Hardware-Based Trust for Security-Aware Situational Awareness



Cyber-physical systems such as smart grids, IoT infrastructures, and industrial monitoring platforms rely on distributed edge devices that continuously collect and transmit telemetry data. Ensuring that these devices are trustworthy and that the telemetry they produce is authentic is essential for maintaining reliable situational awareness. However, many edge devices operate under strong resource constraints and cannot support heavy security infrastructures.

Establishing a reliable hardware root of trust for such devices remains an important research challenge. Recent research has explored the use of hardware-based trust anchors to improve device authentication and system integrity. Physically Unclonable Functions (PUFs) provide unique hardware fingerprints derived from manufacturing variations and have been proposed as lightweight mechanisms for device identification and authentication in embedded systems. In parallel, the concept of Security-aware Situational Awareness (SASA) aims to enhance the trustworthiness of telemetry data and system monitoring by integrating security mechanisms directly into the situational awareness pipeline.

The goal of this thesis is to investigate how PUF-based device identities can support security-aware situational awareness in edge systems. The student will study existing PUF architectures and explore how they can be integrated into secure telemetry and device authentication mechanisms. The work may include designing lightweight authentication mechanisms and implementing a proof-of-concept prototype to evaluate their feasibility and robustness in resource-constrained environments.

Practicalities

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Nature of the work:	30% literature, 30% theoretical work, 40% implementation		
Number of students:	1		

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