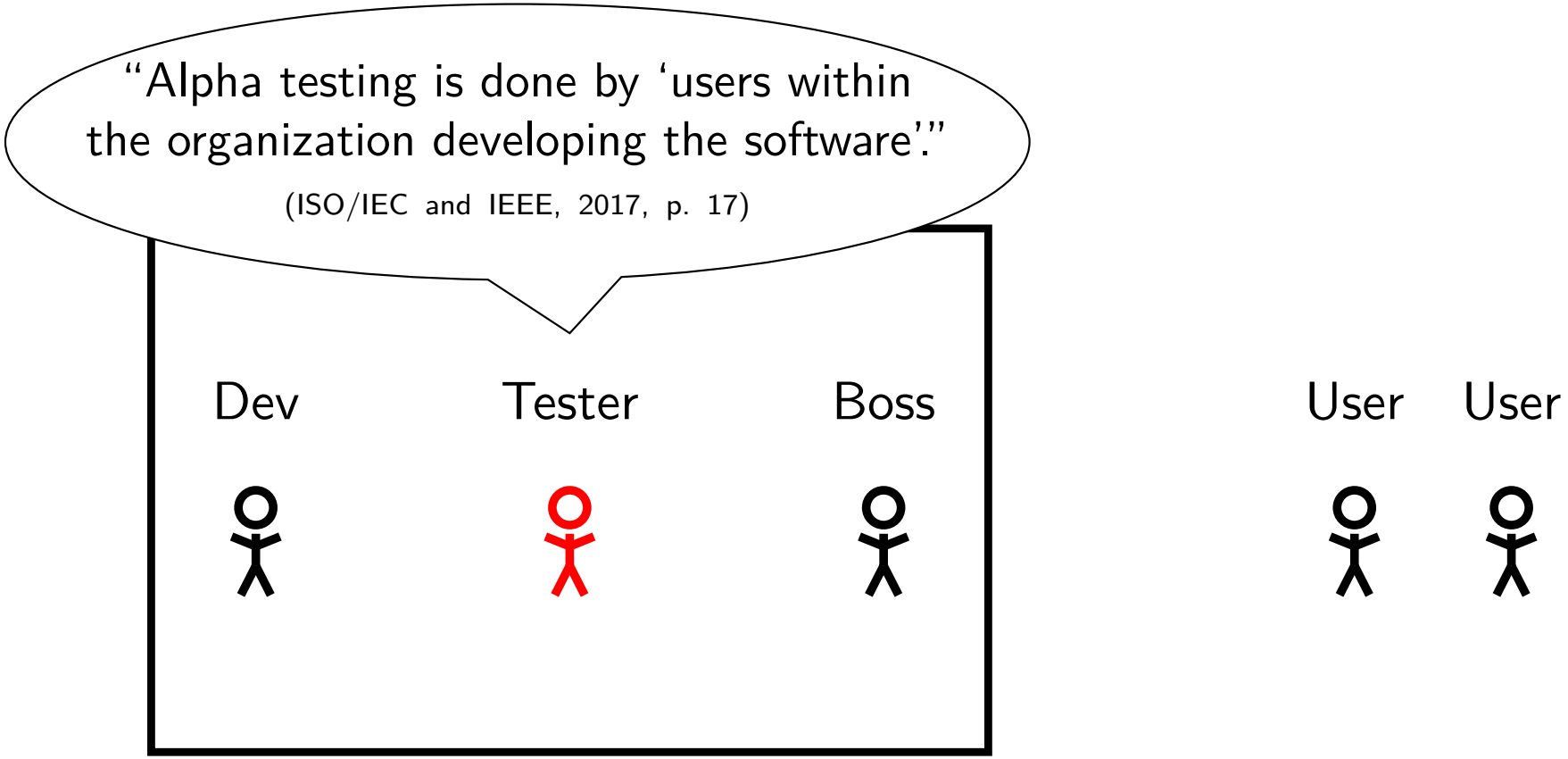

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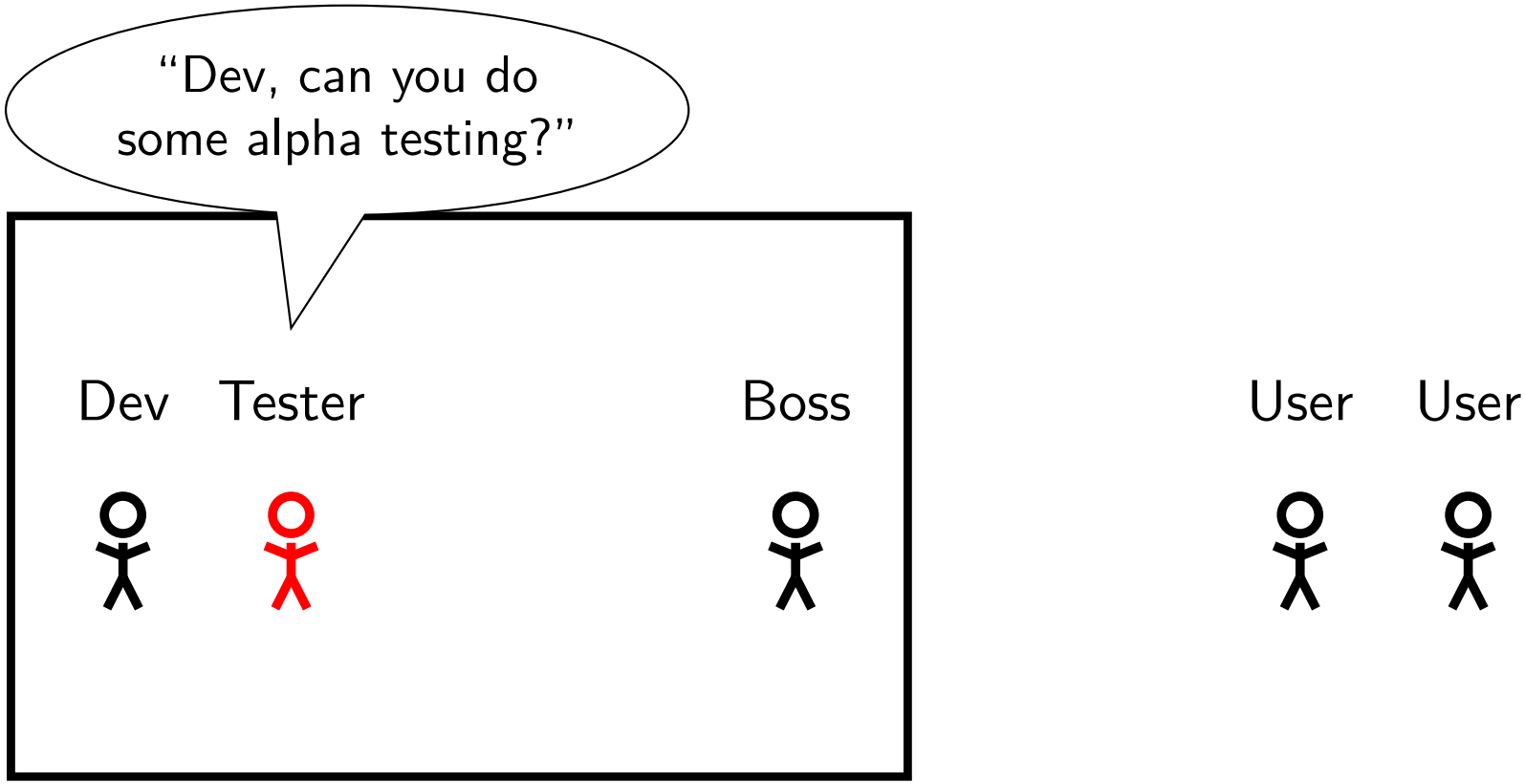

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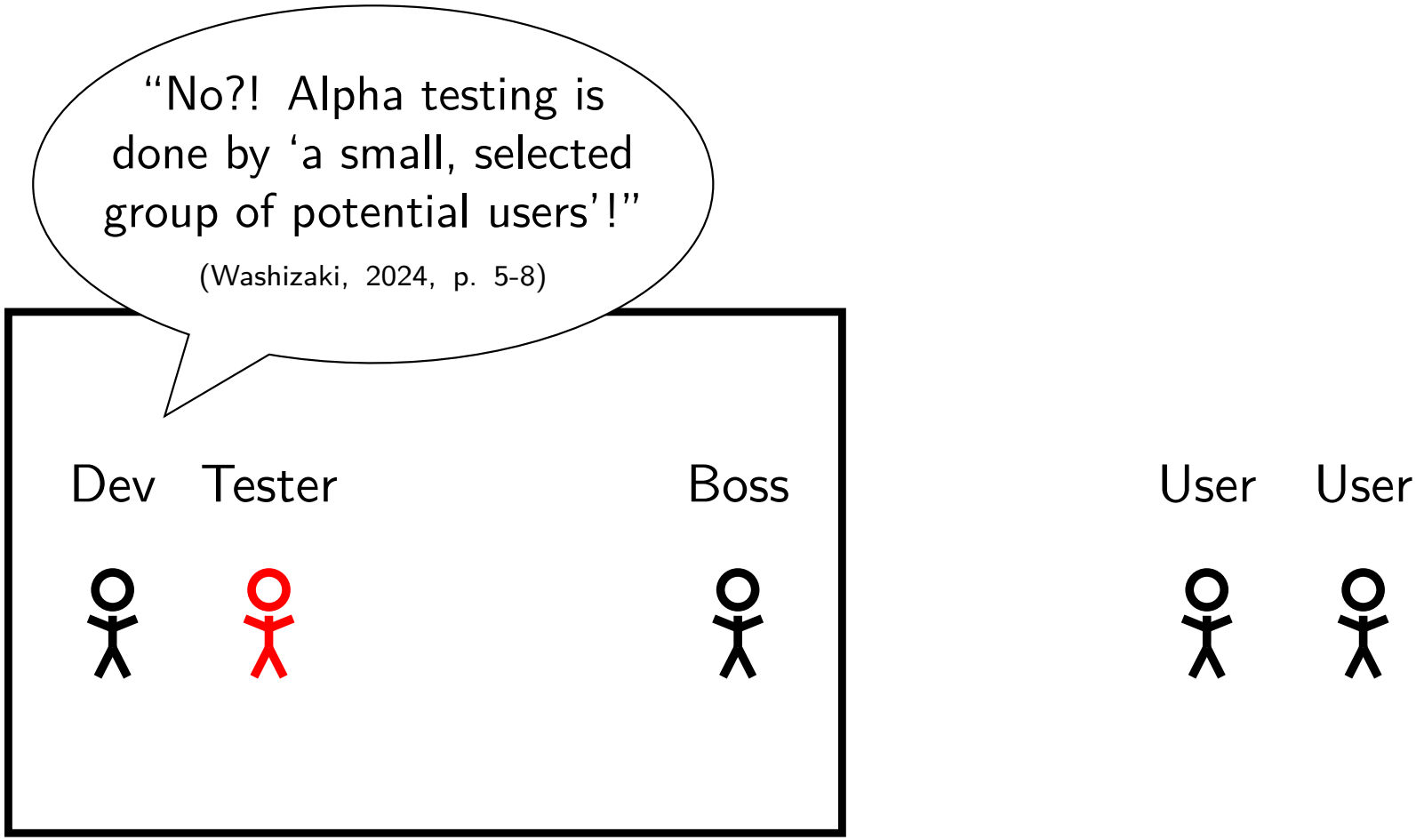

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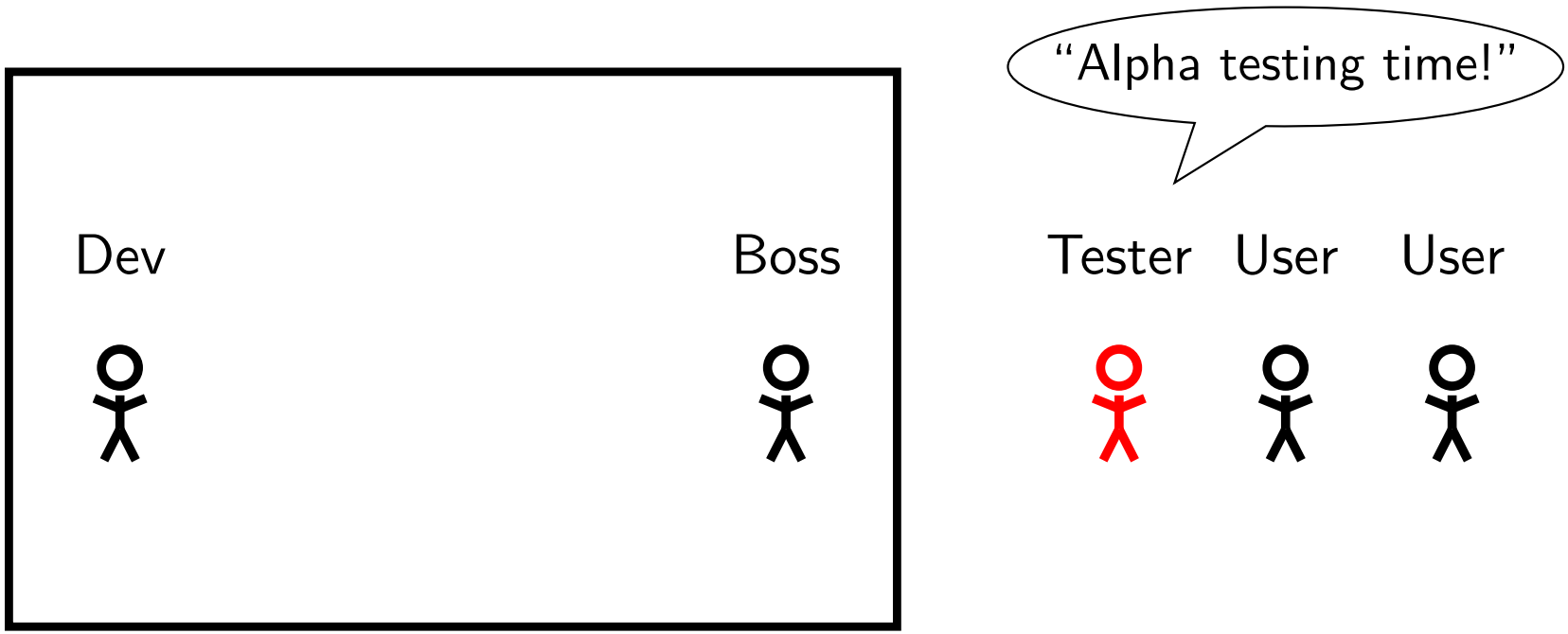

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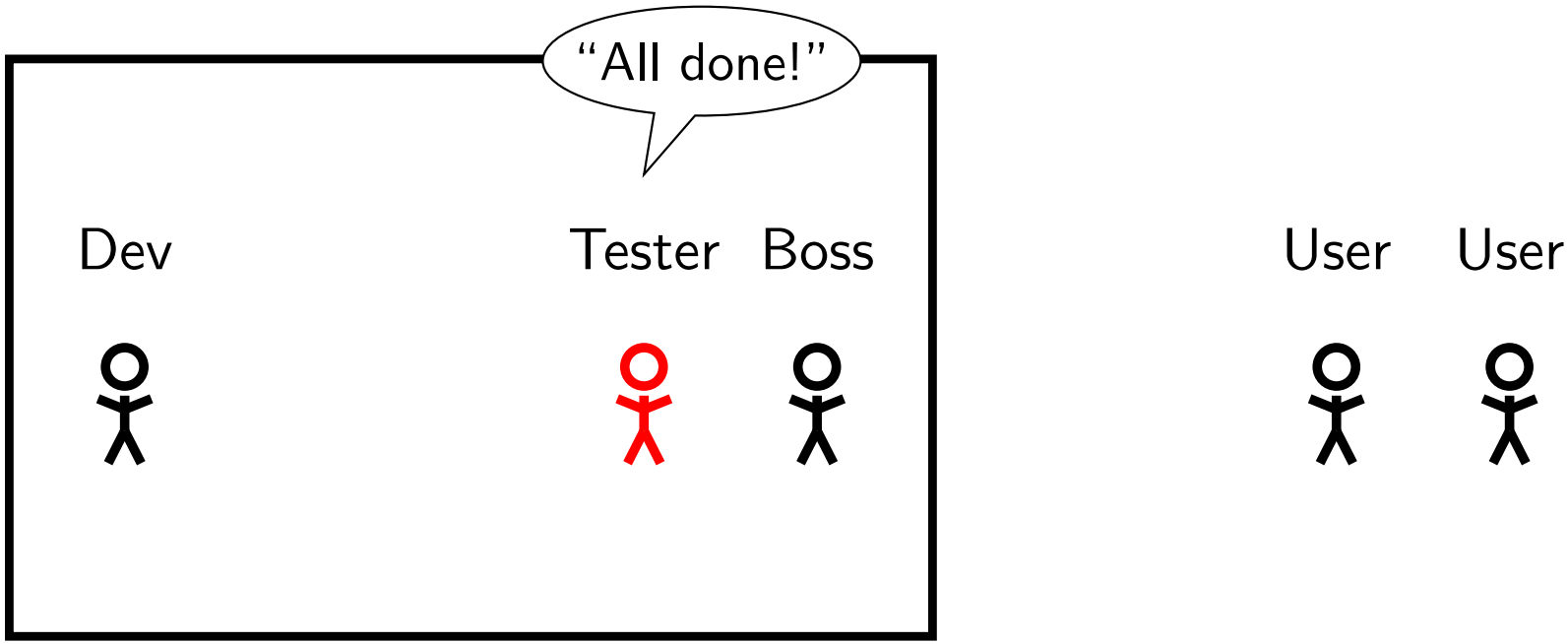

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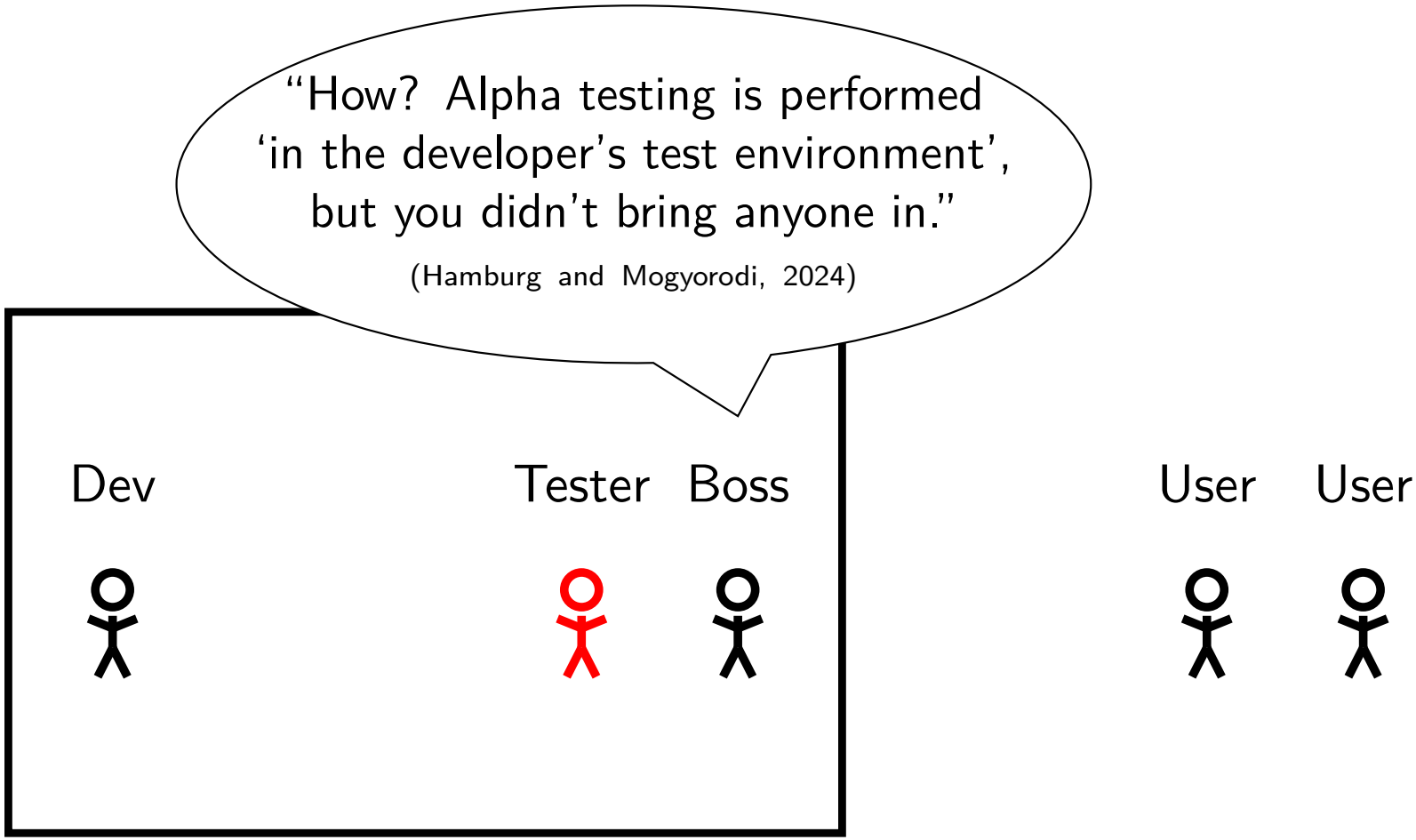
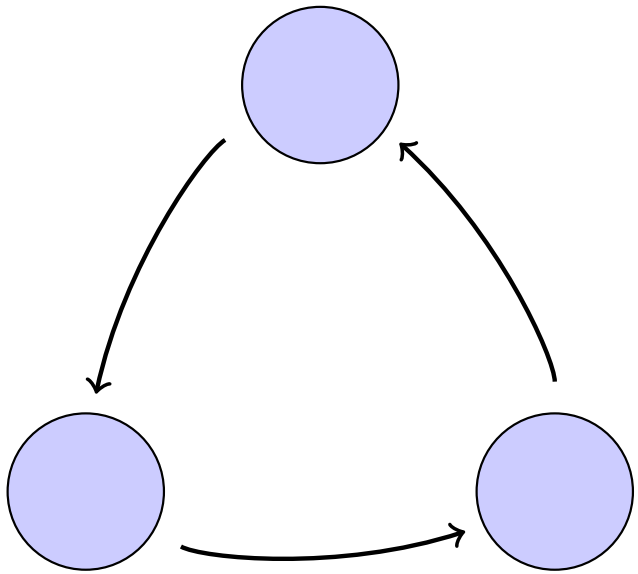


Interorganizational

Schools, companies, etc.



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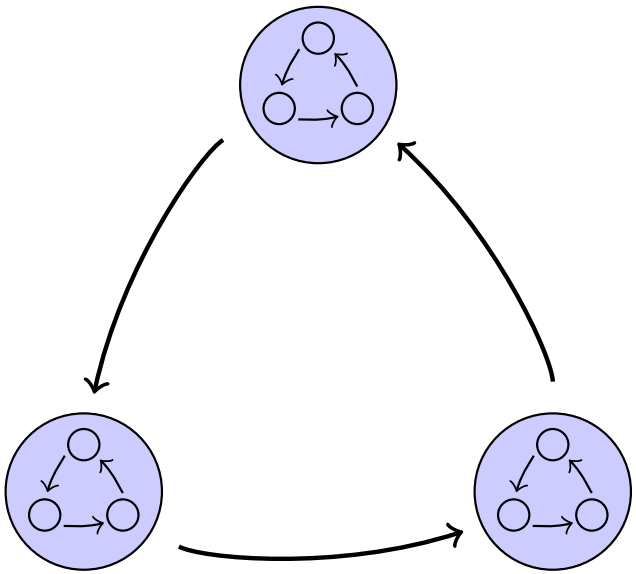

Intraorganizational

"Complete testing" could require the tester to:

- discover every bug,
- exhaust the time allocated,
- implement every planned test,
- . . . (Kaner et al., 2011, p. 7)

Taxonomies to the Rescue?

"The Problem" (cont.)

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

Taxonomies to the Rescue?

"The Problem" (cont.)

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Focus on:

The Testing Process
Organizing Terminology
Relations between Approaches
Traceability between Stages

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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
2. Identify software testing terminology from each source, focusing on test approaches and software qualities
3. For each test approach, record its:
    1. Name
    2. Category
    3. Definition
    4. Synonyms
    5. Parents
    6. Other relevant notes
4. Repeat steps 1 to 3 for any missing or unclear terminology

Research Question 2

Are these descriptions consistent?

5. Analyze these data for discrepancies
    1. Record discrepancies as they arise during data collection
    2. Generate relation graphs
    3. Automatically detect certain classes of discrepancies
    4. Automatically analyze manually recorded discrepancies from step 1
6. Report results of discrepancy analysis

Research Question 3

Can we systematically resolve any of these inconsistencies?

7. Seek to resolve these discrepancies

- A row is created for each test approach

Name	Category	Definition	Parent(s)	Synonym(s)
A/B Testing	Practice (p. 22)	Testing "that allows testers to determine which of two systems or components performs better" (p. 1)	Statistical Testing (pp. 1, 35), ...	Split-Run Testing (pp. 1, 35)

Information from (ISO/IEC and IEEE, 2022)

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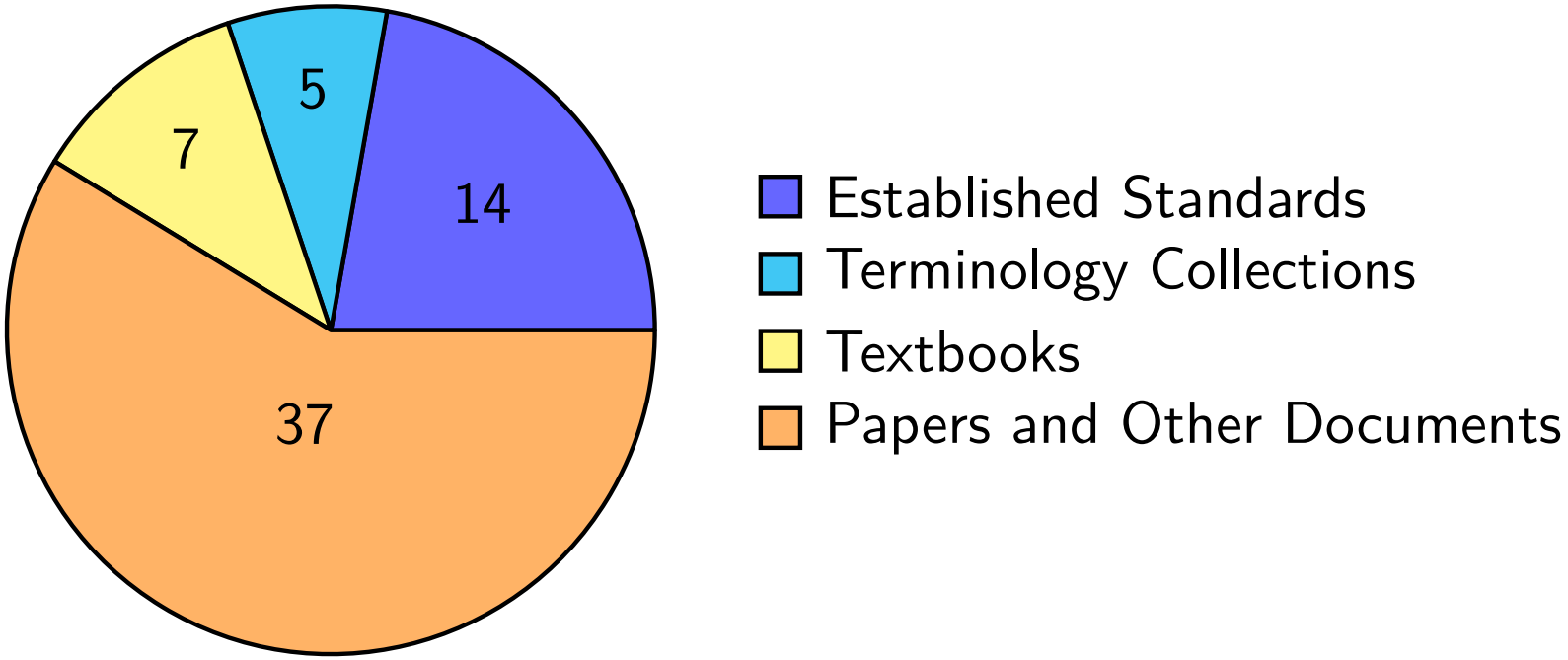
Information from (ISO/IEC and IEEE, 2022)

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

Methodology

Sources

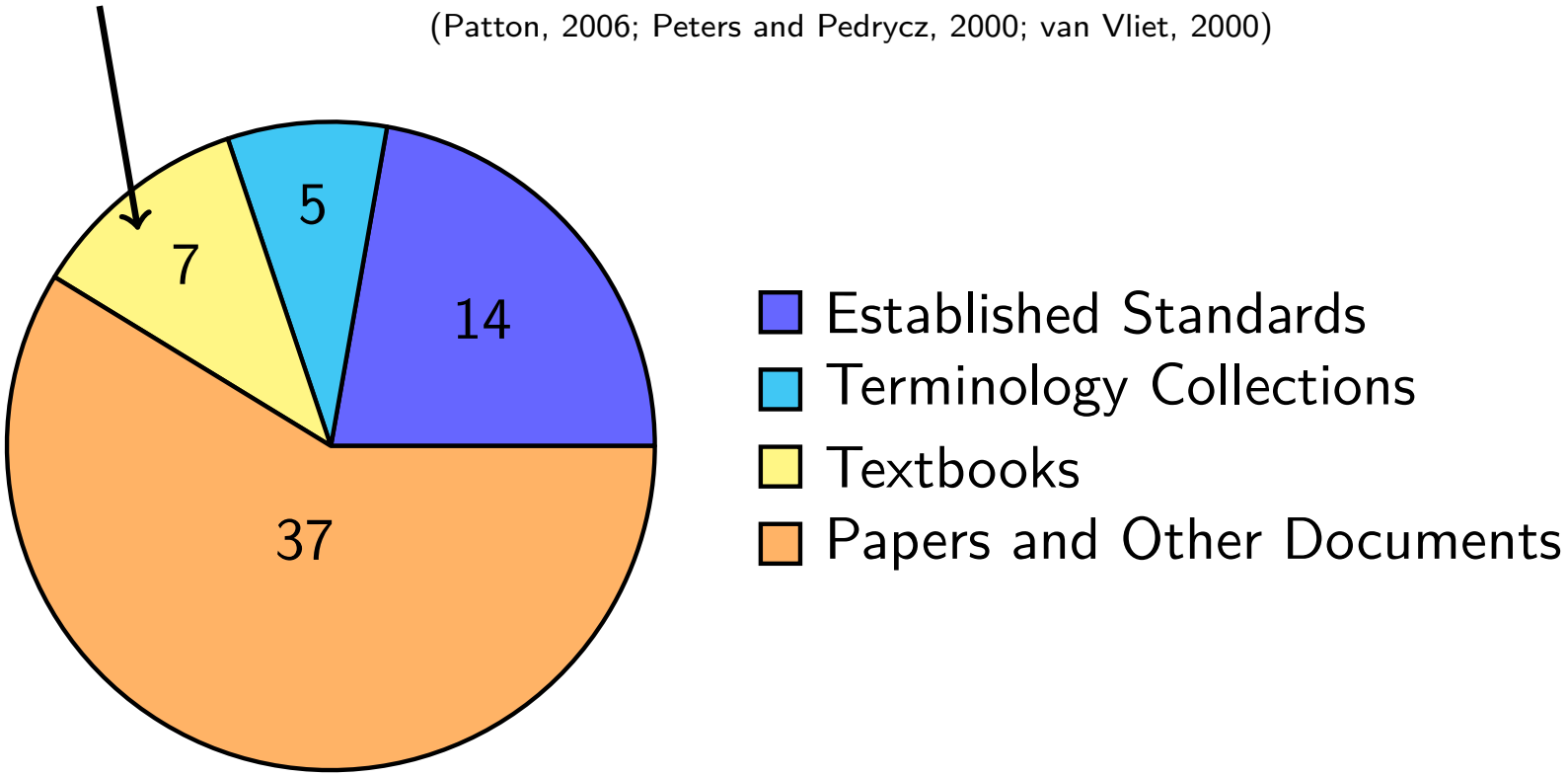


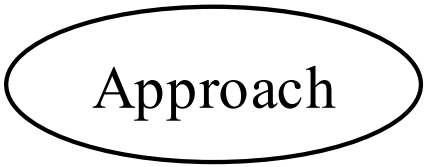
Methodology

Sources

Textbooks trusted at McMaster were our ad hoc starting points

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

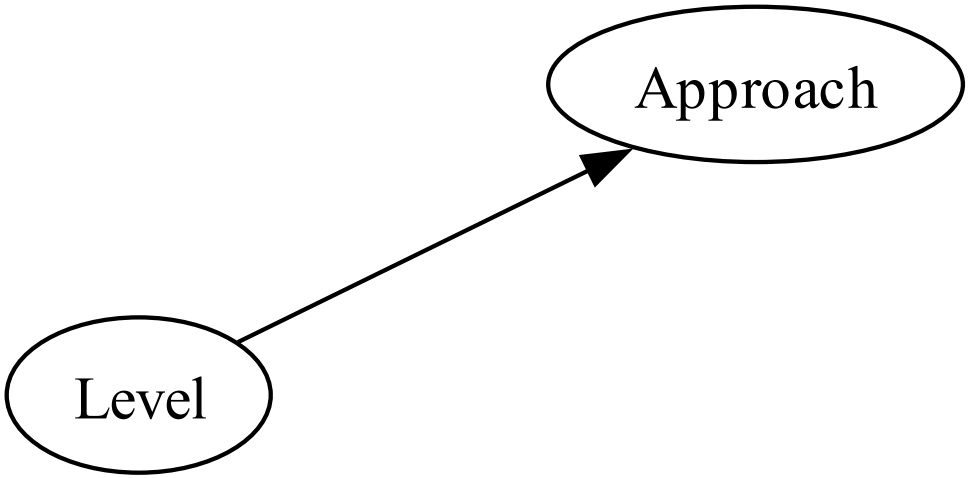




Approach: a "high-level test implementation choice" (ISO/IEC and IEEE, 2022, p. 10) used to "pick the particular test case values" (2017, p. 465)

Methodology

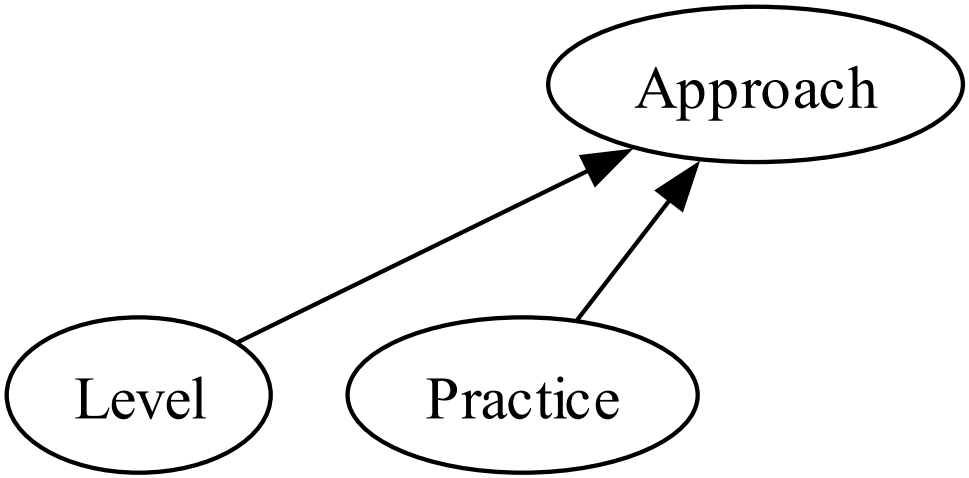
Categories



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

Methodology

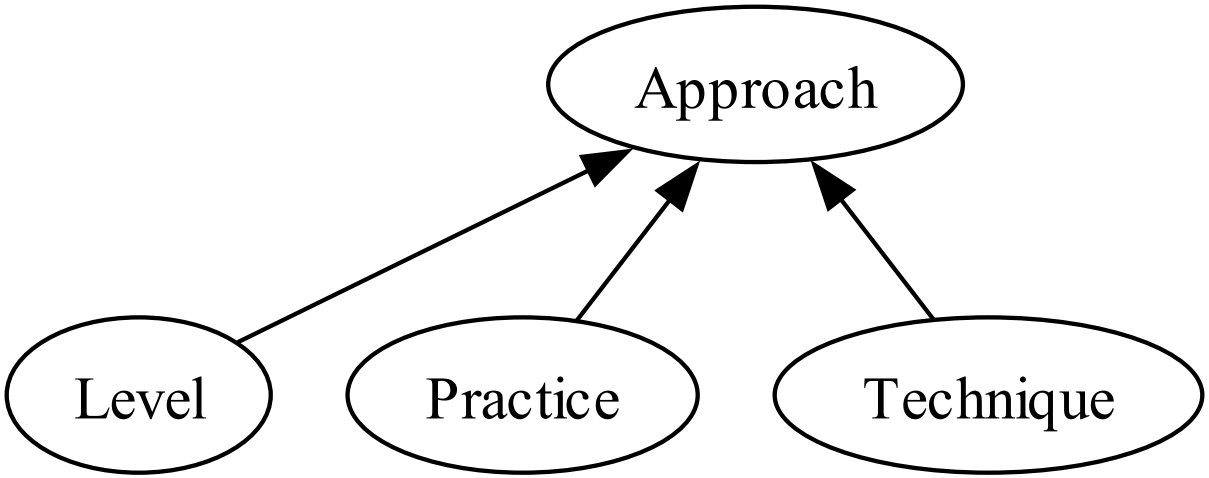
Categories



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

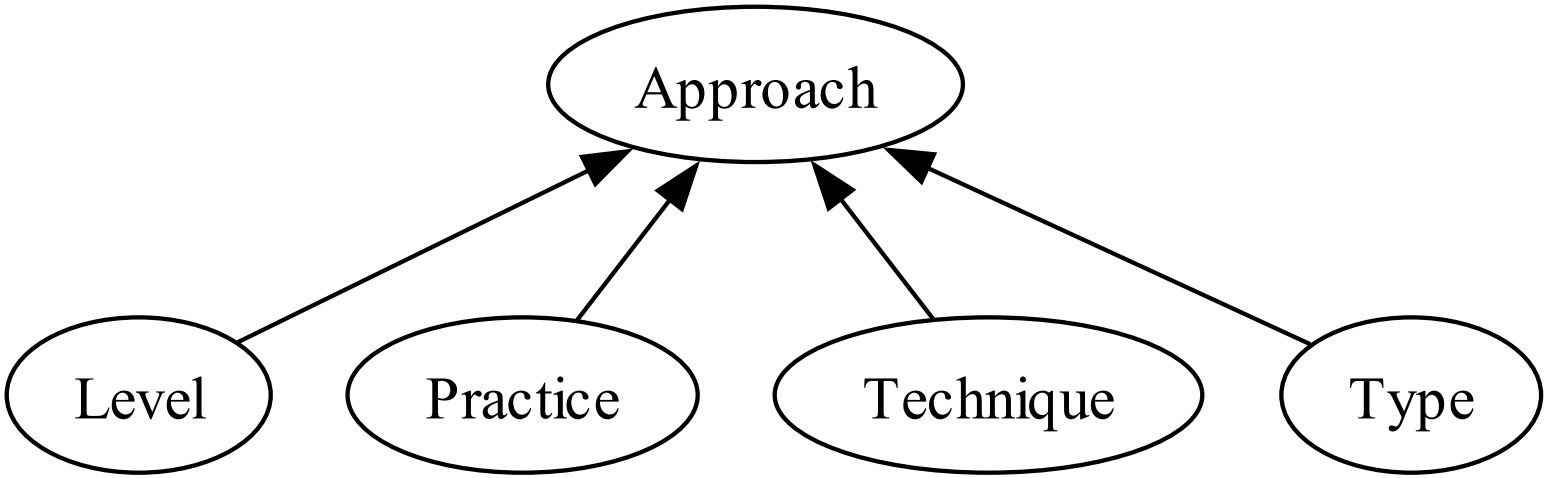
Categories



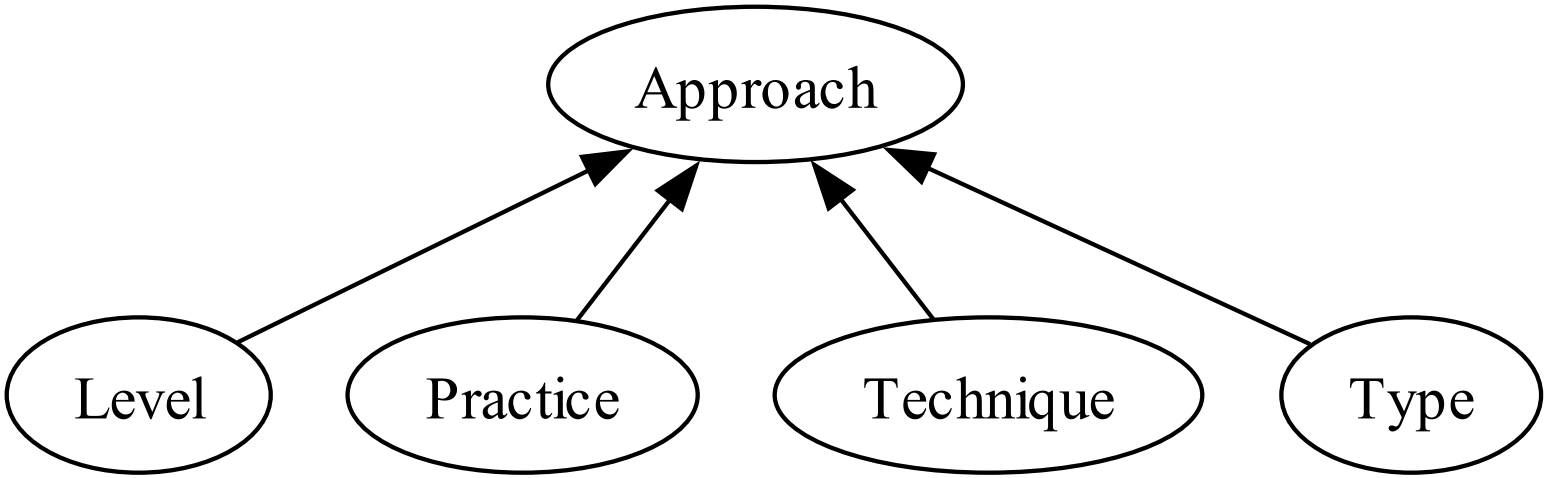
Technique: a "defined" and "systematic" (ISO/IEC and IEEE, 2017, p. 464) "procedure used to create or select a test model, identify test coverage items, and derive corresponding test cases" (2022, p. 11)

Methodology

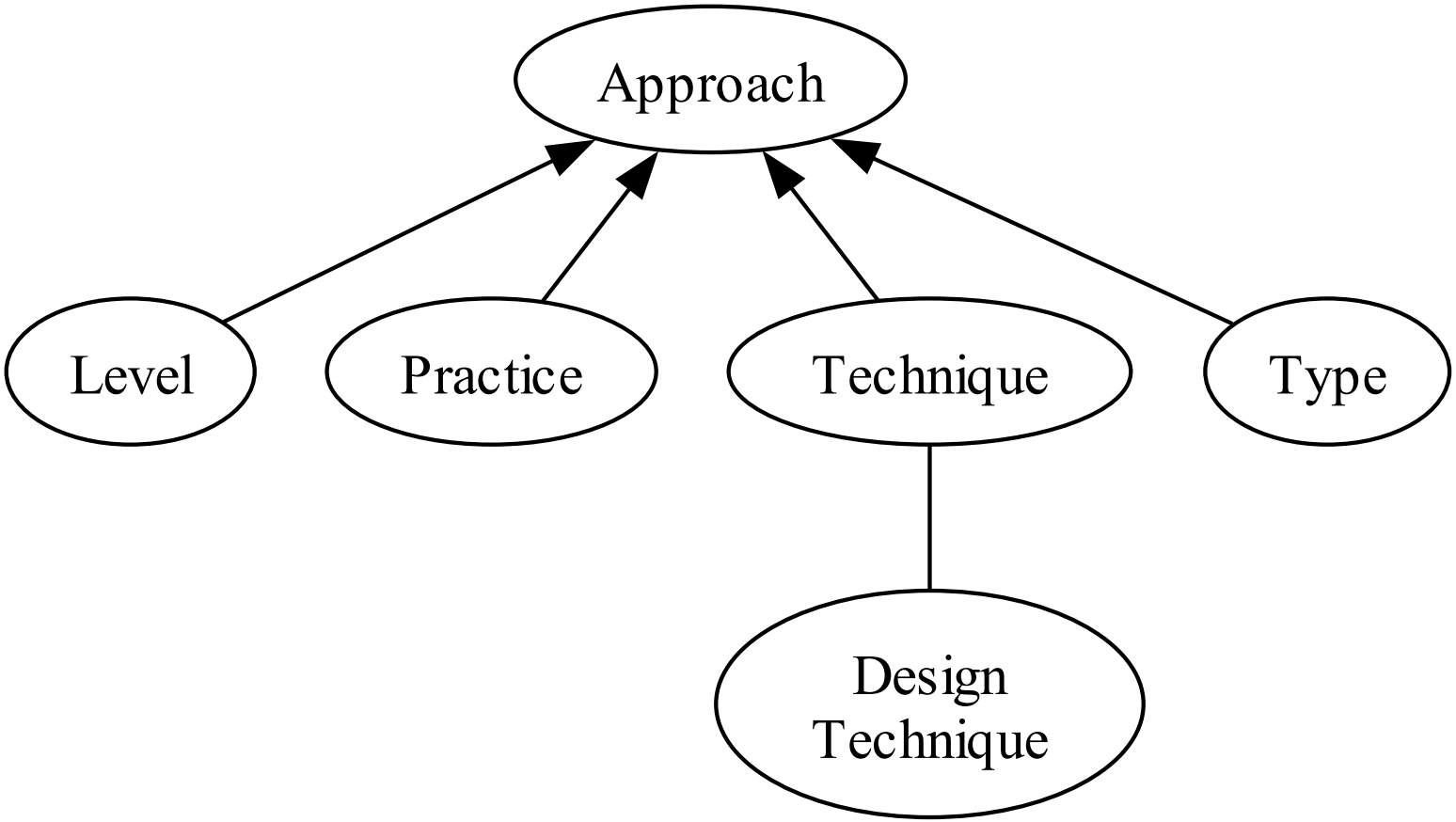
Categories



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



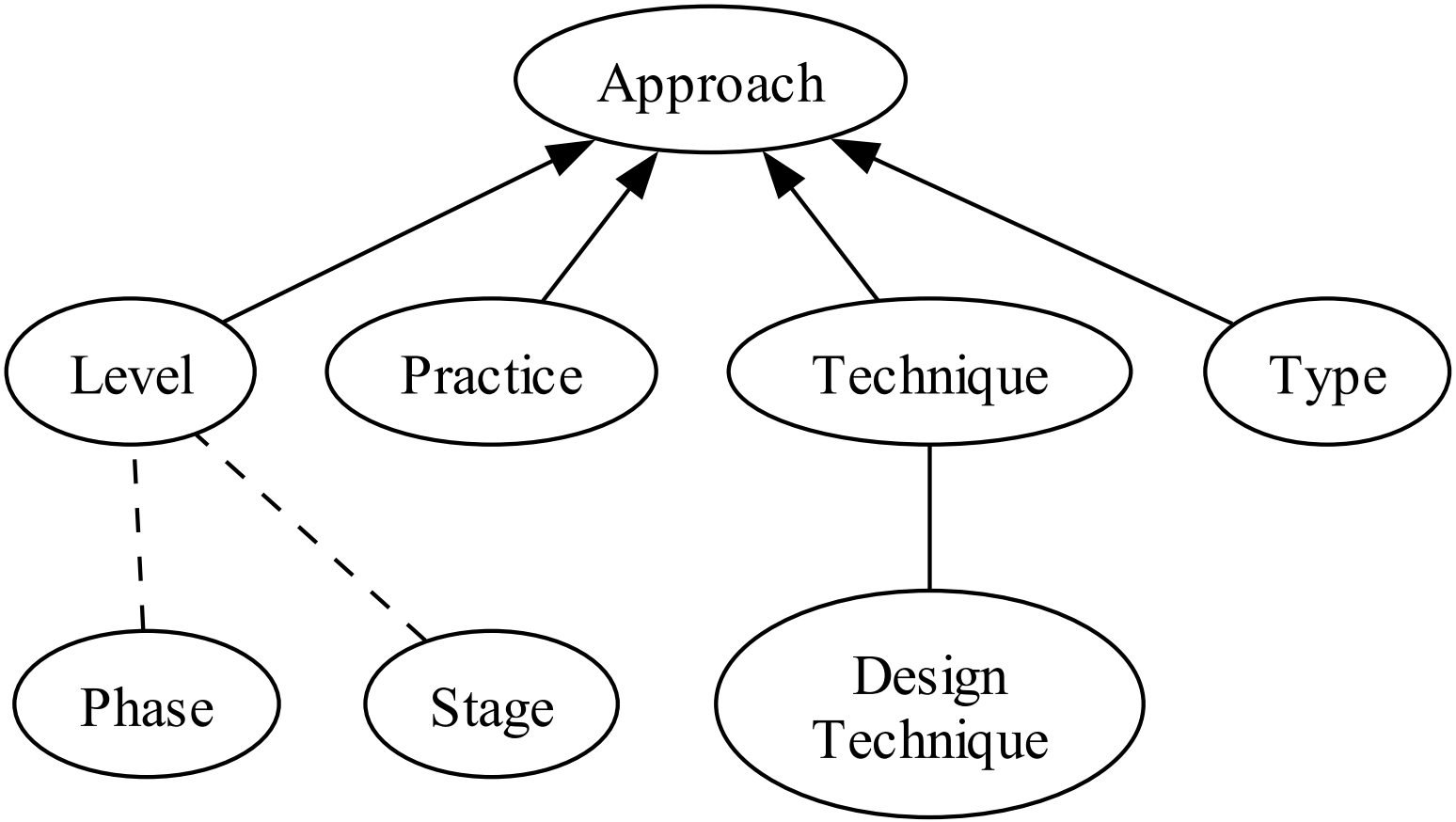
Arrows point from a *child* node to a *parent* node.



Lines without arrowheads connect *synonyms*.

Methodology

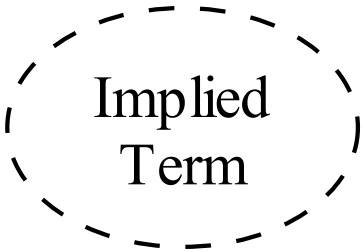
Graph Notation



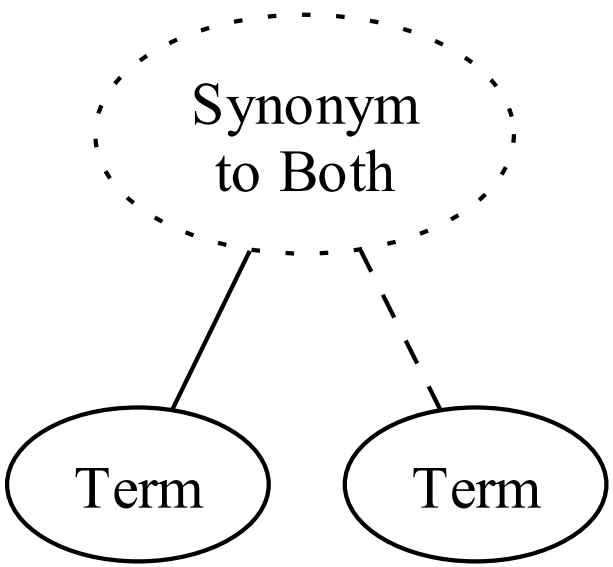
Dashed lines indicate a relationship is *implicit*.

Methodology

Graph Notation



Dashed outlines indicate a term is *implied*.



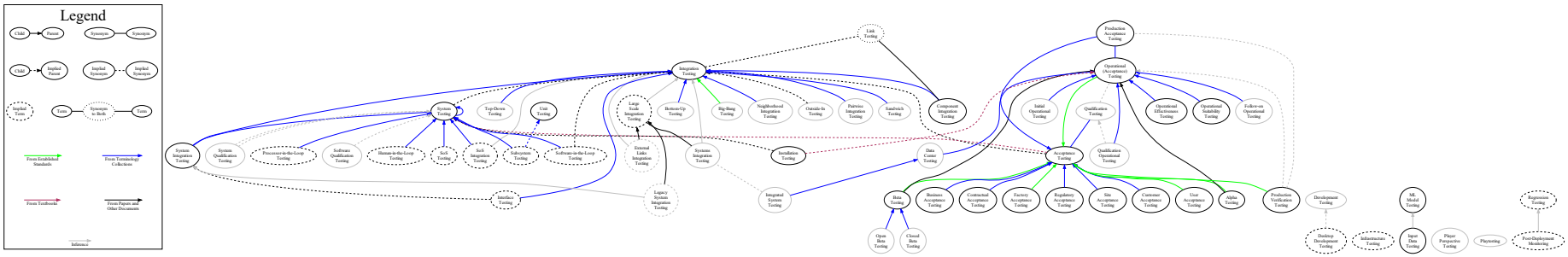
Dotted outlines indicate a term is a *synonym* to more than one term.

Graph of Test Approaches

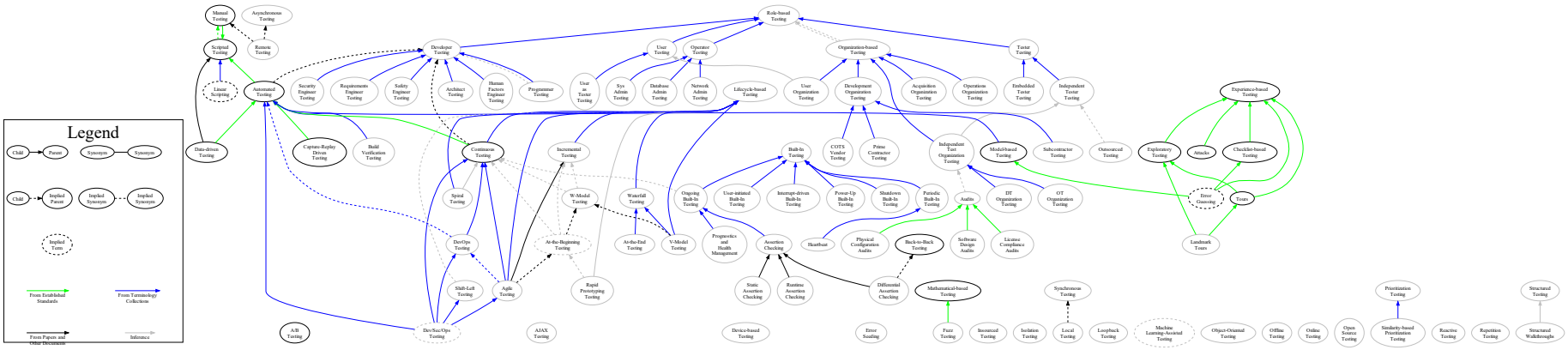
Graph of Test Approaches

```
! Dimension too large.
```

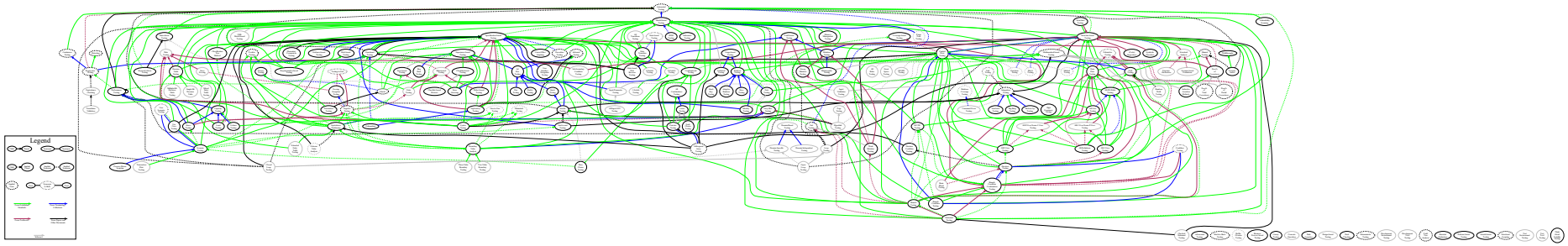
Graph of Test Levels



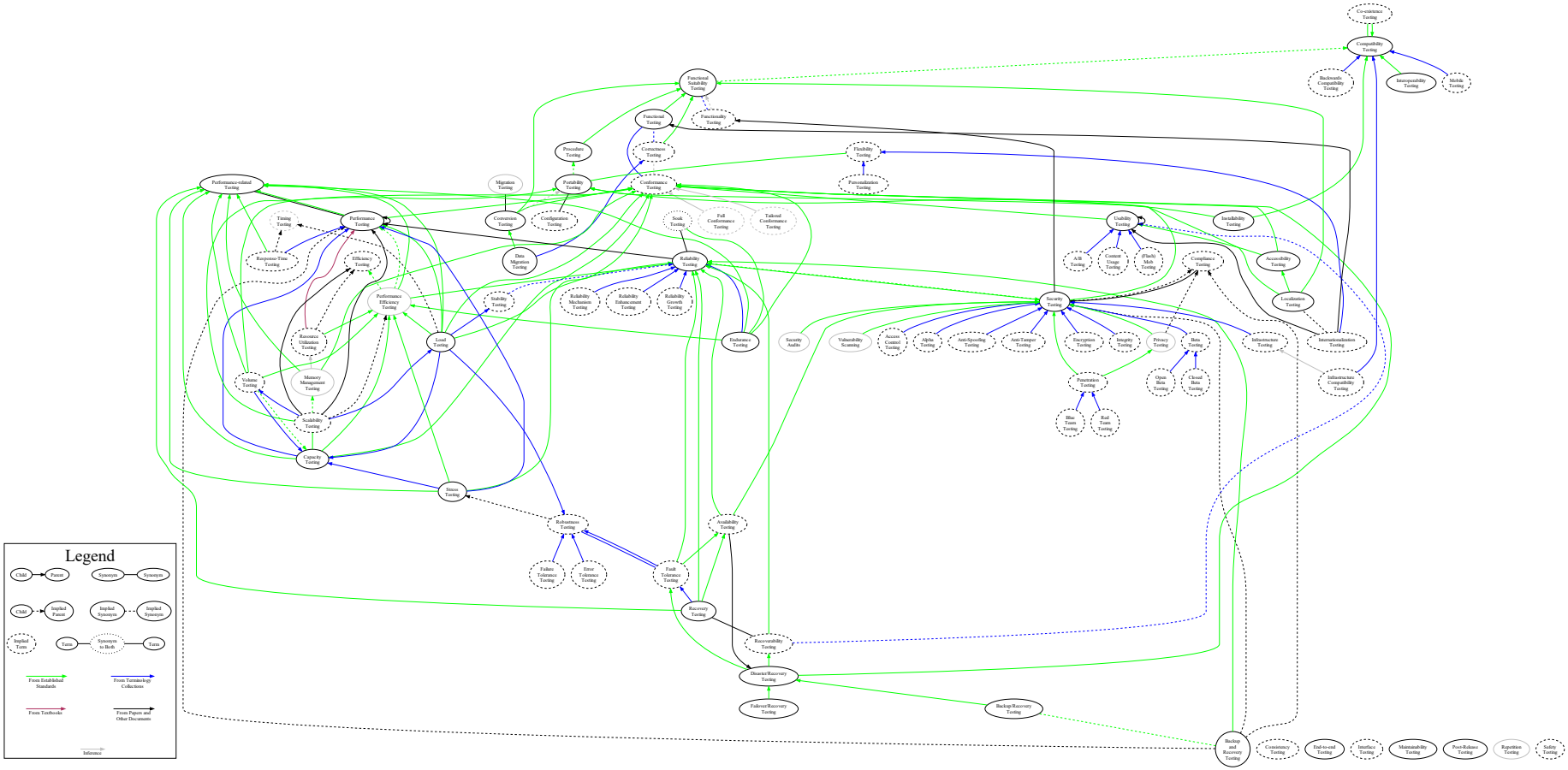
Graph of Test Practices



Graph of Test Techniques

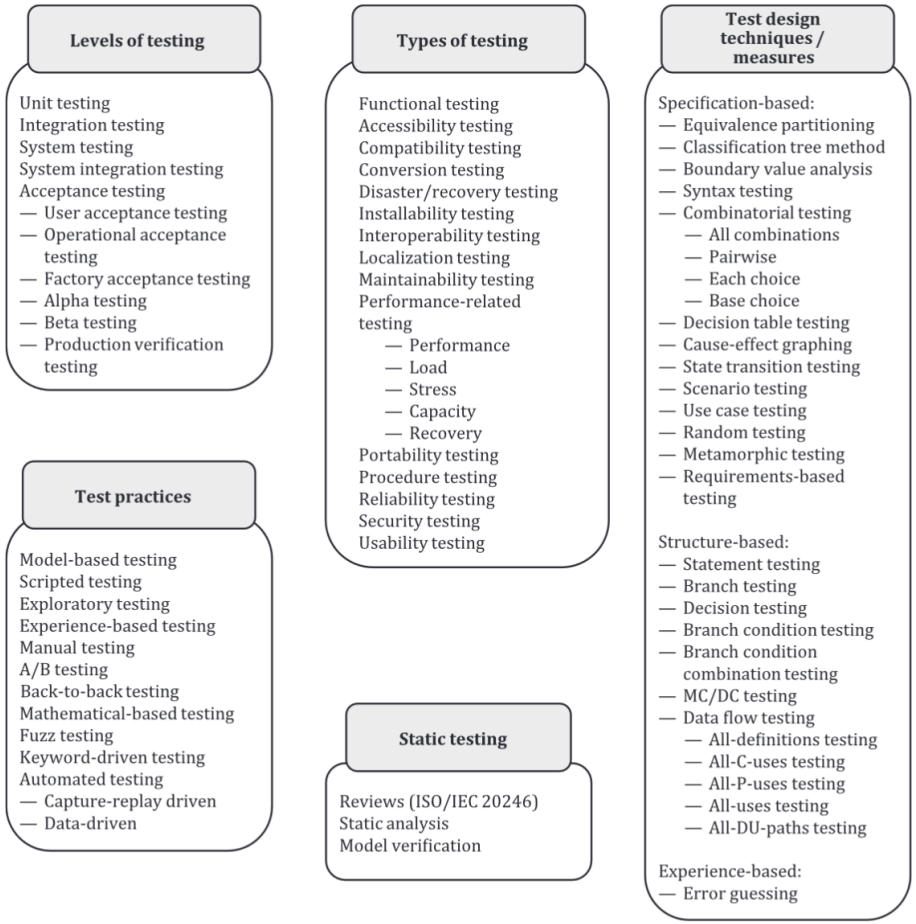


Graph of Test Types



Methodology

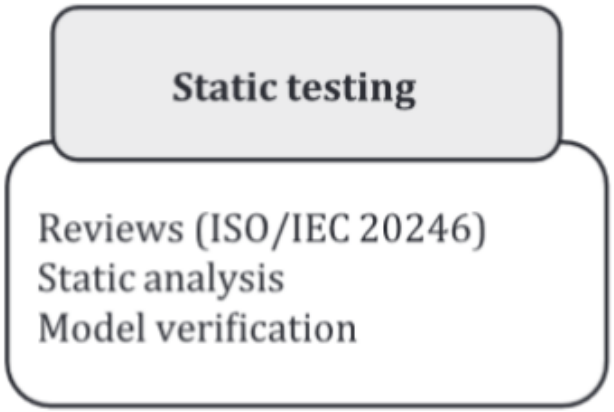
Graph Notation



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

Methodology

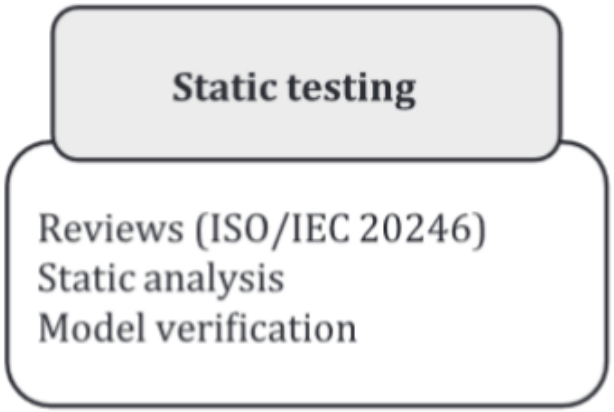
Graph Notation



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

Methodology

Graph Notation



- Quite distinct but not necessarily orthogonal

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

Methodology

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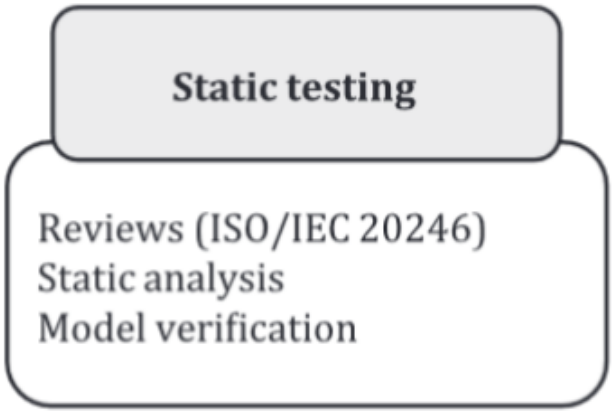
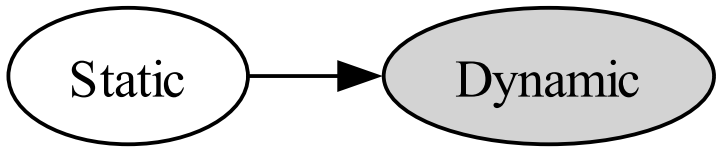
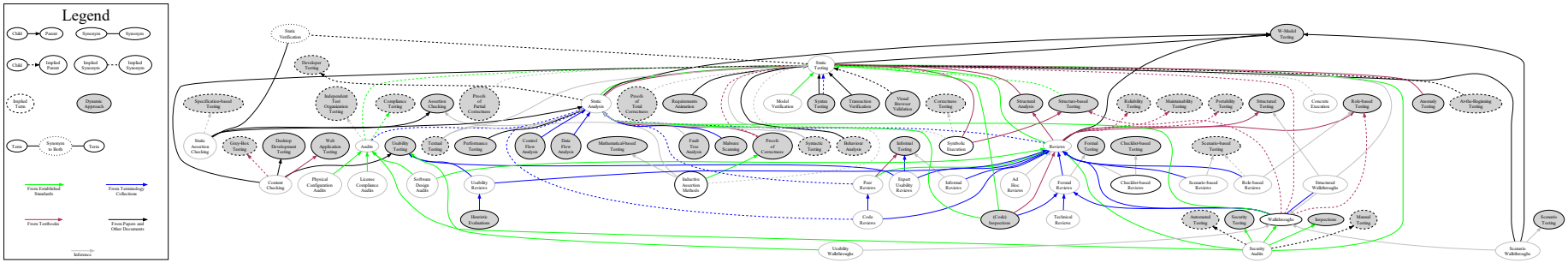


- Quite distinct but not necessarily orthogonal
- When considering static testing in isolation, related *dynamic approaches* have grey backgrounds



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

Graph of *Static* Test Approaches



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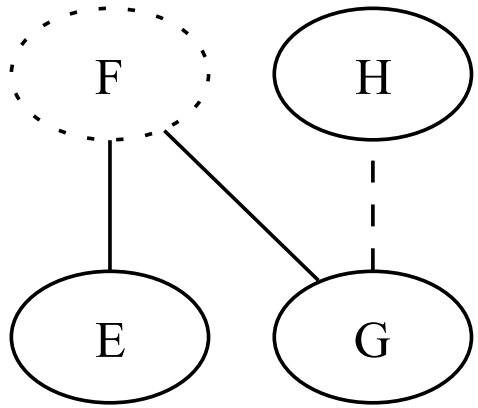
Automated Discrepancies

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

Automated Discrepancies

- 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 graphs automatically

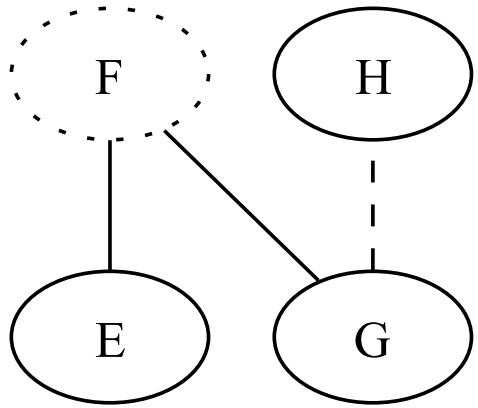
Name	Synonym(s)
E	F (Author, 0000; implied by 0001)
G	F (Author, 0002), H (implied by 0000)
H	X



Automated Discrepancies

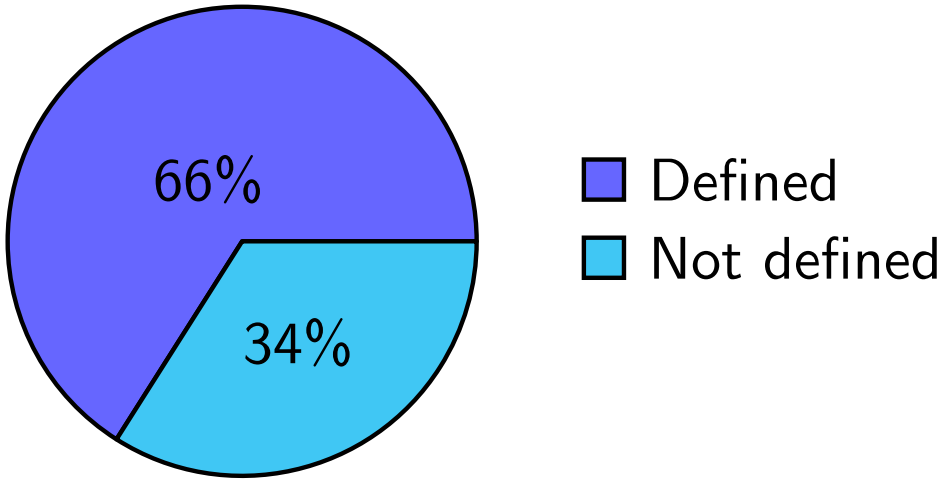
- Some terms are given as a synonym to two (or more) disjoint, unrelated terms, making the relation between the given synonyms ambiguous
- These are included in generated graphs automatically

Name	Synonym(s)
E	F (Author, 0000; implied by 0001)
G	F (Author, 0002), H (implied by 0000)
H	X



Results

- 557 test approaches $\rightarrow$
- 76 software qualities
  (may imply test approaches)



Automated Discrepancies

Prominent examples of these “multi-synonyms”:

1. **Invalid Testing:**
   - Error Tolerance Testing
   - Negative Testing

Source(s)

(Kam, 2008, p. 45)

(Hamburg and Mogyorodi, 2024)

Automated Discrepancies

Prominent examples of these "multi-synonyms":

	Source(s)
1. Invalid Testing:	
• Error Tolerance Testing	(Kam, 2008, p. 45)
• Negative Testing	(Hamburg and Mogyorodi, 2024)
2. Soak Testing:	
• Endurance Testing	(ISO/IEC and IEEE, 2021, p. 39)
• Reliability Testing	(Gerrard, 2000a, Tab. 2; 2000b, Tab. 1, p. 26)

Automated Discrepancies

Prominent examples of these "multi-synonyms":

	Source(s)
1 Invalid Testing:	
• Error Tolerance Testing	(Kam, 2008, p. 45)
• Negative Testing	(Hamburg and Mogyorodi, 2024)
2 Soak Testing:	
• Endurance Testing	(ISO/IEC and IEEE, 2021, p. 39)
• Reliability Testing	(Gerrard, 2000a, Tab. 2; 2000b, Tab. 1, p. 26)
3 Link Testing:	
• Branch Testing	(implied by ISO/IEC and IEEE, 2021, p. 24)
• Component Integration Testing	(Kam, 2008, p. 45)
• Integration Testing	(implied by Gerrard, 2000a, p. 13)

Acknowledgment

- Drs. Spencer Smith and Jacques Carette have been great supervisors in the past and have, both then and now, provided me with valuable guidance and feedback
  - They have helped me refine the scope of this project
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- The past and current Drasil team have created a truly amazing framework!

Thank you!

Questions?

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