Abstract: The talk is based on a paper accepted at the 30th Asia-Pacific Software Engineering Conference (APSEC 2023) [RWH23].

Context. Architecture maintainability smells indicate software quality problems and suggest necessary architecture refactorings. However, there are numerous names for a single smell, including synonyms and subclasses, and the number keeps increasing. This situation leads to confusion and difficulty in identifying the underlying problems. Objective. We organized the existing smells into a taxonomy to address this challenge. Method. We collect smell names through a systematic literature review, followed by a four-step data analysis leading to a taxonomy of maintainability smells, comprising smell characteristics, categories, detection methods, and causes. Results. We found 549 architecture smell names in 189 references, from which we identified 318 maintainability smell names. We derived the distinguishing characteristics and reduced the list to 19 essential maintainability smells. Conclusions. Our taxonomy provides an overview of essential maintainability smells, making future research and discussions more manageable. Moreover, the identified synonyms make existing research comparable, and the characteristics, causes, and detection methods provide a framework for classifying future smells.

Keywords: architecture smell; maintainability; knowledge base; software design principles; ontology; prioritization; architecture technical debt

1 Summary

Architecture smells serve as indicators for necessary architecture refactorings and design principle violations [St14]. Similar to code smells, architecture smells pinpoint potential problem areas in the system but do not necessarily indicate an immediate issue. Architecture maintainability smells (MS) specifically impact maintainability, differentiating them from smells affecting other quality attributes. Identifying MS is crucial as they highlight technical debt items which are short-term advantages that hinder long-term software development and maintenance [Av16]. They especially identify architectural technical debt which focuses on higher-level problems and was identified as one of the most dangerous types of technical debt [MB15].
Our previous research has identified the absence of a standardized catalog for architecture smells, leading to variations in names and subclasses for the same smells [RR22]. We seek to address this gap by condensing the current understanding of maintainability smells and organizing the smells into a coherent taxonomy.

We conducted a systematic literature review (SLR) to collect all architecture maintainability smells names used in research. The SLR revealed 318 maintainability smell names from 189 references. We determined which smell name introduces a new concept and which smell name is already covered by the concept of an existing smell name. In this process, we reduced the list to 19 essential maintainability smells, derived 15 distinguishing characteristics, and defined 5 grouping categories. We also provided a guideline for classifying future maintainability smells with our taxonomy to avoid new names for existing concepts. Our taxonomy provides a basis for common understanding, aiding in discussions, smell detection, and quality enforcement. The taxonomy facilitates future research with a manageable number of smells, ensures comparability of existing research, and keeps the number of smells small by providing a guideline for classifying future maintainability smell names.

2 Data Availability

The data set of the SLR has been made available as open data via Zenodo4. We enclosed the excluded studies with their exclusion criteria and the list of included studies. We included all architecture smell names with their references and our assessment.

References


4 https://doi.org/10.5281/zenodo.7863875