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Integrated framework for enhancing SDN security and reliability

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Abstract

This paper addresses the issues of fault tolerance (FT) and intrusion detection (ID) in the Software-defined networking (SDN) environment. We design an integrated model that combines the FT-Manager as an FT mechanism and an ID-Manager, as an ID technique to collaboratively detect and mitigate threats in the SDN. The ID-Manager employs a machine learning (ML) technique to identify anomalous traffic accurately and effectively. Both techniques in the integrated model leverage the controllerswitches communication for real-time network statistics collection. While the full implementation of the framework is yet to be realized, experimental evaluations have been conducted to identify the most suitable ML algorithm for ID-Manager to classify network traffic using a benchmarking dataset and various performance metrics. The principal component analysis method was utilized for feature engineering optimization, and the results indicate that the Random Forest (RF) classifier outperforms other algorithms with 99.9% accuracy, precision, and recall. Based on these findings, the paper recommended RF as the ideal choice for ID design in the integrated model. We also stress the significance and potential benefits of the integrated model to sustain SDN network security and dependability.