



CAREER: SOISTICe: Software Synthesis with Timing Contracts

AWARD: 1839511



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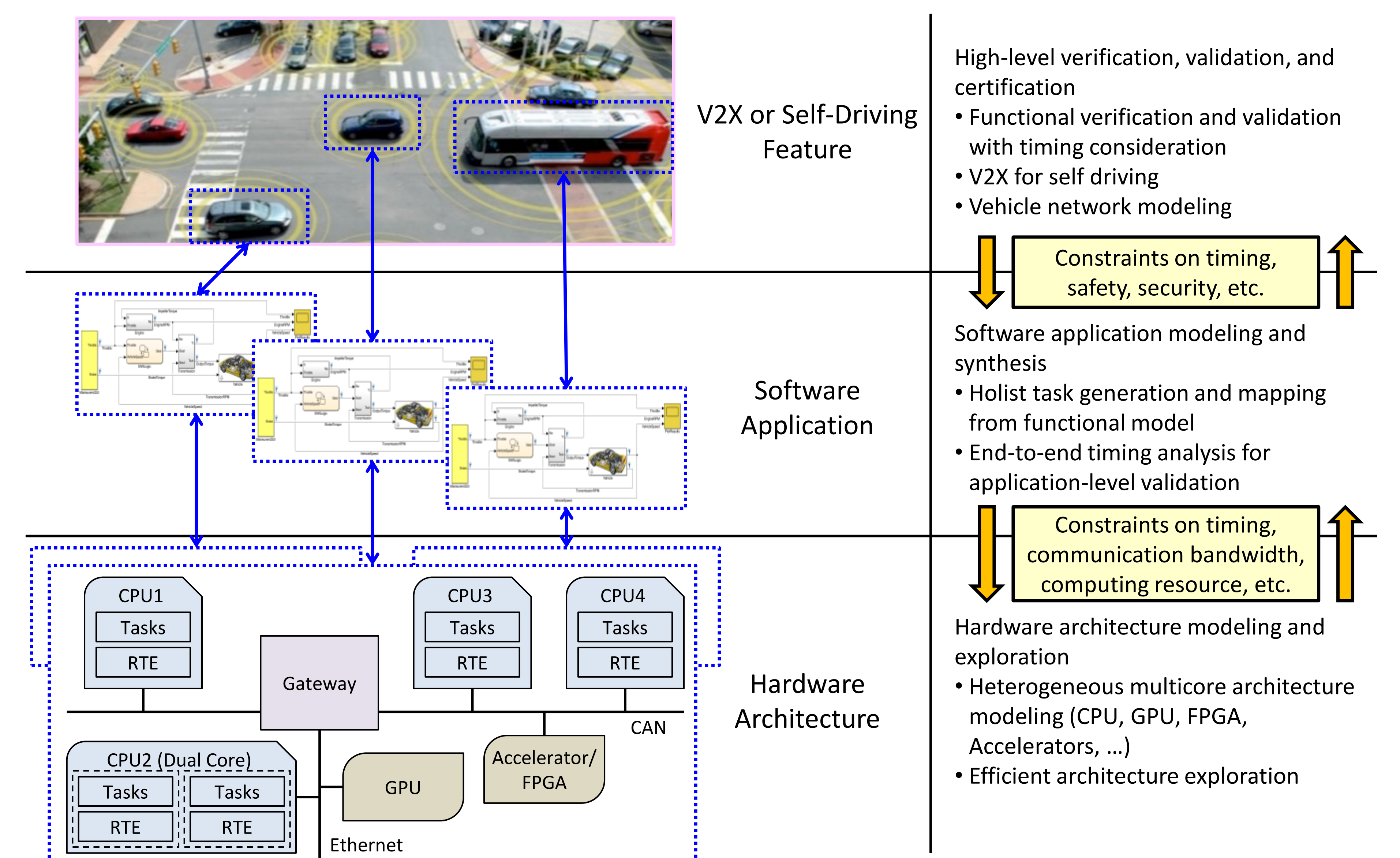
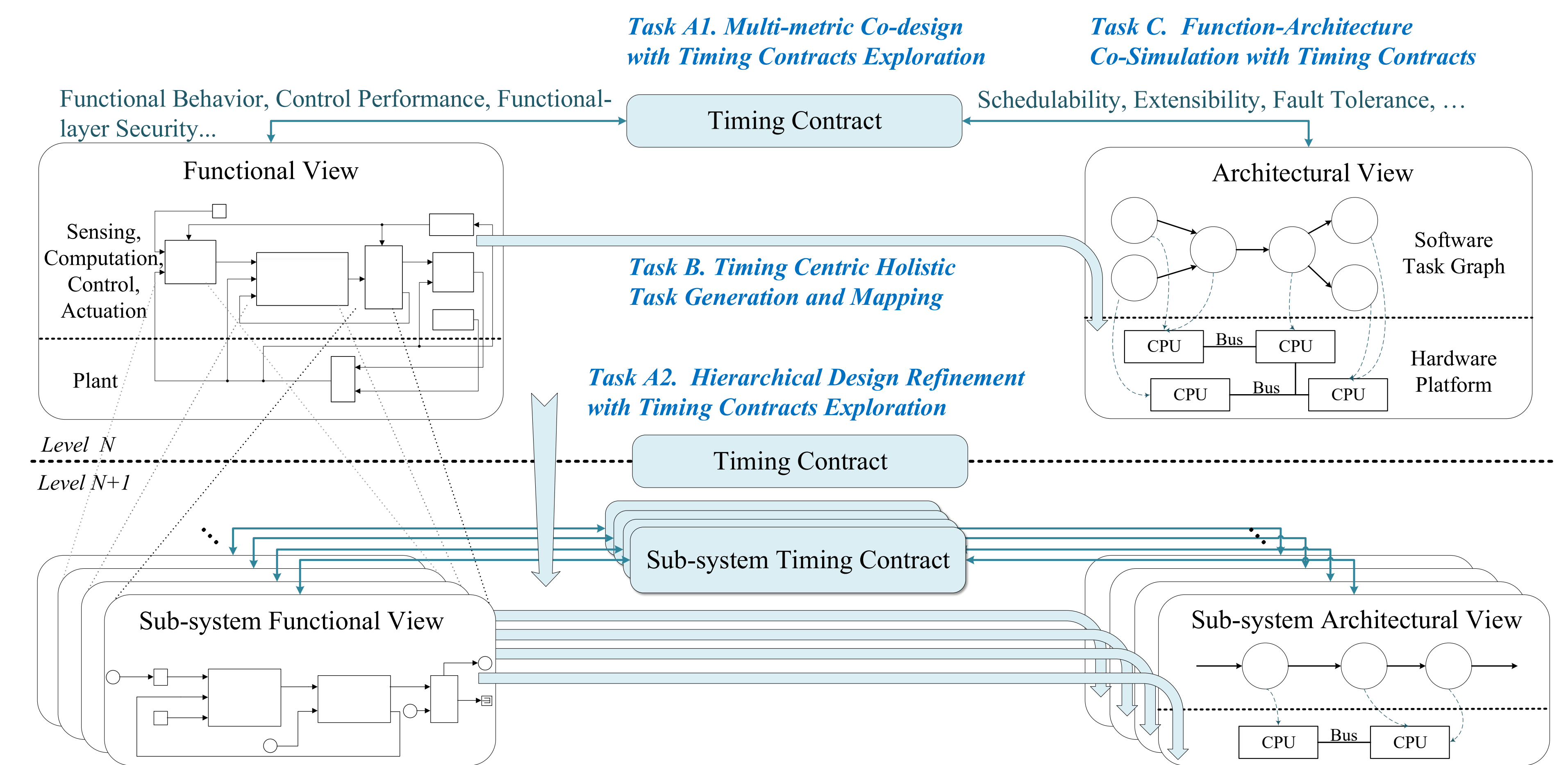
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Description

Develop a **contract-based software synthesis** framework for addressing the **timing challenges** in CPS

Project Goals:

- Develop **timing-driven synthesis algorithms** for holistic software task generation and mapping
- Formulate and explore **timing contracts** to co-design functional and software layers and to conduct design refinement
- Application to the modeling, synthesis and validation of **connected and automated vehicles**



Findings

1. Find software designs under given timing requirements

- Timing-driven software synthesis w.r.t. performance, schedulability, security, extensibility, fault tolerance, energy [NOCS17, DAC17-1, TCAD17, TSUSC18]

2. Explore system designs with varying timing constraints

- Co-design of functional and software layers w.r.t. control performance, feasibility, security [TC16, TCAD16, PIEEE18]
- Cross-layer design and validation of connected and automated vehicles (autonomous intersection design is 10-25% better than smart traffic lights) [ICCAD16, SMARTCOMP17, ICCAD17-1, ICCAD18-1, ITC18, TCPS19, TRB20]

3. Define timing contracts for adaptive & resilient systems

- Leverage weakly-hard timing paradigm for retrofitting and adaptation [HSCC19, RTAS19, ICCD19]
- Adaptive, efficient, safe design of learning components (improve sensing efficiency by 5X; formal safety guarantee of neural network controllers) [DAC17-2, ICCAD17-2, CVPR18, ICCAD18-2, TSUSC19, EMSOFT19, ICCAD19]

