ABSTRACT

Master's thesis: 146 pages, 7 figures, 14 tables, 30 code samples, 29 references.

Relevance of the topic. The transition from monolithic to microservices architectures has created new challenges in organizing inter-service communication. Existing solutions for HTTP request proxying in the Java ecosystem have significant limitations: tight coupling to specific infrastructure (Eclipse Jetty ProxyServlet), excessive configuration complexity and framework dependencies (Netflix Zuul), limited functionality of basic capabilities (Charon Spring Reverse Proxy). The need for developing an adaptive library that combines architectural flexibility with ease of use and ensures independence from specific HTTP client implementations has been identified.

Research objective. The main objective is to increase adaptability and reduce the complexity of integrating proxy components into Java applications by developing a modular library with support for multiple HTTP clients, extensible routing mechanisms, and built-in fault tolerance measures.

Object of research: HTTP request proxying processes in distributed Java systems.

Subject of research: methods and tools for building adaptive proxy components for microservices architectures.

To achieve this objective, **the following tasks were formulated:**

− analyze existing architectural approaches to HTTP request proxying and identify limitations of available technical solutions;

− develop an adaptive proxying method with modular architecture that ensures independence from specific HTTP client implementations;

− create an adaptive library for proxy servlets with support for flexible routing, fault tolerance mechanisms, and performance optimization;

− develop means of integrating the library with popular Java frameworks and deployment environments.

Scientific novelty of the master's thesis results lies in the further development of the adaptive HTTP request proxying method through the application of modular

architecture with protocol client abstraction, which, unlike existing approaches (Eclipse Jetty ProxyServlet, Netflix Zuul, Spring Cloud Gateway), ensures independence from specific HTTP client implementations and allows dynamic selection of optimal implementation depending on system performance and fault tolerance requirements. The result was achieved through the development of an HTTP client abstraction system, mathematical routing model, and fault tolerance mechanisms.

Practical significance of the obtained results lies in the development of an adaptive library for proxy servlets as open-source software, including: modular architecture with support for multiple HTTP clients (Apache HttpClient, OkHttp, Java HTTP Client); flexible routing system with support for rules based on paths, headers, and HTTP methods; fault tolerance mechanisms (Circuit Breaker, Retry Pattern, Fallback); performance optimization tools (Connection Pooling, asynchronous processing, multi-level caching); integration with Spring Boot through a starter module; standalone operation mode with embedded servlet container. The library can be used as a foundation for building API Gateways, proxy services, and integration gateways in microservices architectures. Experimental measurements demonstrate the system's ability to process over 10,000 requests per second with typical hardware configurations.

Connection with scientific programs, plans, themes. The work was carried out at the Department of Computer Science and Software Engineering of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute".

Approbation. The scientific provisions of the dissertation were tested at the IX International Scientific and Practical Conference of Young Scientists and Students "Software Engineering and Advanced Information Technologies" (SoftTech-2025) – Kyiv, November 2025.

Publications. The scientific provisions of the dissertation are published in:

1. Shekera M.O. Adaptive Library for Proxy Servlets / M.O. Shekera, I.O. Zeniv // Proceedings of the IX International Scientific and Practical Conference of Young Scientists and Students "Software Engineering and Advanced Information

Technologies" (SoftTech-2025) – Kyiv: NTUU "Igor Sikorsky KPI", November 2025.