Testing of RESTful Web APIs

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Abstract. RESTful web APIs nowadays may be considered the de facto standard for web integration, since they enable interoperability between heterogeneous software systems in a standard way, and their usage is widespread in industry. Testing these systems thoroughly is therefore of utmost importance: a single bug in an API could compromise hundreds of services using it, potentially affecting millions of end users. In recent years, there has been an explosion in the number of tools and approaches to test RESTful web APIs, making it difficult for researchers and practitioners to select the right solution for the problem at hand.
In this tutorial, we overview some of the main industrial and research tools for testing RESTful APIs, with a primarily practical approach. We analyze different testing tools and frameworks from three different perspectives: a) manual vs automated testing; b) black-box vs white-box testing; and c) online vs offline testing. First, we show the capabilities of industrial tools and libraries for manual testing of web APIs, including REST Assured [3] and Postman [1]. Then, we delve into some of the main research tools for automatically generating test cases for RESTful APIs such as RESTler [6], EvoMaster [5], and RESTest [7]. Finally, we overview existing industrial Testing as a Service (TaaS) platforms such as RapidAPI [2] and Sauce Labs [4], and we show the latest research advances on the provision of continuous online testing of RESTful APIs (including automated test generation and execution) with the RESTest testing ecosystem [8]. We finish the tutorial outlining some of the most pressing research challenges in the domain of web API testing automation, which will hopefully open a range of opportunities for future researchers working on the topic.

Keywords: RESTful APIs · Web APIs · OpenAPI Specification · Black-box testing · White-box testing.

Biographies

Alberto Martín López is a postdoctoral fellow at the Schaffhausen Institute of Technology (SIT) and the Università della Svizzera Italiana (USI), in Switzerland. He belongs to the Software Testing and Analysis Research (STAR) group,

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Juan Carlos Alonso Valenzuela is a PhD student and a teaching assistant at the University of Seville, in Spain. He is part of the Applied Software Engineering (ISA) group and the SCORE Unit of Excellence of the University of Seville. His current research interests lie in the areas of software testing, Artificial Intelligence and Natural Language Processing. He obtained a Bachelor degree in Software Engineering and a Master's degree in Data Science, both of them in the University of Seville. He is one of the core developers of RESTest and the main contributor of ARTE, an approach for the generation of realistic test inputs for web APIs thanks to which he and his team have found domain-specific bugs in the APIs of DHL and Amadeus. To know more about Juan Carlos, visit his personal website at `www.javalenzuela.com`.

Acknowledgments

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