

Benefit of SOTA cloud testing approaches for smart grid penetration and performance testing - A systematic literature review.

Wildermuth Salome
Department of Informatics
University of Zurich
Zurich, Switzerland
salome.wildermuth@uzh.ch

Index Terms—Smart grid, IoT, Cloud testing, Cloud computing

Abstract—The present document contains a review on the topic of cloud testing approaches that have been applied in the domain of smart grid testing so far. Intelligent electrical supply systems are subject to an emerging field of research, especially the related risks of cyber security attacks and the challenge of processing high data volumes in real-time. The review emphasizes scientific papers from 2018 - 2023 about penetration and performance testing of cloud-based IoT devices, like smart meters, and metering infrastructure, like communication networks or data management systems. (<https://www.blackridgeresearch.com/blog/what-is-a-smart-grid-what-are-the-major-smart-grid-technologies>)

I. INTRODUCTION

Being a substantial part of smart cities, evolving all around the globe, smart grids have gained increased focus from the society during the last years. Smart grids are electrical grids that replace manual by automated, i.e. digital / software-based monitoring, controlling and steering mechanisms of electrical flaws and electricity consumption. While smart grids open doors to unprecedented possibilities, like many other technological achievements, they have some downsides at the same time. Being part of the highly critical infrastructure of electricity supply, they are exceptionally exposed and vulnerable towards malicious attacks. Furthermore they face high-performance requirements in order to fulfill real-time data processing. Successful cyber attacks or misbehavior due to badly performing systems can cause huge damage to institutions and humans depending on this infrastructure.

Appropriate security and protection mechanisms and well designed software and hardware are inevitable to minimize these risks. Such systems require a high amount of thorough testing, especially with high focus to their vulnerabilities. Penetration and performance testing can be key to addressing the two main weaknesses of smart grids and cloud testing can make extended testing feasible by providing highly scalable test environments and resources.

This present review study emphasizes scientific papers from the years 2018 - 2023 containing research about penetration and performance testing of IoT devices, especially software for

smart meters, communication networks and data management systems, in the cloud.

The search included manual document retrieval from four popular web libraries: IEEE, Google Scholar, Xplore and ACM Digital Library. From initially XX potential papers, XX were selected based on suitability criteria for the topic. Backward snowballing iterations have been done on the six most relevant papers, which added another XX papers to the review. The documents have been retrieved by using the following search terms in different combinations: smart grid, cloud testing, cloud computing, IoT, penetration testing, performance testing, testbed, co-simulation.

II. RELATED WORK

So far no literature review covering cloud testing techniques for IoT devices in smart grid industry have been found. However research has been done on the topic itself. Research about how to test IoT devices generally with regard to cyber security and performance aspects has been done, as well as proposals on how such tests could be executed on the cloud. Furthermore there is a bunch of literature about how software components of smart grids can be tested and which frameworks and tools are available. Finally there are also some papers, investigating how cloud-based testing might help improving smart grids' resistance to the mentioned risks / vulnerabilities. ... Test reference: [1]

III. RESEARCH METHODOLOGY

Blablabla...

IV. REVIEW

Blablabla...

V. CONCLUSION

We conclude that blablabla...
Testreference: [2]

REFERENCES

- [1] A. Bertolino, G. D. Angelis, M. Gallego, B. García, F. Gortázar, F. Lonetti, and E. Marchetti, "A systematic review on cloud testing," *ACM Computing Surveys (CSUR)*, vol. 52, no. 5, pp. 1–42, 2019.
- [2] A. A. Smadi, B. T. Ajao, B. K. Johnson, H. Lei, Y. Chakhchoukh, and Q. Abu Al-Haija, "A comprehensive survey on cyber-physical smart grid testbed architectures: Requirements and challenges," *Electronics*, vol. 10, no. 9, 2021. [Online]. Available: <https://www.mdpi.com/2079-9292/10/9/1043>