Bachelor Thesis - Development of Machine Learning based Intrusion Detection System for Substation

Description:
At Institute of Automation and Applied Informatics (IAI) within Secure Energy Systems (SES) group we focus on modern security challenges for Smart Grids (SGs). With the evolution in attacks surfaces, security threats, adversary models and attack techniques, existing defence solutions have proven to be inadequate. Hence, we are developing a network-level Hybrid Intrusion detection System (HIDS) for critical infrastructures like SGs. Within this project we aim to integrate specification and Machine Learning (ML)-based models in order to devise a systematic detection approach which is more robust and accurate. As part of this methodology, we shall investigate existing ML-based models for Smart Grids, identifying their limitations, to put forth an improved algorithm that correctly detects and classifies the attacks. The developed method will focus on attacks against MMS and IEC 60870-5-104 based traffic in particular. For case studies and validation of developed system, we will consider different setups comprising of hardware and simulated components.

Tasks:
- Investigation state-of-the-art ML-based IDS for considered protocols and their limitations.
- Identification of physical and cyber features for the detection of different attacks and development of robust ML-based detection approach.
- Expansion and implementation of available attack scripts after setting up Hardware-In-The-Loop (HIL) testing environment with different protocols.
- Validation and performance evaluation of developed IDS against adversarial attacks.

Requirements:
- Studying Electrical/Power Engineering/Computer Science.
- Familiarity with implementation/structuring of different protocols or ready to learn.
- Motivated to work independently and as a team.
- Knowledge of python or any other programming language is a must.

If you are interested, do not hesitate to inquire by email to aneeqa.mumrez@kit.edu, including current transcript of grades and a resume/CV.

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