

A MATHEMATICAL MODEL OF ADAPTIVE DATA FLOW CONTROL IN A SIDECAR COMPONENT

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Modern distributed microservice systems are being actively adopted in corporate environments where organizations use microservice architecture. Such systems face complex challenges in managing cross-service interactions, including authorization, monitoring, load balancing, and error handling, which are addressed through centralized components in distributed microservice systems with limited scalability.

The sidecar pattern is an architectural solution for decentralizing these auxiliary functions. However, existing sidecar components suffer from limited adaptability and restricted application variability.

Thus, the development of a mathematical model for adaptive data flow control in a sidecar component is a relevant research problem.

The aim of the report is to improve the speed of request processing in the sidecar component within distributed microservice systems.

The report proposes a mathematical model for adaptive data flow control in a sidecar component based on three control strategies with dynamic queue resizing, as well as an adaptive delay mode that provides dynamic queue size adjustment from 128 KB to 512 KB and adaptive determination of request processing resumption delays based on the state of the network infrastructure.

The mathematical model dynamically scales the queue with data streams in the sidecar component and adjusts query processing based on its current load, which helps improve query processing speed under unstable conditions.

It minimizes RAM consumption when processing a large number of concurrent queries in distributed microservice systems. She takes into account the performance metrics of microservices within the system, enabling a 54% increase in the system’s adaptability and request processing speed under unstable network conditions.

References

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