ABSTRACT

Explanatory note size – 99 pages, contains 6 illustrations, 28 tables, 3 applications, 15 references.

Topicality. In today's reality of advancing information technologies, more and more software solutions focus on ensuring high data exchange speeds and interactive user interaction[1]. One of the key tools that enables such requirements is the WebSocket technology. At the same time, with the increasing use of applications utilizing this technology, there arises a need for high-quality testing of these solutions[2]. A major challenge is ensuring precise measurement of latency and performance under load, which requires the development of effective algorithms for data collection and analysis. Traditional testing tools often fall short—they are not always capable of accurately simulating application behavior under high load, tracking delays with sufficient precision, or supporting the scalability needed to test thousands of simultaneous connections[3][4].

The aim of the study. The goal of this research is to improve the testing process for WebSocket applications by enabling realistic simulation of working conditions, detecting and analyzing latencies, and evaluating performance in real-time.

Object: Real-time applications that use the WebSocket protocol to provide bidirectional communication.

Subject: The processes of testing these applications, including methods, tools, and approaches used to evaluate their performance, reliability, and scalability.

Research Tasks:

– Analyze existing approaches to testing real-time applications and their shortcomings in the context of WebSocket.

– Develop and justify the architecture of a testing tool for WebSocket applications.

– Investigate the effectiveness of different load models and methods for collecting data on latency and performance under real conditions.

The scientific novelty. The scientific novelty lies in improving the process and approach to testing WebSocket applications, providing realistic simulation of user activity in real-time and enabling performance and latency evaluation under high-load bidirectional connections. Unlike existing tools, the proposed solution combines:

– The use of adaptive load models that can vary interaction intensity depending on testing conditions, ensuring more accurate simulation of user behavior.

– Algorithms for collecting and analyzing latency with precise timestamps, allowing identification of specific delay stages: network-level delays, server-side processing, and overall connection response time.

– A distributed architecture with Redis as a communication adapter, enabling the scaling of the testing environment and simulating thousands of simultaneous connections while maintaining measurement accuracy and data consistency even under heavy load.

The practical value. The software can be used for testing WebSocket applications without requiring substantial computational resources, as the developed architecture allows these computations to be offloaded to easily scalable servers. This helps mitigate performance risks at early stages of development, thereby contributing to higher-quality software products and improved user satisfaction.

KEYWORDS: WEB-SOCKET, TESTING, SOFTWARE, REAL-TIME, FUNCTIONAL TESTING, LOAD TESTING, PERFORMANCE, TESTING SCENARIOS, LATENCY ANALYSIS, DATA TRANSMISSION.