Challenges & Opportunities in Low-Code Testing

Faezeh Khorram, Jean-Marie Mottu, Gerson Sunyé

LS2N, Université de Nantes, IMT Atlantique, Nantes, France

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Problem Statement

- ***Low-code Testing*** required for Quality Assurance of Low-Code Systems
- A few techniques are offered by commercial LCDPs
- A new area without a precise definition
  - Lack of information on the impacts of low-code principles on testing activities
  - High dependency of existing LCDPs to technical testing tools
- Lack of academic research

No formal structure to the ideas, concepts, and research questions of this area

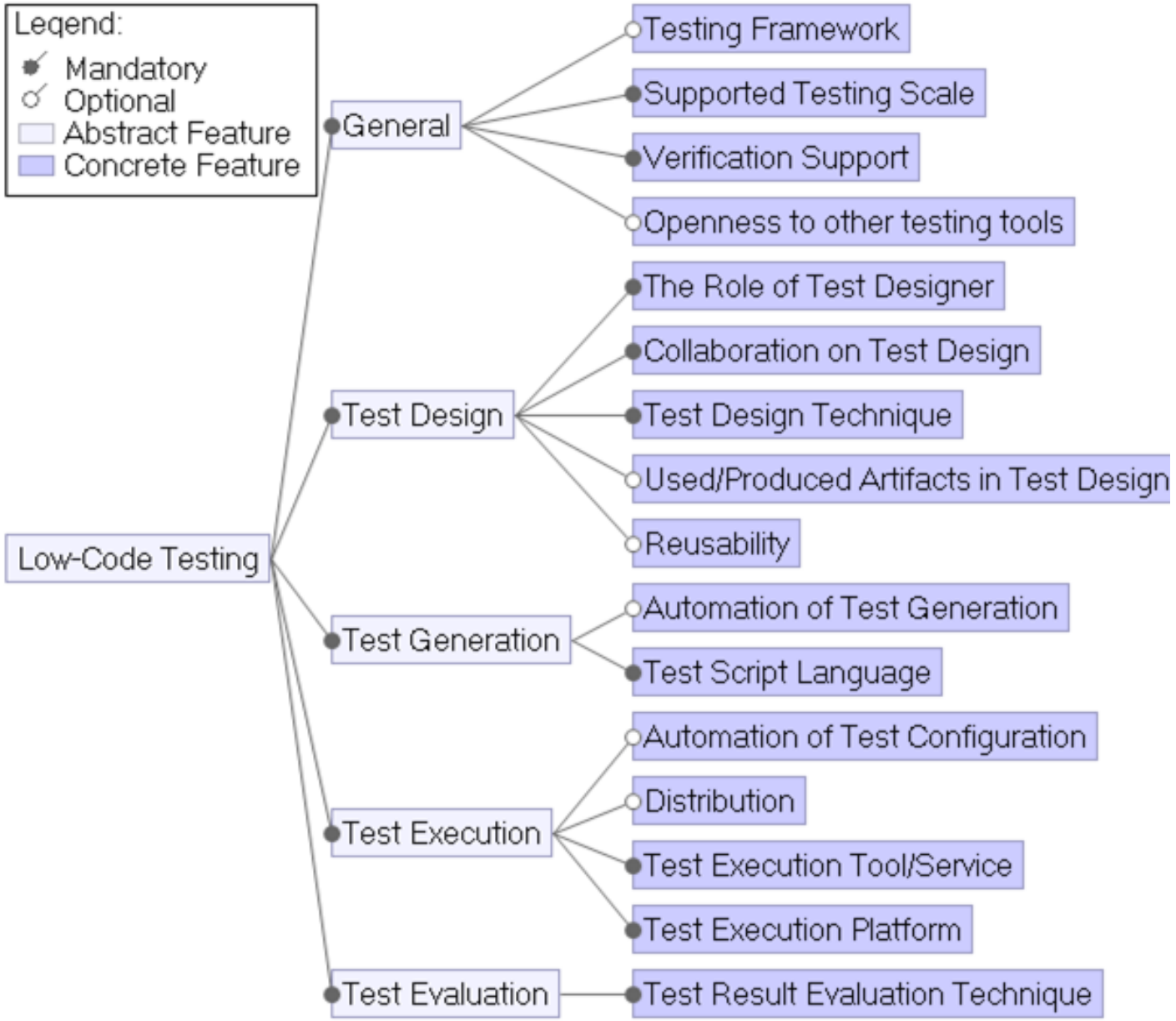
Contribution

- Studying the testing component of 5 commercial LCDPs
  - Mendix, OutSystems, PowerApps, Temenos Quantum, Lightning
- Extracting Low-code testing features
  - A feature set with possible values for them
- Characterizing existing challenges into three categories from research point of view
- Proposing opportunities for future work based on the previous attempts

Low-Code Testing Feature Set

- Characterizing Low-Code Testing
  - Comparison of the existing tools
  - Finding the gaps in the state-of-the-art
  - Help on developing new tools
  - Roadmap for future research

- Extracting 16 Features
  - Based on Low-Code principles
  - Considering capabilities and deficiencies of the existing commercial tools
  - Providing some possible values for them



Example of Feature: Test Design Technique

	MBT	Record & Replay	DDT	Keyword -driven	BDD/ TDD	AI
mendix	✓	✓	✓	✓		
outsystems	✓	✓			✓	
PowerApps		✓	✓	✓		
TEMENOS | kony		✓			✓	
salesforce lightning platform		✓	✓	✓	✓	✓

✓ Supported by Low-Code testing tool

✓ Supported by integrated third-party testing tool

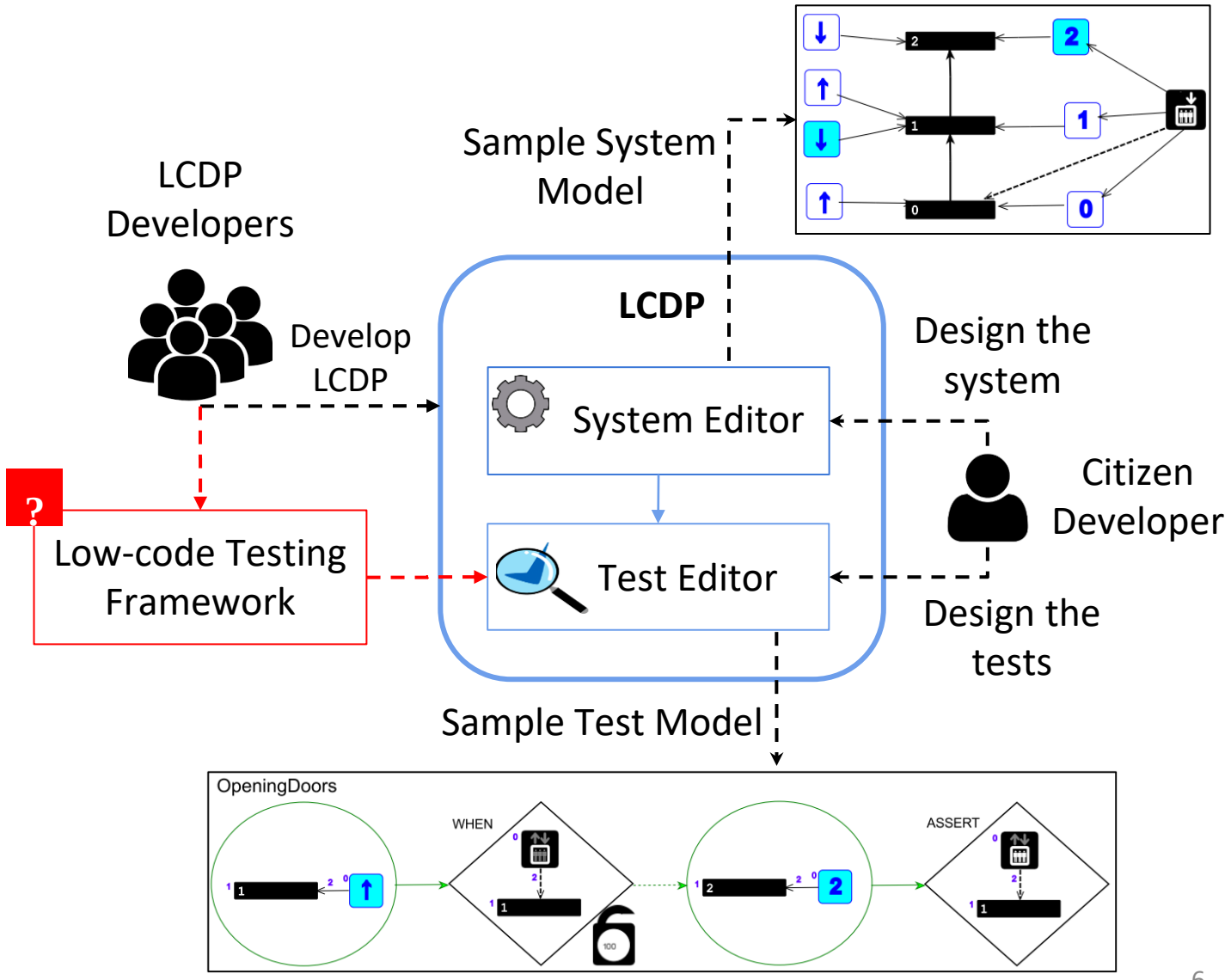
Identified Challenges & Opportunities

Main observation: Lack of Low-Code Testing Framework

- For the development of Low-code testing components
- To be Generic, Reusable, and Open to access

Three sets of challenges

- Role of citizen developer in testing
- Need for high-level test automation
- Cloud Testing



The Role of Citizen Developer in Testing

Challenges

- Low-level technical knowledge of Citizen developer
  - Simple, familiar, and non-technical approaches are required
- Modeling test cases in the same way as system modeling
  - Testing support for DSLs is required

Previous Attempts

- Automated Testing Support for Reactive Domain-Specific Languages (Meyers, et al. 2016)
  - Restricted to DSLs with rule-based semantics
  - Not efficient: The semantics must be regenerated for each test case
  - Limited support for testing elements

Opportunities

- Support for other testing DSLs (e.g., TDL)
- Proposing a generic approach for testing support of different DSLs
- Assistant chatbots and recommendation systems for helping citizen developer in test case definition

The Need for High-level Test Automation

Challenges

- High-level of automation alongside low dependency to technical knowledge
  - *Suitable techniques*: Data-Driven, Model-Based Testing (MBT), and Record and Replay
- Lack of reusability for MBT tools because of their dependency to specific DSLs
- Lack of MBT tool repository and challenges in MBT tool selection/creation

Previous Attempts

- 70 MBT supporting tools are proposed from 2006 to 2016 (Bernardino, et al. 2017)
  - For different domains (i.e., for different DSLs)

Opportunities

- Development of a repository for existing MBT tools
- Application of MBT in the testing component of LCDPs
  1. If MBT is already applied to the LCDP's underlying DSL, and associated tools exist: an appropriate tool can be selected from the pool.
  2. Otherwise: new MBT tools adapted to the new DSL should be implemented.

Cloud Testing

Challenges

- Cloud-native of LCDPs and their support for building cloud-based applications
  - Need for supporting cloud testing in LCDPs
- Supporting cloud in MBT

Previous Attempts

- MIDAS: A cloud-based MBT testing platform for Software-Oriented Architectures (SOA)
  - Dedicated to MIDAS DSL
  - Usable for automatic generation of test cases, so not applicable for test case modeling

Opportunities

- Application of MIDAS approach (i.e., MBT as a service) for different DSLs
- Proposing a cloud-based low-code testing framework
  - A comprehensive framework that auto-generates test-specific services for a given DSL

Future Work

- Definition of an executable testing language
  - Based on Test Description Language (TDL)
  - Independent and customizable for different DSLs

- Definition of a cloud-based low-code testing framework
  - Based on the proposed testing language
  - Auto generation of test-specific services for a given DSL
  - Supporting test execution in the cloud

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