An Epistemic Approach to Confidence through Objectivity in Assurance of Safety-Critical Complex Systems

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Abstract : This paper presents a framework for assessing the objectivity of the assurance effort for safety-critical complex systems. Assurance is the process of building justified confidence that a system will behave as expected. Objectivity, as a property of the inquiry process, is key to generating this confidence. The framework identifies three main dimensions of objectivity: the methods and processes used to generate system and assurance artefacts, the reasoning and values underlying those artefacts, and the social processes that enable agreement on their validity. Each dimension contributes to overall objectivity, however, not as a set of independent dimensions. Objectivity is not a binary but a matter of degree, and different levels are required depending on the criticality of the system. The framework provides guidance on how to apply the concept of objectivity to different aspects of the assurance effort, from identifying stakeholders and their concerns to communicating risk. Requirement identification and refinement, verification, and risk communication are illustrations of its use in various assurance activities. Overall, this work offers a systematic approach to building justified confidence in the safety of complex engineered systems.