Poster: Hourglass-Shaped Architecture for Model-Based Development of Safe and Secure Cyber-Physical Systems

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ABSTRACT

Inspired by the hourglass-shaped architecture of Internet, we propose an approach to model-based development of networked cyber-physical systems (CPS) that is centered on the notion of a standardized CPS design specification language. The proposed design specification language can be used to build a CPS design specification model that can serve as a narrow interface between a set of platform-aware feedback controller design techniques and a set of runtime CPS computing platforms. As a result, this model-based development approach can support the goals of an integrated, cross-layer CPS design and development methodology, while still acknowledging the differences between the domain-specific skillset that control system engineers and embedded system engineers typically possess. The poster will outline a number of CPS-related safety and security concerns that the proposed hourglass-shaped architecture for networked CPS development must address. The poster will also document a number of requirements that any standardized CPS design specification language must meet in order to address the CPS-related safety and security concerns.

The proposed approach is inspired by the hourglass-shaped architecture of Internet. The narrow waist of hourglass-shaped architecture suggests that there is less diversity of protocols at this layer of Internet [4]. Any application that can operate based on the services of IP layer can be deployed on the Internet, and any underlying technology that can transport bytes from one point to another according to IP services can be used in the Internet. Similarly, according to the proposed approach to the model-based development of networked CPS, a wide range of DSMLs (and associated analysis tools) can be utilized to develop a platform-aware feedback controller design, which is then specified using a standardized design specification language. The proposed feedback controller design can then be analyzed for mapping on to wide range of runtime CPS computing platforms by utilizing their corresponding DSMLs (and associated analysis tools).

This approach can support the goals of an integrated CPS theory and development methodology while still taking into account the differences between the domain-specific skillset that control system engineers and embedded system engineers typically possess. However, this poster will outline a number of CPS-related safety and security concerns that the proposed hourglass-shaped architecture for networked CPS development must address. The poster will also document a number of requirements that any standardized CPS design specification language must meet in order to address the CPS-related safety and security concerns.

CCS CONCEPTS

• **Computer systems organization** → **Embedded systems**; *Redundancy*

KEYWORDS

Cyber-physical systems, safety, security, service-oriented architecture, quality-of-service

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