Analysis of Load Balancing and Horizontal Pod Autoscaling Implementation in Kubernetes to Improve Website Performance (Case Study: JTI Slearn)

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ABSTRACT

The JTI Slearn website, an e-learning platform used by the Department of Information Technology at Politeknik Negeri Jember, experienced performance degradation during periods of high user traffic. This study aims to analyze the implementation of Kubernetes-based load balancing and Horizontal Pod Autoscaler (HPA) in improving system performance. The implementation was carried out using Kubernetes K3s with internal load balancing and the Horizontal Pod Autoscaler (HPA). Performance testing was conducted using Grafana K6 with scenarios ranging from 100 to 160 Virtual Users (VUs). The results show that the HPA-based system increased throughput with a gap of 1.20–1.70 requests per second and reduced response time with a gap of 3.79–4.90 seconds compared to the Non-HPA system under high workloads. In addition, the HPA system maintained an equal or lower error rate in most testing scenarios. The implementation of Kubernetes proved effective in improving the scalability, stability, and availability of the JTI Slearn website.

Keywords: Kubernetes, Horizontal Pod Autoscaler, Load Balancing, Auto Scaling, Grafana K6.