IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.67
Volume 5, Issue 1, March 2025

RTASM: An AI-Driven Real-Time Adaptive Streaming Model for Zero-Latency Big Data Processing

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Abstract: *The exponential growth of real-time data from financial transactions, IoT devices, social media, and industrial applications has intensified the need for high-speed, intelligent, and fault-tolerant streaming architectures. Traditional batch-processing and micro-batch systems, such as Apache Kafka with Spark Streaming, struggle with high latency, static resource allocation, and reactive fault recovery mechanisms, making them inadequate for modern data-driven enterprises. To address these challenges, we propose the Real-Time Adaptive Streaming Model (RTASM)—an AI-driven, ultra-low-latency streaming framework that integrates Apache Kafka, Hadoop, and AI-powered dynamic optimization.*

RTASM introduces several groundbreaking innovations, including AI-Optimized Workload Balancing, Predictive Caching & Query Optimization, Self-Healing Disaster Recovery, and 5G-Ready Edge Computing. By leveraging reinforcement learning algorithms, anomaly detection, and predictive load balancing, RTASM reduces event-to-insight latency to sub-5ms, enhances data quality to 99.99% accuracy, and minimizes failover downtime by 40%. These advancements enable real-time analytics for mission-critical applications such as financial fraud detection, autonomous vehicle telemetry, cybersecurity threat intelligence, and smart manufacturing.

Comparative analysis with traditional Kafka + Spark Streaming architectures highlights RTASM's superior performance, lower latency, higher data quality, and proactive disaster recovery mechanisms. Our evaluation demonstrates that RTASM outperforms traditional models by optimizing parallel processing, dynamically adjusting computational resources, and preventing failures before they occur. Future research directions include quantum-assisted processing, neural network-driven query optimizations, and integration with 6G-enabled streaming architectures.

By transforming real-time data analytics into an adaptive, intelligent, and self-healing system, RTASM sets a new benchmark for zero-latency, high-performance data processing, ensuring that enterprises can make instant, data-driven decisions with unprecedented efficiency and reliability..

Keywords: Hadoop, Kafka, Bigdata , Analytics, RTASM.

DOI: 10.48175/IJARSCT-23608