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Streamlining Cybersecurity Risk Assessment for Industrial Control and Automation Systems: Leveraging the National Institute of Standard and Technology's Risk Management Framework (RMF) Using Model-Based System Engineering (MBSE)

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Abstract : The cybersecurity landscape is constantly evolving, and organizations must adapt to the changing threat environment to protect their assets. The implementation of the NIST Risk Management Framework (RMF) has become critical in ensuring the security and safety of industrial control and automation systems. However, cybersecurity professionals are facing challenges in implementing RMF, leading to systems operating without authorization and being non-compliant with regulations. The current approach to RMF implementation based on business practices is limited and insufficient, leaving organizations vulnerable to cyberattacks resulting in the loss of personal consumer data and critical infrastructure details. To address these challenges, this research proposes a Model-Based Systems Engineering (MBSE) approach to implementing cybersecurity controls and assessing risk through the RMF process. The study emphasizes the need to shift to a modeling approach, which can streamline the RMF process and eliminate bloated structures that make it difficult to receive an Authorization-To-Operate (ATO). The study focuses on the practical application of MBSE in industrial control and automation systems to improve the security and safety of operations. It is concluded that MBSE can be used to solve the implementation challenges of the NIST RMF process and improve the security of industrial control and automation systems. The research suggests that MBSE provides a more effective and efficient method for implementing cybersecurity controls and assessing risk through the RMF process. The future work for this research involves exploring the broader applicability of MBSE in different industries and domains. The study suggests that the MBSE approach can be applied to other domains beyond industrial control and automation systems.

Keywords : authorization-to-operate (ATO), industrial control systems (ICS), model-based system's engineering (MBSE), risk management framework (RMF)
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