

IMPLEMENTASI *HORIZONTAL POD AUTOSCALER* (HPA) DALAM SISTEM DETEKSI HOAKS BERBASIS ORKESTRASI *KUBERNETES*

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ABSTRAK

Penelitian ini membahas implementasi *Horizontal Pod Autoscaler* (HPA) pada sistem deteksi hoaks berbasis orkestrasi *Kubernetes* yang mengintegrasikan pra-pengolahan citra, *Optical Character Recognition* (OCR), dan klasifikasi teks menggunakan *IndoBERT*. Sistem dirancang menggunakan arsitektur *service* dengan komunikasi asinkron untuk mengurangi *bottleneck* pada arsitektur monolitik. Implementasi dilakukan pada lingkungan lokal dan server, kemudian diuji menggunakan *Locust* melalui skenario *baseline*, *ramp-up*, *stress*, dan *soak*. Parameter pengujian meliputi *throughput*, P95 *latency*, penggunaan *CPU*, penggunaan memori, *error rate*, serta jumlah *replica*. Hasil pengujian menunjukkan bahwa arsitektur *service* menghasilkan *throughput* lebih tinggi dan P95 *latency* lebih rendah dibandingkan arsitektur monolitik. Pada skenario *stress*, *service* lokal dan *service* server mencapai 147 *req/s* dan 177 *req/s*, sedangkan monolitik lokal dan monolitik server hanya mencapai 2,67 *req/s* dan 0,689 *req/s*. HPA mampu meningkatkan *replica* hingga 25 pada *service* lokal dan 20 pada *service* server. Uji *Wilcoxon Signed-Rank* menghasilkan *p-value* 0,0078 pada *throughput* dan P95 *latency*, yang menunjukkan perbedaan kinerja signifikan. Dengan demikian, arsitektur *service* berbasis *Kubernetes* mampu meningkatkan kapasitas, responsivitas, dan skalabilitas sistem deteksi hoaks.

Kata Kunci: *Horizontal Pod Autoscaler*, *Kubernetes*, deteksi hoaks, OCR, *IndoBERT*, pengujian kinerja.

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ABSTRACT

This study discusses the implementation of a Horizontal Pod Autoscaler (HPA) in a Kubernetes-orchestrated fake news detection system that integrates image preprocessing, Optical Character Recognition (OCR), and text classification using IndoBERT. The system was designed using a service-based architecture with asynchronous communication to reduce bottlenecks in the monolithic architecture. The implementation was deployed in local and server environments and evaluated using Locust through baseline, ramp-up, stress, and soak scenarios. The evaluation parameters included throughput, P95 latency, CPU usage, memory usage, error rate, and the number of replicas. The results show that the service-based architecture achieved higher throughput and lower P95 latency than the monolithic architecture. In the stress scenario, the local and server service configurations reached 147 req/s and 177 req/s, while the local and server monolithic configurations reached only 2.67 req/s and 0.689 req/s. The HPA increased the replicas to 25 in the local service configuration and 20 in the server service configuration. The Wilcoxon Signed-Rank Test produced a p-value of 0.0078 for throughput and P95 latency, indicating a significant performance difference. Therefore, the Kubernetes-based service architecture improved the capacity, responsiveness, and scalability of the fake news detection system.

Keywords: Horizontal Pod Autoscaler, Kubernetes, fake news detection, OCR, IndoBERT, performance testing.